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A respecification of Hanson's updated Static-99 experience table that controls for the effects of age on sexual recidivism among young offenders

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The original version of Static-99 is widely used for assessing sexual recidivism. It does not, however, account for the negative effect of age on recidivism. Hanson (2006, *Sexual Abuse*, **18**, 343–355) took up this problem by disseminating an updated experience table for Static-99, based on 3425 sex offenders, that was stratified by four rows of risk categories and five columns of age categories. Contrary to expectations, updated Static-99 reported that the highest group-wise recidivism rates accrued to sex offenders in the second youngest category. The explanation for this inconsistency is that the entries in updated Static-99 are misspecified for the youngest offenders because, in effect, Hanson used one scoring system for assigning older offenders to risk groups and another for the classification of younger offenders. Updated Static-99, therefore, needs to be respecified. We applied a Bayesian algorithm to do so. Updated Static-99 holds out so many advantages that we believe it is unethical for evaluators to use original Static-99 unless they can present overwhelming evidence in support of this choice. Other contributions of respecifying updated Static-99 are discussed.

Keywords: age invariance; Bayes' theorem; sexual recidivism; risk assessment; Static-99.

1. Introduction

The original version of Static-99 (Hanson & Thornton, 2000), developed under the auspices of the Solicitor General of Canada, is the most widely used actuarial table for the prediction of sexual

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recidivism (McGrath *et al.*, 2003, as cited in Hanson, 2006). One important consequence of this fact is that it is used more frequently than any other experience table in the United States to evaluate whether sex offenders should be civilly committed as 'sexually violent predators' (SVPs), perhaps for life.

In spite of the popularity of original Static-99, a number of recent studies have indicated that it does not adequately account for the 'age invariance effect' (Hirschi & Gottfredson, 1983; Sampson & Laub, 2003; Wollert, 2006) that sexual recidivism decreases dramatically over the adult lifespan (Barbaree & Blanchard, 2008; Barbaree *et al.*, 2003; Hanson, 2002; Prentky *et al.*, 2006; Fazel *et al.*, 2006; Wollert, 2006).

Hanson (2002, p. 350) recently took up this problem by disseminating an updated experience table for Static-99, which has always included one item that assigns 1 point to those under 25 versus 0 points to older offenders and nine nonage items that are scored for other offender characteristics such as the number of previous sex offense convictions and the gender of victims. Including three times the number of offenders who were in the original sample ($N = 3425$ versus 1086), updated Static-99 is a two-way table that is stratified by four rows of risk categories that are grouped by point totals [high (H) = 6 points and above; moderately high (MH) = 4–5; moderately low (ML) = 2–3 and low (L) = 0–1] and five columns of age groups (18–24.9 years old, 25–39.9, 40–49.9, 50–59.9 and 60 and over). Hanson's updated Static-99 is shown in Table 1.

In light of the articles cited in the second paragraph, recidivism rates should decrease with increasing age in each of the first four rows in Table 1. This trend is apparent for groups that are more than 25 years old but, surprisingly, the recidivism rates for the 18–24.9 group tend to be lower than those for the 25–39.9 group.

The explanation for this inconsistency is that the entries in updated Static-99 are misspecified for the youngest offenders because, in effect, Hanson used one Static-99 scoring system for assigning older offenders to risk groups and another for the classification of younger offenders. Older offenders, on the one hand, were always given a zero on the dichotomous age item from Static-99. They were also placed in the H risk group if they had at least 6 nonage points on Static-99, in the MH group if they had 4 or 5 nonage points, in the ML group if they had 2 or 3 points and in the L group if they had 0 or 1 points. Every offender between 18 and 24.9, on the other hand, was given a score of 1 on the age item. As a result, young offenders were placed in the H group if they only had 5 nonage points on Static-99, in the MH group if they had 3 or 4, in the ML group if they had 1 or 2 and in the L group only if they scored as a 0 on all nonage items.

The dangerousness of the 18–24.9 year-olds in the L group was therefore attenuated because any young offenders who were positive for a nonage risk factor were assigned to a higher risk group, their score going from 1 to 2 because of the age adjustment. Being less dangerous on average than their 25–39.9 year-old counterparts in the same group, they tended to recidivate less often. The other recidivism differences between these two age groups reported in Table 1 are also attributable to the effects of this type of risk attenuation.

Assigning an additional risk point for young adulthood was justified when the experience table for Static-99 was originally compiled on the assumption that the age item contributed as much as any other dichotomous test item to variations in risk. The updated experience table for Static-99 treated age as a five-level factor, however, that was external to the test items. Consequently, all age groups should have been scored with the same system. Continuing to count the original dichotomous age item for the purpose of risk classification therefore undermined the comparability of the distributions for younger versus older offenders.

