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Predicting Recidivism in Sex Offenders Using the VRAG and SORAG: The Contribution of Age-at-Release

Howard E. Barbaree, Calvin M. Langton, and Ray Blanchard

Sex offenders (N = 468) were released from custody and recidivism outcome recorded. The Violence Risk Appraisal Guide (VRAG) and Sex Offender Risk Appraisal Guide (SORAG) were scored for each offender. Results indicated that, for the majority of actuarial items contained in the VRAG and SORAG and for VRAG and SORAG bin scores, offenders with lower actuarial scores were released from custody at a significantly older age. Actuarial scores were regressed on age-at-release and residuals saved as age-corrected actuarial scores. Using ROC analysis, predictive accuracy was evaluated comparing original actuarial scores with age-corrected scores. For most item scores and both bin scores, the ability to predict recidivism was significantly reduced after the effects of age-at-release had been removed.

Perhaps the most significant advance in the assessment of the sex offender during the past 20 years is the development and promulgation of actuarial instruments that are demonstrably predictive of recidivism among adult male sexual offenders (Doren, 2002; Hanson, 1998; Quinsey, Harris, Rice, & Cormier, 1998). In a recent meta-analysis of sex offender recidivism studies, Hanson and Morton-Bourgon (2004) identify the 5 most commonly used actuarial instruments as the Violence Risk Appraisal Guide (VRAG; Quinsey et al., 1998), the Sex Offender Risk Appraisal Guide (SORAG, Quinsey et al., 1998), the Rapid Risk Assessment of Sexual Offense Recidivism (RRASOR: Hanson, 1997), the Static-99 (Hanson & Thornton, 1999), and the Minnesota Sex Offender Screening Tool-Revised (MnSOST-R: Epperson et al., 1998).

The VRAG and SORAG were the first of these to be developed. The VRAG (Harris, Rice, & Quinsey, 1993) was developed to assess risk for violent recidivism (including sexual offences involving physical contact with the victim) among mentally disordered offenders. The SORAG (Quinsey et al., 1998) is a modification of the VRAG and was developed using a similar method to assess risk for violent recidivism among adult sexual offenders. On the basis of the VRAG and SORAG total scores, individual offenders are assigned to one of nine ascending risk categories (bins) ranging from 1 (lowest risk) to 9 (highest risk). The actuarial development of the VRAG and SORAG has been described in detail in Quinsey et al. (1998). According to the actuarial method, the content of actuarial items has no meaning, and actuarial assessment is not guided by any theoretical understanding of sex offender recidivism. Rather, the actuarial items are selected and weighted based on their empirical relationship with recidivism outcome.

Most items that comprise these instruments reflect static characteristics of offenders in that the characteristics cannot or do not change with time. Harris and Rice (2003) have argued that actuarial

Howard E. Barbaree, Law and Mental Health Program, Centre for Addiction and Mental Health, Toronto, Canada; Calvin M. Langton, Peaks Unit, Rampton Hospital, Nottinghamshire Healthcare Trust, Nottingham, U.K.; Ray Blanchard, Law and Mental Health Program, Centre for Addiction and Mental Health, Toronto, Canada. Howard Barbaree and Ray Blanchard are also affiliated with the Department of Psychiatry, Faculty of Medicine, University of Toronto. Calvin Langton is also affiliated with the University of Nottingham.

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Correspondence concerning this article should be directed to Howard Barbaree, Law and Mental Health Program, Centre for Addiction and Mental Health, 1001 Queen Street West, Toronto, Canada M6J 1H4. e-mail: Howard_Barbaree@camh.net. Phone 416-535-8135; ext 2919.

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assessment based on the evaluation of static features of the offenders provides optimal prediction of recidivism risk over the long term. They argue that these predictions account for so much of the variance in recidivism outcome that there is virtually nothing left for "dynamic" factors to predict. This view of actuarial assessment based on static features of the offender is consistent with their broader view that the majority of scientific evidence supports the notion that violent criminal behaviour including sexual aggression is due mainly to enduring traits that are genetically and physiologically determined and that persist to the end of life (Harris, Skilling & Rice, 2001; Harris & Rice, 2003).

Very recently, interest has been focused on the age of offenders at the time of their release from custody. Hanson (2002) has examined the effects of age-at-release on rates of sexual recidivism in a large sample of sex offenders. Dividing his sample into nine age cohorts (18-24, 35-29;30-34,35-39,40-44,45-49,50-59,60-69, 70+), Hanson plotted the rate of recidivism over age cohorts. The results indicated that sex offenders' risk for recidivism decreases with age-at-release. We (Barbaree, Blanchard, & Langton, 2003) examined sexual recidivism in a sample of sex offenders (N = 477) released from a Canadian federal penitentiary and followed for an average of almost five years. We divided our sample into age cohorts (21-30; 31-40; 41-50; 51+) and found that recidivism decreased as a linear function of age-at-release.

Since our 2003 paper was published, there have been four additional studies of the relations between recidivism and age in sex offenders. Fazel, Sjöstedt, Långström, and Grann (2006) followed all adult male sex offenders released from prison in Sweden from 1993 to 1997 (N = 1,303) and recorded criminal convictions for an average of 8.9 years. They divided their sample into age cohorts (<25; 25-39; 40-54; 55+). The rates of violent recidivism decreased significantly in older aged cohorts. Thornton (2006) followed a large nationally representative sample (N = 752) of sex offenders for a period of 10 years after their release from prison in the UK. Dividing his sample by age cohort (<18; 18-24; 25-39; 40-59; 60+), he found that the rate of sexual recidivism declined with age. Hanson (2006) followed a very large sample (N = 3,425; compiled over 8 separate samples) of sex offenders released from prison in North America and the UK. Hanson calculated 5-year recidivism rates for different age cohorts (18-24; 25-39; 40-49; 50-59; 60+) and found significant reductions in recidivism with age.

Finally, Prentky, and Lee (2007) followed a group of rapists and child molesters who had been civilly committed in a specialized treatment facility in Massachusetts, dividing their sample into age cohorts (18-30, 30-40, 40-50, 50-60, and 60+). Both groups showed significant decreases in recidivism rates with age. Rapists showed reductions in rates of recidivism throughout the span of ages from 20's to 60+, whereas child molesters showed an increase is recidivism rates from the 20's to the 40's, followed by a decrease from the 40's to 60+. Based on these studies, it would be reasonable to conclude that when sex offenders are released from custody at different ages, they show age-related decreases in recidivism. These reductions in recidivism among sex offenders are very similar to reductions in recidivism (both violent and non-violent) among non-sexual criminals (Hirschi & Gottfredson, 1983; Sampson & Laub, 2003).

Therefore, two seemingly disparate and potentially conflicting processes are described in relation to recidivism in sex offenders. First, recidivism can be most accurately predicted using actuarial instruments composed of items that are thought to reflect stable enduring traits. Second, recidivism is subject to a gradual but substantial decrease from young adulthood to the end of life. The present paper explores the relationship between actuarial prediction and age-related reductions in recidivism in sex offenders. Specifically, the present article explores the possibility that offenders that have been identified as low risk by the VRAG and SORAG have been released at an older age and that part of the predictive power of these actuarial instruments is due to maturational processes (aging) that are reflected in varying ages-at-release.

For the present study, mean age-at-release for subgroups identified by each score value were compared for each of the items contained in the VRAG and SORAG. Then, mean age-at-release for subgroups of offenders who have been assigned to different actuarial bins were compared. We hypothesized that lower levels of actuarial risk would be associated with older age-at-release. We then "corrected" actuarial scores for age-at-release. Item and bin scores were regressed on age-at-release and residual scores (the difference between the original score and the predicted value of the score based on the age of the offender at release) were saved in the data file. Using this statistical method, we removed the effects of age-at-release from the distribution of actuarial scores. Using ROC analysis (Hanley & McNeil, 1982; Swets, Dawes, & Monahan, 2000), each of the item scores and bin scores were compared with their age-corrected counterpart in their ability to predict recidivism. It was hypothesized that the original scores would be superior in predictive accuracy compared with their age-corrected counterparts because the original scores include age-at-release information that is related to recidivism.

METHOD

The current research was reviewed and approved by the Centre for Addiction and Mental Health Research Ethics Board (REB).

Participants

The sample was comprised of adult male sex offenders offered assessment and treatment at the Warkworth Sexual Behavior Clinic during its first eight years of its operation (1989-1996). The clinic was located in Warkworth Penitentiary, a medium-security federal penitentiary in Ontario, Canada. Of the 806 offenders offered assessment and treatment, 571 participated in either assessment or treatment. All sexual offenders incarcerated at Warkworth Penitentiary were eligible for treatment at the WSBC and were encouraged to participate by their case managers. Offenders who did not consent to participation (N = 235) were not admitted to the program and are not included in this study. All 571 sexual offenders agreed to the use of their file information for research as part of their written consent to assessment and treatment at the WSBC. The sample included all sexual offenders seen at the WSBC for whom relatively complete file information was available. Ninety-five sexual offenders were excluded for various reasons (death, deportation, major inconsistencies in file information, offender not released by end of follow-up period). Data on recidivism outcomes were obtained for 476 sexual offenders who had been released to the community and therefore at risk to re-offend during the follow-up period.

The group of 476 sexual offenders was comprised of 175 rapists (offenders who had sexually assaulted females aged 16 years or older, exclusively), 155 child molesters (offenders who had sexually assaulted extra-familial children, aged 15 years or younger), 93 familial offenders (offenders who had sexually assaulted biologically related and/or step-children aged 15 years or younger, exclusively), 45 mixed offenders (offenders who had sexually assaulted females aged 18 years or older and children aged 13 years or younger, while being 5 or more years older than the child victim at the time of the abuse), 5 sexual offenders with adult male victims (offenders who had sexually assaulted a male aged 18 years and older), and 3 offenders with non-contact sexual offences (e.g., a conviction for indecent exposure). Due to the lack of empirical evidence demonstrating the validity of the risk assessment instruments with non-contact sexual offenders or sexual offenders with adult male victims, these last two subsets (offenders with male victims 18 years or older and non-contact sexual offenders) were removed, leaving a final sample of 468 sexual offenders. This total sample was comprised of 199 individuals from the follow-up reported by Barbaree, Seto, Langton, and Peacock (2001), and a new sample of 269 sex offenders from the same clinic. Seto (2005) utilized 215 of the individuals included in the present sample. Among these 468 participants, we have also reported results from a subset of N = 311 who had complete item scoring on five actuarial instruments (VRAG, SORAG, RRASOR, Static-99, and MnSOST-R; Barbaree, Langton & Peacock, 2006a, b).

Data Collection

Three sources of information were used to code data: archived clinical files generated by the Warkworth Sexual Behaviour Clinic (WSBC); the Offender Management System (OMS), a computerized national database containing correctional, psychological, and psychiatric reports on federally sentenced offenders maintained by the Correctional Service of Canada (CSC); and the Canadian Police Information Centre (CPIC) records, maintained by the Royal Canadian Mounted Police, detailing all criminal charges and convictions incurred in Canada.

Measures

A number of demographic and clinical variables were coded from the files. These data included basic identifying information; information on family, education, and employment history; and past and current offence information, and of course age-at-release from custody.

We scored the VRAG and SORAG from these same files. The VRAG and SORAG are described in detail in Quinsey et al. (1998). These instruments have 10 items in common: lived with both biological parents until age 16; elementary school maladjustment; history of alcohol problems; marital status; non-violent offence history; failure on prior conditional release; age at index offence; DSM-III diagnosis of any personality disorder (American Psychiatric Association, 1980); DSM-III diagnosis of schizophrenia (APA, 1980); and Psychopathy Checklist score (PCL-R, Hare, 1991). For simplicity and clarity of presentation, these 10 common items will be specified in the remainder of this article by their SORAG item number. The VRAG contains two unique items: victim injury, and any female victim. The SORAG has four unique items: violent offence history, number of previous convictions for sexual offences, history of sex offences only against girls under 14, and phallometric test results. Total VRAG scores can range from -26 to +38. SORAG scores can range from –27 to +51. According to their total score on both the VRAG and SORAG, individual offenders were assigned to one of nine ascending risk categories (bins), ranging from 1 (lowest risk) to 9 (highest risk).

A total of 3 coders were involved in scoring the actuarial instruments. Coders underwent rigorous training. Coding instructions were obtained from the developers of the actuarial instruments and coders were required to become familiar with these instructions. Coders were given a test file to code, and resulting scores compared with the scoring completed by the coding supervisor (author C.L.). Discrepancies between coder and supervisor were discussed and resolved. A second and third test file were coded and discussed in a similar way until discrepancies were minimized. As coding progressed, a number of questions concerning coding arose that were resolved with the assistance of the actuarial developers. Inter-rater reliability of actuarial scoring was calculated. A randomly selected sample of 25 participants was scored on all 5 instruments by two coders. Pearson correlation coefficients were calculated based on the two coder's total score on each actuarial instrument.