TABLE 1 *Five-year sexual recidivism rates, subdivided by age and risk groups, for updated Static-99 (from Hanson, 2006, p. 350)*

Static-99 categories	Age at release											
	18–24.9		25–39.9		40–49.9		50–59.9		60 and older		All ages	
	n[c]	Recidivism ± 95% CI[d]	*n*	Recidivism ± 95% CI	*n*	Recidivism ± 95% CI	*n*	Recidivism ± 95% CI	*n*	Recidivism ± 95% CI	*n*	Recidivism ± 95% CI
L[a]	17	5.8 ± 11.2	486	6.7 ± 2.7	321	5.5 ± 2.9	159	2.5 ± 2.8	112	0.0 ± 0.0	1095	5.3 ± 1.6
ML[a]	275	7.6 ± 3.7	590	11.7 ± 3.3	260	6.7 ± 4.3	126	4.3 ± 4.4	56	3.0± 5.7	1307	8.7 ± 1.9
MH[a]	199	24.6 ± 7.4	321	24.3 ± 5.9	124	13.8 ± 8.0	63	19.4 ± 16.1	25	4.8 ± 9.1	732	21.4 ± 3.8
H[a]	61	35.5 ± 14.9	116	37.5 ± 11.9	71	25.7 ± 13.2	32	24.3 ± 22.6	11	9.1 ± 17.0	291	31.6 ± 6.9
All levels	552	16.2 ± 3.6	1513	14.4 ± 2.2	776	8.8 ± 2.5	380	7.5 ± 3.8	204	2.0 ± 2.3	3425	12.0 ± 1.4
Static-99		3.6 (1.4)		2.6 (1.9)		2.4 (1.9)		2.3 (2.0)		1.9 (1.0)		2.6 (1.9)
A ± 95% CI[b]		0.68 (0.62–0.74)		0.68 (0.64–0.72)		0.66 (0.58–0.73)		0.76 (0.66–0.85)		0.82 (0.68–0.95)		0.70 (0.67–0.72)

Notes. [a] The letters in the left-most column stand for Static-99 risk groups (L = 0–1 points, ML = 2–3, MH = 4–5, H = 6 or above). [b]'*A*' is the *A* statistic which reflects the area under the receiver operating characteristic curve for Static-99; the range of the 95% confidence interval for this estimate is parenthesized. [c]'*n*' is the sample size that started the follow-up period for each age group in each risk category referenced in the left-most column. [d]'recidivism ± 95%CI' is the sexual recidivism rate for each age group in each risk category, calculated through survival analysis; the 95% confidence interval for this estimate is parenthesized.

This lack of comparability is reflected in a number of simple indicia. First, the average number of Static-99 risk points for the young offender group is a full point higher than the adjacent age group of 25–39.9 year-olds ($M = 3.6$ versus 2.6, respectively). Second, compared to their 25–39.9 year-old counterparts, young offenders are under-represented in the L risk group (3% versus 31%, $X^2 = 13$, $\underline{p} < 0.01$). Third, the MH and H risk groups that include only the younger offenders are relatively ineffective in differentiating recidivists from non-recidivists compared to the MH and H risk groups composed of offenders from the adjacent age group (likelihood ratio = 1.85 versus 2.23, $\underline{p} < 0.05$).

Relying on the misspecified entries for young offenders in updated Static-99, some clinicians who conduct sex offender risk assessments for court and parole-release hearings might erroneously testify that those offenders between 25 and 39.9 years old are most likely to sexually recidivate. Furthermore, from the standpoint of actuarial development, it may be difficult to replicate updated Static-99 unless it is corrected to optimize its value as a 'target criterion' for this type of research.

Two methods might be used to address these problems by respecifying the entries for young offenders in updated Static-99. One way would be to resort Hanson and the Canadian government's frequency data so that (a) young offenders with scores of 7 and above on the original Static-99 are placed in the H group; (b) those with original scores of 5 or 6 are placed in the MH group; (c) those with scores of 3 or 4 are placed in the ML group and (d) those with scores of 1 or 2 are placed in the L group.