Recidivism information for the sample was obtained from the CPIC records up to December 13, 2001. Offenders were classified dichotomously according to whether or not they had a conviction in each of the following four categories of recidivism: non-violent recidivism, defined as a new conviction for a non-contact offence (i.e., an offence with no violence or sexual contact); sexual recidivism, which involved a new conviction for a contact offence in which a clear sexual element was evident; violent recidivism, meaning a new conviction for a violent (including sexual) offence; and any recidivism, referring to a new conviction for an offence of any kind (i.e., offences from all three previous categories). To prevent any bias in the scoring of risk assessment instruments, all variables were coded blind to recidivism outcomes. The CPIC records were obtained after all other coding work had been completed. The focus of the present study was on violent recidivism (including sexual recidivism). Both the VRAG and SORAG were developed empirically so that items were chosen and weighted based on their relation with violent recidivism. For the developers of the VRAG and SORAG, violent recidivism (as opposed to sexual recidivism) is the preferred measure of recidivism in sex offenders (see Quinsey et al., 1998, p. 129; Rice & Harris, 1997).

The average time-at-risk for the sample was 5.1 years. The time-at-risk reflects the time between release and the first instance of violent recidivism or the end of the follow-up period (December 13, 2001), subtracting any time during which the offender was returned to custody for parole violations or new offenses of another kind.

Data Analysis

Most data analyses were conducted using the Statistical Package for the Social Sciences (SSPS) Version 12. The data analysis was conducted in four stages. First, we computed mean age-at-release for offenders obtaining each score value on each actuarial item. Then we computed ANOVA to compare mean age-at-release across score values for each item. Second, we calculated mean age-at-release for offenders in each actuarial bin. We then computed ANOVA to compare mean age-at-release across bin score values for each actuarial instrument.

Third, for each item that showed a significantly different mean age-at-release associated with different risk scores, and for each bin score, a regression analysis was conducted, regressing item and actuarial scores on age-at-release. Following from the regression analysis, residual scores representing the difference between actual and age predicted score values were saved in the data file. These residual values represented an "age-corrected" version of the item or actuarial score. To put this another way, these scores represented the actuarial scores with the effects of age-at-release removed. Finally, for each actuarial item and bin score, a comparison was made between the original and the age-corrected version in terms of predictive accuracy.

Predictive accuracy was measured by the area under the curve (AUC) of the Receiver Operating Characteristic (ROC). ROC curves plot the sensitivity (hit rate or true positive probability) of a prediction as a function of specificity (false alarm rate = 1 minus specificity, or false positive probability; Hanley & McNeil, 1982; Swets et al., 2000). Unlike other indices commonly used to evaluate the accuracy of recidivism predictions — such as correlations or percentage of recidivists and non-recidivists correctly classified — AUC values are relatively uninfluenced by base rates in the sample or selection ratios (Swets, 1986), and therefore represent the most appropriate index of accuracy for relatively low base rate events such as sexual re-offending (Rice & Harris, 1995). In recidivism research, the AUC value can be interpreted as the probability that a randomly selected individual in the sample who re-offends has a higher score on a given risk assessment instrument than a randomly selected individual who does not re-offend. AUC values range from 0 to 1; an AUC value of .5 represents prediction at chance level. Values higher or lower than .5 represent performances better or worse than chance, respectively. ROC analyses were carried out using SPSS version 12.

In similar research studies, direct comparisons between AUC values have been carried out using the method described by Harris et al. (2003), in which inferences about statistically significant differences between ROC areas are based on the 95% Confidence Intervals (CIs) derived from maximum-likelihood estimates of the ROC functions. Using this method, an ROC area outside the 95% CI for a second ROC area would be significantly different from the second ROC area at an alpha level of .05 in a two-tailed test. Such a methodology is appropriate when comparing AUC's calculated from different samples of subjects. In contrast to this method, we used Hanley and McNeil's (1983) method in which inferences about statistically significant differences between ROC areas derived from the same cases take into account the correlation between the areas being compared, thereby reducing the standard error of estimate. This correction for within-subjects comparisons is analogous to that used in a paired t-test compared with a *t*-test for independent samples and can lead to a considerable increase in power of the eventual statistical comparison.

RESULTS

A detailed description of the sample demographic and offense history characteristics, time-at-risk for each recidivism outcome, and details of actuarial scoring, inter-rater reliabilities, missing values for each instrument, etc., can be found in Langton et al. (2007b). Briefly, the sample consisted of offenders who (1) had committed their index offense at the age of approximately 31, (2) were approximately 40 years of age at release from custody, (3) had attained the educational level of grade 9-10, (4) most were not married (35% never married, 37% separated/divorced/widowed), (5) on average had committed six previous non-violent offenses, and one previous violent offense.

Inter-rater reliabilities for the scoring of actuarial instruments were high, with our coding of the VRAG and SORAG achieving *r*'s of 0.88 and 0.90 respectively. Coders were able to score the complete set of items in the VRAG and SORAG for 86% and 71% of the sample respectively. We assigned a score of "zero" to missing items as per instructions from the developers of the VRAG and SORAG.

Table 1 presents mean age-at-release (and standard deviations and Ns) for offender subgroups who received different scores on VRAG/SORAG actuarial items.

For nine actuarial items contained on the VRAG and/or SORAG, increased item score values representing higher risk were associated with significantly younger age-at-release. Offenders coded as not having lived with both parents to the age of 16 were released at a significantly younger age than offenders who were coded as having lived with both parents to age 16, $F(1,464) = 16.88$, $p<.001$. Offenders coded as having had more severe problems in adjustment at elementary school were released at a significantly younger age, $F(2,444) = 9.62$, $p<.001$.[1] Offenders who were scored as having more severe alcohol problems were released at a significantly younger age, $F(3,464) = 7.78$, $p<.001$. Offenders who had never been married were released to the community at a significantly younger age, $F(1,454) = 46.46$, $p<.001$. Offenders who had been scored as having a higher non-violent criminal history score were released to the community at a younger age, $F(2,449) = 16.52$, $p<.001$. Offenders who did not have a history of sex offenses only against girls under 14 were released to the community at a significantly younger age, $F(1,460) = 13.28$, $p<.001$. Offenders who had failed on a prior conditional release were released from custody at a significantly younger age, $F(1,458) = 41.88$, $p<.001$. Offenders who were younger at the time of their index offense were significantly younger when they were released to the community, $F(4,457) = 84.88$, $p<.001$. Offenders who scored higher on the PCL-R were released from custody at a significantly younger age, $F(5,442) = 6.88$, $p<.001$. For all of these 9 items, higher actuarial scores were associated with release from custody at a younger age. Therefore, these results supported our hypotheses.

Unexpectedly, for three actuarial items contained on the VRAG and/or SORAG, increased item score values representing higher risk were associated with significantly older age-at-release. Offenders coded as having a larger number of previous convictions for sex offenses were significantly older at release than offenders with fewer previous offenses, $F(2,460) = 4.94$, $p<.01$. Offenders coded as having positive phallometric results were significantly older at release than offenders who had no such positive phallometric results, $F(1,391) = 5.56$, $p<.02$. Offenders coded as not having any female victims were significantly older at release than offenders who had female victims, $F(1,466) = 5.83$, $p<.02$. For these three items, higher actuarial scores were associated with release from custody at an older age. The results for these three items were not predicted by hypotheses stated in the introduction.

For VRAG item #8 (victim injury), the relationship between item scores and age-at-release was more complex. The lowest risk item score (death) and the highest risk item score (none or slight) were associated with ages-at-release near 40. The two middle risk level item scores (hospitalized, treated and released) were associated with ages-at-release less than 37 years of age. While the ANOVA indicated significant differences in ages-at-release among score groups, $F(3,464) = 4.56$, $p<.01$), there was no obvious tendency for higher risk individuals to be released at a younger or older age.

For three actuarial items contained on the VRAG and/or SORAG, increased item score values representing higher risk were not associated with significantly different ages at release. Offenders scoring higher on criminal history score for violent offenses were not significantly different in age at release compared with offender with lower scores, $F(2,461) = 1.50$, $p = .23$. Offenders meeting DSM criteria for any personality disorder were not significantly different in age at release compared with offender who did not meet such criteria, $F(1,465) = 2.25$, $p = .13$. Offenders meeting DSM criteria for schizophrenia were not significantly different in age at release compared with offender who did not meet such criteria, $F(1,466) = 1.03$, $p = .31$.

Therefore, 12 of the 16 items contained in the VRAG/SORAG were found to be correlated with age-at-release, and the majority of these (9 of 12) correlations were negative. It follows that since VRAG/SORAG bin scores are the result of combining item scores, bin scores are likely to be negatively correlated with age-at-release. Figures 1 and 2 present box plots of the age-at-release of each offender group assigned to each actuarial bin for each

[1] *DF*'s in these statistical comparisons differ from item to item depending on the number of response options in the item (e.g., "lived with both biological parents to age 16" has two response options (yes, no), whereas "elementary school maladjustment" has three (none, slight, severe)).

Table 1
Means (and standard deviations) for age-at-release for each score value for each item in the VRAG/SORAG

Item# VRAG	SORAG	Actuarial Item		Level of Risk 1	2	3	4	5	6
1	1	Lived with biological parent	M	42.7	38.5				
			SD	10.8	10.8				
			N	187	279				
2	2	Elementary school maladjustment	M	42.1	39.9	35.9			
			SD	11.2	10.9	9.2			
			N	211	156	80			
3	3	Alcohol problems	M	44.3	40.8	38.8	37.1		
			SD	13.1	10.8	9.0	9.9		
			N	88	177	96	107		
4	4	Marital status	M	41.9	33.4				
			SD	10.8	8.8				
			N	370	86				
5	5	Criminal history score non-violent	M	44.4	41.0	37.7			
			SD	12.5	10.5	9.6			
			N	122	90	240			
N/A	6	Criminal history score violent	M	39.8	37.8	40.9			
			SD	11.2	10.0	10.9			
			N	192	38	234			
N/A	7	Number of previous convictions for sex offenses	M	39.3	40.4	44.3			
			SD	11.4	9.4	10.7			
			N	295	113	55			
N/A	8	Sex offences against girls < 14	M	43.6	39.1				
			SD	10.6	10.9				
			N	100	362				

...continued

Table 1 (continued)

Item# VRAG	SORAG	Actuarial Item		Level of Risk 1	2	3	4	5	6
6	9	Failure prior conditional Release	M	43.4	37.1				
			SD	11.7	9.1				
			N	225	235				
7	10	Age index offence	M	52.3	44.0	40.0	36.0	32.2	
			SD	7.4	6.5	8.3	8.8	9.6	
			N	86	84	115	22	155	
10	11	Meets DSM criteria for personality disorder	M	40.5	38.1				
			SD	11.1	9.5				
			N	414	53				
11	12	Meets DSM criteria for schizophrenia	M	45.1	40.1				
			SD	11.5	11.0				
			N	5	463				
N/A	13	Phallometric test results	M	38.4	41.1				
			SD	10.4	11.1				
			N	163	230				
12	14	PCL-R score	M	41.0	45.7	42.1	38.2	37.6	31.9
			SD	14.3	12.8	10.5	10.3	9.2	6.0
			N	9	71	115	184	67	2
8	N/A	Victim injury	M	39.6	36.8	35.8	41.1		
			SD	9.2	9.9	8.4	11.3		
			N	8	25	53	379		
9	N/A	Any female victim	M	39.7	43.4				
			SD	11.0	10.1				
			N	410	58				

Note. *VRAG* = *Viol*ence Risk Appraisal Guide. SORAG = Sex Offender Risk Appraisal Guide. Level of risk refers to the different levels of actuarial scores for each actuarial item, with level 1 being the lowest score for the item.

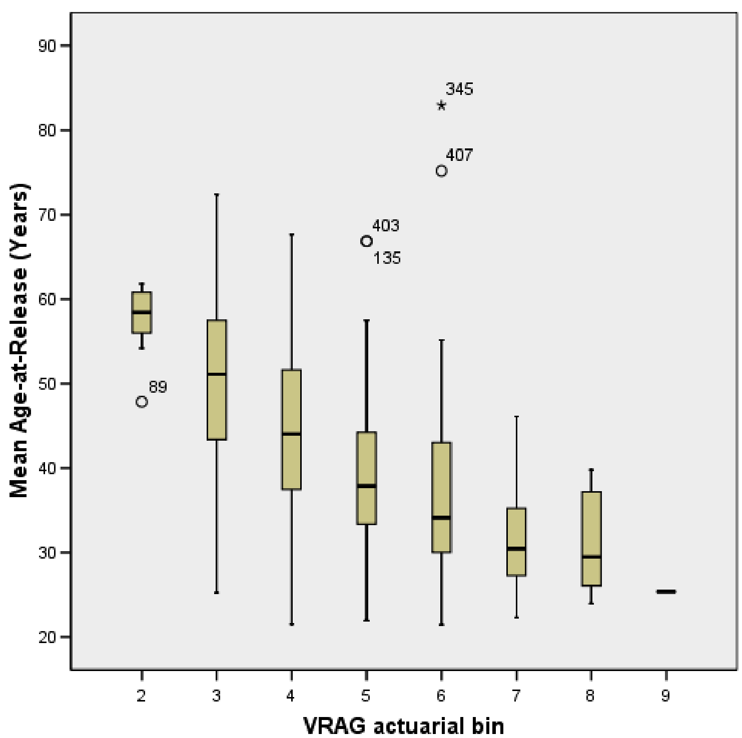
of the VRAG and SORAG respectively. The box depicts the inter-quartile range (from the 25th to the 75th percentiles) and the horizontal line through the box represents the median score. The "whiskers" represent the range of values in the sample from lowest to highest. Outliers are outside the whiskers and do not contribute to the calculation of the inter-quartile range but are shown on the figure. Since the n's in the actuarial bins or score value groupings were unequal but "planned" in the sense that they were proportional to the representation of these categories in the population of offenders, an analysis of weighted means (outliers included) was conducted (ANOVA) with the linear trend and deviations from linearity terms tested.

As can be seen in Figure 1, the median age-at-release decreased substantially over the 8 bin values for the VRAG (we did not have any offenders assigned to bin 1). This decrease was statistically significant and linear in shape, F_{linear} (1,460) = 158.65, $p<.001$; $F_{Deviation\ from\ linearity}$ (6,460) =1.30, p = .26. For the lowest risk offenders (Bin 2), median age-at-release was near 60 years of age, and for the highest risk offenders (Bins 8- 9), median age-at-release was 30 years of age and younger. Similarly, as can be seen in Figure 2, the median age-at-release decreased substantially over the 9 bin values for the SORAG. This decrease was statistically significant and linear in shape, F_{linear} (1,460) = 70.77, $p<.001$; $F_{Deviation\ from\ linearity}$ (7, 460) = 1.27, p = .27. For the lowest risk offenders (Bin 1), median age-at-release was almost 50 years of age, whereas for the highest risk offenders, (Bin 9), median age-at-release was approximately 27 years of age.

Another way of presenting these findings would be simple bi-variate correlations between VRAG and SORAG bin scores and age-at-release. Age-at-release was correlated with actuarial bin scores for both the VRAG and SORAG, r's (466) = -.503, and -.362 respectively; both p's<.001. This negative

Figure 1

Box plots for age-at-release plotted over each actuarial bin for the VRAG. The box depicts from the 25th to the 75th percentiles and the horizontal line through the box represents the median score. The "whiskers" represent the range of values in the sample from lowest to highest. Outliers are excluded from the box plot but indicated on the figure.



correlation indicates that offenders with lower actuarial risk scores were released at an older age-at-release.

The remainder of the data analyses focused on the differences in predictive accuracy between original actuarial items and their age-corrected counterparts. As indicated above, item and actuarial bin scores were regressed on age-at-release and residual scores saved as age-corrected versions of the original item scores. Table 2 presents the results of ROC analyses comparing the original scoring of items and the age-corrected (residual) scoring for all items exhibiting a significant relationship with age-at-release.

As indicated in Table 2, for the nine items for which higher item scores were associated with younger age-at-release, original actuarial item scores yielded significantly higher AUC's than their age-corrected counterparts. This would indicate that the "addition" of age-related information to the actuarial score contributes significantly to the ability of these items to predict recidivism. Of the nine "original" items, seven were significant predictors of recidivism. Only the items "elementary school maladjustment" and "marital status" were not significant predictors of recidivism in their original version. In contrast, of the "age-corrected" items, only one was a significant predictor of recidivism. For SORAG items 1, 5, 8, 9, 10, and 14, the addition of the age-at-release information changed the item from a non-significant to a significant predictor of recidivism.

Also indicated in Table 2, for the three items for which higher item scores were associated with older age-at-release, original actuarial item scores yielded significantly lower AUC's than their age-corrected counterparts. This would indicate that the "addition" of age-related information to the actuarial score significantly impaired the ability of these items to predict recidivism. Of the three "original" items, only

Figure 2

Box plots for age-at-release plotted over each actuarial bin for the SORAG. The box depicts from the 25th to the 75th percentiles and the horizontal line through the box represents the median score. The "whiskers" represent the range of values in the sample from lowest to highest. Outliers are excluded from the box plot but indicated on the figure.

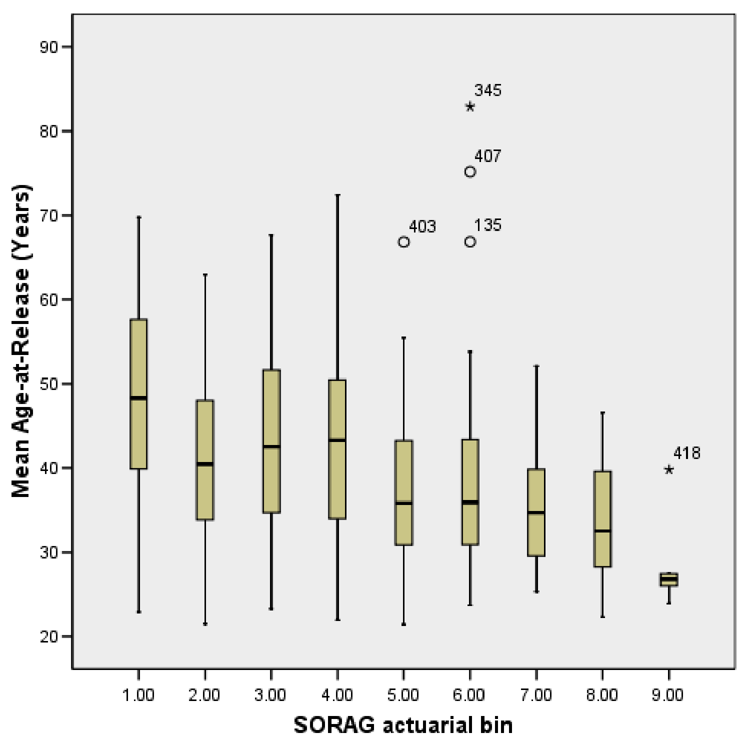


Table 2
AUC's (and 95% CI) predicting violent recidivism using original SORAG actuarial item scores and items scores after the effects of age-at-release have been removed. This table contains items for which different item score values were associated with significantly different ages-at-release

Item #	Item	Original		Age Corrected			
		AUC	95% CI Lower Upper	AUC	95% CI Lower Upper	N	Z
SORAG							
1	Lived with both bio parents to 16	.58	(.52 - .64)	.49	(.43 - .54)	406	9.66*
2	Elementary school maladjustment	.55	(.48 - .61)	.48	(.42 - .55)	447	5.91*
3	History of alcohol problems	.62	(.57 - .68)	.58	(.52 - .64)	468	4.54*
4	Marital status	.52	(.46 - .59)	.39	(.33 - .45)	456	10.41*
5	Criminal History Non-violent	.63	(.57 - .69)	.56	(.50 - .62)	452	6.22*
7	Number of previous sex offenses	.67	(.59 - .75)	.73	(.67 - .80)	463	-9.69*
8	Sex offenses only girls under 14	.57	(.51 - .62)	.45	(.40 - .50)	462	12.53*
9	Failure on prior conditional release	.63	(.58 - .69)	.56	(.50 - .62)	460	6.28*
10	Age index offense	.60	(.54 - .65)	.48	(.43 - .54)	462	6.13*
13	Phallometric test results	.49	(.42 - .55)	.57	(.50 - .63)	393	-8.38*
14	PCL-R score	.62	(.56 - .68)	.55	(.49 - .61)	448	6.67*
VRAG							
9	Any female victim index offense	.57	(.48 - .66)	.67	(.59 - .75)	468	-15.15*

*Note. An AUC is stat*istically significant at the .05 level (two-tailed) when the lower bound of the 95% confidence interval is above 0.50. Such statistical significance would indicate that the item or scale is a significant predictor of recidivism. In comparing AUC values, we used Hanley and McNeil's (1983) method in which inferences about statistically significant differences between ROC areas derived from the same cases take into account the correlation between the areas being compared, thereby reducing the standard error of estimate. This correction for within-subjects comparisons is analogous to that used in a paired t-test compared with a t-test for independent samples and can lead to a considerable increase in power of the eventual statistical comparison.
*p< .001

one was a significant predictor of recidivism (as indicated by the lower 95% confidence interval exceeding .50). Only the item "number of previous convictions for sex offenses" was a significant predictor of recidivism in its original version. In contrast, of the "age-corrected" items, all three were significant predictors of recidivism. For SORAG item 13 and VRAG item 9, the removal of age-at-release information changed the item from a non-significant to a significant predictor of recidivism.

Table 3 presents the results of ROC analyses comparing the original scoring of actuarial bin scores and the age-corrected (residual) scoring for these same bin scores separately for the VRAG and SORAG.

As can be seen in Table 3, AUC values for the "original" actuarial scores were significantly higher than AUC values for the "age-corrected" scores. VRAG and SORAG actuarial scores were significant predictors of recidivism even when age-corrected, with AUC values of .61 and .65 respectively. Nevertheless, the addition of age-at-release information as contained in the "original" actuarial scores provides for significantly higher AUC values of .67 and .70 for the VRAG and SORAG respectively.

As an additional test of these effects, we conducted step-wise Cox Regression (forward conditional) predicting violent recidivism. We entered the "age-corrected" actuarial score (residuals) in the first block, then the original actuarial score in the second block. For the VRAG, the age-corrected (residual) scores were significant predictors of violent recidivism, χ^2 (1, N = 462) = 21.51, p<.001) when evaluated on their own. In Step 2, the combination of the residual and original actuarial scores resulted in a significant prediction equation overall, omnibus χ^2 (2, N = 462) = 55.291, p<.001. Importantly, the addition of the original actuarial scores in Block 2 added significantly to the prediction equation, χ^2 (1, N = 462) = 36.68, p<.001. Similarly, for the SORAG, the age-corrected (residual) scores were significant predictors of violent recidivism, χ^2

Table 3
AUC's (and 95% CI) predicting recidivism using original actuarial total (bin, category) scores and compared with the same scores after the effect of age-at-release have been removed

		Actuarial (bin) Score		
Actuarial Instrument		Original	Age Corrected	Z
VRAG	AUC	.67	.61	4.27*
	95% CI	(.62-.73)	(.55-.67)	
	N	462	462	
SORAG	AUC	.70	.65	4.17*
	95% CI	(.65-.75)	(.59-.70)	
	N	462	462	

Note: VRAG = Violence Risk Appraisal Guide. SORAG = Sex Offender Risk Appraisal Guide. AUC = Area under the Receiver Operator Characteristic curve. Age corrected scores were computed by regressing original actuarial scores on age-at-release and saving the residuals as corrected scores. Bin scores ranged from 1 to 9, representing level of risk from lowest to highest.
*p<.001

(1, N = 462) = 35.74, p<.001) when evaluated on their own. In Block 2, the combination of the residual and original actuarial scores resulted in a significant prediction equation overall, omnibus χ^2 (2, N = 462) = 70.37, p<.001. As in the case of the VRAG, the addition of the original SORAG scores added significantly to the prediction equation, χ^2 (1, N = 462) = 36.77, p<.001.

DISCUSSION

The present study has examined the relationship between age-at-release and actuarial scores on the VRAG and SORAG. For nine items on the VRAG/SORAG, significantly older age-at-release was associated with lower risk item scores, and for three items, significantly older age-at-release was associated with higher risk item scores. Since nine items comprise the majority of items on the VRAG and SORAG, it was not surprising that the combination of items in the total VRAG/SORAG score reflected a negative correlation with age-at-release. Our findings indicated that offenders with lower bin scores were released at a significantly older age (and obviously, offenders with higher bin scores were released at a significantly younger age). On the VRAG, median age-at-release was approximately 27 years of age for the highest risk bin and 57 years of age for the lowest risk bin.

Since only one of these nine items coded age of the offender being assessed, the question arises as to why offenders with different risk scores would have different ages-at-release. A possible explanation is based on the actuarial method itself, the statistical method used in the development of actuarial instruments. In pure actuarial risk assessment, the items have no meaning. They are selected and weighted based on their empirical relationship with outcome. If recidivism decreases with age-at-release, as a large body of recent literature would indicate (Barbaree et al., 2003; Fazel et al., 2006; Hanson, 2002, 2006; Prentky & Lee, 2007; Thornton, 2006), we should not be surprised that the VRAG and SORAG item responses have a statistical relationship with age-at-release. In other words, after the actuarial statistical method has done its work, age-at-release, actuarial item responses, and recidivism are all inter-correlated. It follows that, in the empirical process of selecting items for the VRAG/SORAG, it may be that the developers of these actuarial instruments unwittingly selected items for which higher item scores were associated with offenders who were younger at release from custody. In this process, because younger sex offenders are more likely to re-offend, age contributes to the relationship between higher item scores and recidivism. After selecting numerous such items and combining them in an actuarial instrument, the relationship between age and recidivism is imbedded in actuarial prediction.

Of course, the content of many of these items also reflect other factors that are related to recidivism risk in sex offenders (e.g., Hanson & Bussiere, 1998; Hanson and Morton-Bourgon, 2004) such as antisocial behavior and sexual deviance (Barbaree et al., 2006a; Doren, 2002). We would be foolish to argue that actuarial prediction is all due to age. However, we are making the case that a single actuarial item's predictive power may be due to two or more underlying risk factors. For example, "history of alcohol problems" reflects a well-known aspect of antisocial behavior; Substance abuse is prevalent in antisocial individuals. However, this item also reflects aging as a risk factor as indicated by our findings reported in Tables 1 and 2. Therefore, we would argue, the ability of "history of alcohol problems" to predict recidivism is a combination of its relation with two underlying risk factors, antisocial behavior and aging.

After we statistically removed the influence of age-at-release from these items, the predictive ability of these actuarial items was adversely affected. We will continue to use "history of alcohol problems" as an example. In its original version (See Table 2), this item was a significant predictor of recidivism with an AUC of .62 (95% CI .57-.68). According to the analysis above, the predictive ability reflected in this AUC value is based on the influence of both antisocial behavior and age-at-release. After we removed the age-at-release information from the data set, the AUC value decreased to .58 (95% CI .52-.64) and this decrease was statistically significant. However, this age-corrected item was still a significant predictor of recidivism, and we would argue that the remaining predictive ability is likely related to "antisocial behavior."

Beyond the effects of age on item scores, age-corrected bin scores were impaired in their ability to predict recidivism compared with the original bin scores. Therefore, the hypotheses developed in the introduction to this article were supported. These results quite clearly indicated that age-at-release contributed to the predictive accuracy of these actuarial instruments. In this way the predictive accuracy of the VRAG and SORAG can be said to depend in part on the relationship between aging and recidivism in the sex offender. Our results were taken to indicate a strong influence of age-at-release on actuarial scores over and above the influence of the single item reflecting age of offender contained in each actuarial instrument. As we have demonstrated here, age-at-release is imbedded in the actuarial instruments, not just in the one item whose nominal meaning has some bearing on some measure of age, but also in items whose meaning has no obvious conceptual relationship to age.

For three actuarial items on the VRAG/SORAG, higher item scores were associated with older ages-at-release. For these items, this relationship is opposite to the one described for the nine items described above. Removing the effects of age-at-release from these item scores improved their ability to predict recidivism. This improvement is opposite to the impairment described for the nine items described above. These results seem to separate items on the VRAG/SORAG into two distinct groups, according to their relationship with age-at-release. The three items for which higher risk scores were associated with older age-at-release were contained in *Child Sexual Abuse, Persistence, and Male Victim(s)*, all sexual deviance risk factors identified by Barbaree et al. (2006a), and these risk factors seem to be more relevant to risk assessment of child molesters. In contrast, eight of the nine items for which higher risk scores were associated with younger ages-at-release were contained in factors *Antisocial Behavior* and *Young and Single* identified in Barbaree et al. (2006a), and these risk factors seem to be more relevant to risk assessment of rapists. As reported by numerous researchers (e.g., Hanson, 2002), child molesters are more prevalent among older offenders at release, and rapists tend to be more prevalent among younger offenders at release. The different age distributions in these two offender subgroups may partly explain the findings reported here.

The present findings highlight the two disparate and conflicting aspects of sex offender recidivism identified in the introduction to this paper. A vast literature has described the development of actuarial instruments with proven predictive ability that contain items that reflect stable enduring traits of sex offenders, and, a more recent but convincing literature describes a process of aging in which recidivism risk in sex offenders decreases with age.

The developers of the VRAG/SORAG have recently taken the position that the apparent effects of age on sexual recidivism are actually due to actuarial risk (Harris & Rice, 2007). They point out that the evidence for the age effect is based on cross-sectional rather than longitudinal research designs, and that age-at-release is confounded with actuarial risk. In other words, in the studies of age and recidivism, the different age cohorts vary in their levels of actuarial risk. As indicated in the findings reported here, offenders who scored lower on the actuarial instruments were released at an older age. Therefore, our findings confirm that age-at-release and actuarial risk are confounded. However, the problem with confounds is that they can be legitimately argued either way. If Harris and Rice can argue that lower actuarial scores among older offenders explain lower recidivism among older offenders, then we can argue that older age-at-release explains lower rates of recidivism among offenders with lower actuarial scores. In other words, in light of this confound, either stable enduring traits or maturation can be legitimately used as explanatory constructs.

Harris and Rice (2007) go on to argue that age-at-first offence (a static age variable) is a more powerfully predictive age variable than age-at-release (a maturational age variable). They postulate that high-risk offenders will, on a probabilistic basis, offend earlier in life, and these same high risk offenders will persist in offending into old age. This argument seems unconvincing to us. These two indices of age are entirely and profoundly different. Age-at-first offence is a static factor. Once an offender has committed a criminal offence, his age-at-first offence is determined for the remainder of his life. This index of age bears no relationship whatever to the aging process. In contrast, age-at-release is a maturational risk factor (Barbaree & Blanchard, in press) in that it reflects the level of maturity of the individual when he is released from custody. This variable is determined by a combination of many factors, including age-at-index offence, sentence length or length of incarceration, parole decision-making, etc. But importantly, age-at-release changes over time, and with it, the level of risk posed by the offender. We do not agree with Harris and Rice (2007) when they argue that the power of age-at-first offence to predict recidivism takes away from the significance of age-at-release as a predictor. In our view, whether or not age-at-first offence is a significant predictor of recidivism is totally independent of the predictive ability of age-at-release. Aging can have its effect on recidivism whether or not higher risk youthful offenders are convicted of crimes at a young age.

Finally, the developers of the VRAG/SORAG (Harris & Rice, 2007) argue that once the effects of actuarial risk and age-at-first offence have been taken into account, age-at-release adds nothing to the prediction equation. They argue that, since age-at-release does not enter the prediction equation, there is no significant aging effect to be recognized. We disagree and feel that their logic is flawed. As demonstrated in the present findings, the effects of aging are imbedded in their actuarial instruments. When actuarial scores are entered into the equation first, the effects of aging already contribute to the predictive accuracy of their instruments. In this way, the subsequent "test" of age-at-release is pre-empted. The variance due to age-at-release is at least partly used up in the prior test of the actuarial score. Testing the ability of actuarial scores to predict recidivism is not an appropriate or fair statistical method for evaluating the effects of aging on recidivism.

While the test developers have unwittingly capitalized on the relationship between age-at-release and recidivism, they deny the effects of aging when applying the instrument to the evaluation of risk in the individual sex offender. Prevalent accounts of actuarial prediction have pointed to the static nature of the items contained in these instruments, and have inferred underlying stable enduring traits as the psychological foundation for recidivism risk (Harris & Rice, 2003). Such accounts do not allow for maturational changes having any role in determining recidivism risk. However, as the present results indicate, the predictive accuracy of both the actuarial items and composite scales capitalize on these items' relationship with age-at-release. It follows that the actuarial scales' predictive accuracy does not depend exclusively on relationships with static characteristics of offenders stemming from stable enduring traits. The present results question the exclusive influence of stable enduring traits in the determination of risk and suggest the necessity of including maturation in efforts to provide a more complete account of sex offender recidivism. More recent attempts to develop actuarial instruments for sex offenders have included an age-at-release item that codes age-related changes later in life (Static-2002; Hanson & Thornton, 2003; Langton, Barbaree, Hansen, Harkins, & Peacock, 2007a; Langton et al., 2007b).

Because actuarial items are predominantly static items, a high actuarial score obtained by a young man will follow him unchanged for the remainder of his life despite repeated scoring by various evaluators. So even while the offender's risk is decreasing as part of the maturational process, the actuarial instrument confirms his lifetime static risk. Ironically, the validity of the actuarial instrument that asserts his ongoing risk is based partly on the effects of aging on recidivism.

In arguing against the need for age-based adjustments to actuarial prediction in the older offender, the developers of the VRAG/SORAG state that the existing actuarial instruments weight age more or less appropriately and that no further adjustments for aging are required. We feel this represents a significant error in logic. Actuarial items code characteristics of offenders at a particular point-in-time, usually the date of the assessment as release from custody is imminent (or in research, the date of the file from which the items are coded). The evaluation of the predictive accuracy of the actuarial instrument is based on an analysis of relations between the data recorded at the time of the assessment and later recidivism. The maturational variable (age-at-release) contributes to the prediction equation, either directly or indirectly, through contrasts between different offenders released at different ages. These between-offender contrasts contribute to the predictive power of the actuarial instruments because offenders released at a younger age recidivate at a higher rate. However, age as a maturational risk factor is a within offender contrast. Because the VRAG and SORAG were developed without any explicit recognition of maturation as a potential risk factor, and because the resulting item sets do not include any items that reflect changes in risk that occur after the age of 39, the actuarial instruments are not sensitive to the within-offender changes that occur later in life. In order to accommodate age as a maturational risk factor, an assessment instrument must make adjustments to estimates of risk as the offender ages. At present, these instruments will overestimate risk for the older offender, while at the same time they may underestimate risk for younger offenders. These considerations suggest strongly that some correction or allowance for age-at-release is required to be built into the actuarial assessment instruments. Clinical and forensic uses of actuarial instruments have not made allowances for maturational changes in risk. The result has been that estimates for risk in the older offender, based on empirical studies of younger offenders, have been exaggerated.

The use of these actuarial instruments with older offenders is problematic in two ways. First, the majority of men in the samples that have been used to develop and validate these actuarial instruments have been released from custody in their 20s, 30s and early 40s (Hanson, 2002). The N-weighted average age-at-release amongst the offenders comprising the samples used to develop and validate the Static-99 was approximately 35 years of age (Hanson & Thornton, 1999). Actuarially-estimated recidivism rates are based on samples of men who have been released from custody at a relatively young age. In contrast, routine evaluations are conducted on older offenders. In clinical and forensic settings throughout the western world, assessments are conducted to inform courts in respect of incapacitation or civil commitment or similar proceedings (Sexually Violent Predator statutes in many US states, Dangerous Offender proceedings in Canada, and similar proceedings in Australia and New Zealand). These offenders usually have a long history of criminal offenses and many years of incarceration. As a consequence, many candidates being assessed are older that 45 and a significant minority are much older. Use of actuarial instruments in these assessments will over estimate risk because recidivism rates are lower in older offenders. And second, none of these instruments contain items that reflect maturational changes (age-at-release) that occur after the age of 30. In other words, as offenders age their reduced risk is not reflected in their risk score.

A number of authors have suggested that actuarially-based recidivism estimates should be adjusted based on the age of the offender. For example, Prentky, Janus, Barbaree, Schwartz, and Kafka (2006) have suggested that risk estimates could be adjusted based on hazard ratios empirically derived using Cox Regression that suggest an approximate 5% reduction in risk each year an offender ages (Barbaree et al., 2003) after the mean age of the standardization samples used to make the original risk estimate. Wollert (2006) has suggested that adjustments could be made to actuarial estimates based on a Bayesian Model using parameters derived from Hanson's (2002) data. More conservatively, Hanson (2006) has suggested that estimates should be adjusted downward for offenders released after age 60, but he does not make an explicit suggestion as to how the adjustment should be calculated. These three suggested methods of adjustment would be described as "adjusted actuarial approaches" to risk assessment in which age is a risk factor that is external to the actuarial instrument and is used as a basis for adjustments to the risk estimates (Hanson, Morton, & Harris, 2003). At the very least, direct application of actuarial estimates of recidivism risk to the older sex offender is inaccurate and therefore inappropriate. Professional standards guiding the use of psychological tests warn against the use of tests if such use may be discriminatory on the basis of age, race, culture, etc. (American Psychological Association, 2002).

The present study should not be interpreted as being an argument against the actuarial approach to prediction of recidivism in the sex offender. Rather, these results should be used to point the field in the direction of improved actuarial prediction. Future developments might lead to improvements if the various risk factors (age-at-release or component elements; sexual deviance; antisocial behavior) were calculated so that they were independent of one another (orthogonal) and then combined in a way that optimizes prediction. We are arguing for an improved actuarial assessment that factors maturation into the assessment.

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