Since this method requires access to the data set from which Table 1 was compiled, we contacted Hanson with this purpose in mind on several occasions. Initially, he refused to make the data available on the grounds that 'Given that I do not see how the requested information would advance our understanding, I decline to respond to your request.' When we pointed out how the information might be useful and alluded to the 'ethical responsibility of researchers to share data from publications in the interest of advancing knowledge', we were told the same thing—i.e. 'You have not confinced (sic) me of the merits of your request.'[1]

Fortunately, Hanson's table may also be respecified by relying on probability coordinates rather than frequency data. This approach, which has previously been described in published research that estimated expected recidivism rates for sex offenders with high Static-99 scores (Wollert, 2006), consists of two steps. The first is to calculate the 'likelihood ratio' (Donaldson & Wollert, 2008; Mossman, 2006) for the H, MH, ML and L risk groups in the cohort of older offenders—those aged 25–39.9 years—whose *A* statistic for Static-99 in the last row of Table 1 comes closest of all age groups to matching that for the young offender cohort. The specific operations for making this calculation are as follows:

$$\mathrm{LR}_j^+ = \frac{P(S_j|R^+)}{P(S_j|R^-)}, \tag{1}$$

where (a) LR_j^+ equals the accuracy, or 'positive likelihood ratio', with which a risk category j differentiates recidivists from non-recidivists; (b) $P(S_j|R^+)$ equals the percentage of all recidivists in the distribution of recidivists for a given age group that are assigned to risk cartegory j and (c) $P(S_j|R^-)$ equals the percentage of all non-recidivists in the distribution of non-recidivists for the same given age group that are assigned to risk category j.

The second step respecifies the recidivism rate for each risk category of young offenders by using the following version of Bayes' theorem (Dawid, 2002; Mossman, 2006) to separately combine the

[1] Copies of the emails that were exchanged with Dr Hanson may be obtained from Dr Cramer.

TABLE 2 *Procedures and values for estimating the sexual recidivism rate for each risk category of young offenders tabled by Hanson (2006)*

S_j	R_j^+	$P(S_j\|R^+)$	R_j^-	$P(S_j\|R^-)$	LR_j^+	P	$P(R^+\|S_j)$
L	33	0.147	453	0.351	0.419	0.162	0.075
ML	69	0.308	521	0.404	0.762	0.162	0.128
MH	78	0.348	243	0.189	1.841	0.162	0.262
H	44	0.196	72	0.056	3.500	0.162	0.403
Total	224	100%	1289	100%			
Symbol	N_{R+}		N_{R-}				

Notes. S_j = a risk category of j on Static-99 (L = 0–1 points, ML = 2–3, MH = 4–5, H = 6 or above). R_j^+ = the number of 25–39.9 year-old recidivists assigned to risk category j of Static-99. $N_{R+} = 224$ = the total number of 25–39.9 year-old offenders who were recidivists. $P(S_j \mid R^+)$ = the probability of S_j on the condition of R^+, obtained by dividing R_j^+ by N_{R+}.R_j^- = the number of 25–39.9 year-old non-recidivists assigned to risk category j of Static-99. $N_{R-} = 1289$ = the total number of 25–39.9 year-old offenders who were non-recidivists. $P(S_j|R^-)$ = the probability of S_j on the condition of R^-, obtained by dividing R_j^- by N_{R-}. LR_j^+ = the 'positive likelihood ratio' for a risk category of j, obtained by dividing $P(S_j|R^+)$ by $P(S_j|R^-)$. P = the 5-year recidivism rate for 18–24.9 year-old offenders from Table 1. $P(R^+|S_j)$ = the expected rate of recidivism on the condition of each risk category, obtained by inserting LR_j^+ and P into (2).

base rate of recidivism that Hanson identified for the young offender cohort as a whole (symbolized on the right-hand side of the equation below as P and equaling 16.2% per the 'All levels' row of the '18–24.9' column of Table 1) with each of the four likelihood ratios calculated with (1):

$$P(R^+|S_j) = \frac{\frac{P}{1-P} x \mathrm{LR}_j^+}{1 + \left[\left(\frac{P}{1-P}\right) x \mathrm{LR}_j^+\right]}, \tag{2}$$

where $P(R^+|S_j)$ equals the expected rate of recidivism on the condition that subjects are in a specific risk category S_j.

Denied access to the Canadian government's frequency data, we respecified the recidivism rates for each young offender risk category using (1) and (2). The procedures this entailed, and the terms inserted in (2), are described and presented in Table 2. Table 3 presents a respecified table for Static-99 that integrates the estimated rates we obtained for young offenders with the estimated rates that Hanson reported for older offenders in his 2006 article.

Discussion

Several considerations indicate that updated Static-99 (Hanson, 2006) represents an important advance in risk assessment. First, it is based on more recent data than the original table. Second, it includes three times the number of offenders who were included in the original sample. Third, it is the first and only actuarial table that accounts for the effects of age on sexual recidivism over the adult lifespan. Fourth, whereas the original table did not include any U.S. offenders, updated Static-99 includes over 500. Fifth, it reports the confidence interval for each recidivism rate for the first

TABLE 3 *A respecified 5-year experience table for Static-99 that controls for the effects of age on recidivism for all age groups*

Static-99 categories	Age at release											
	18–24.9		25–39.9		40–49.9		50–59.9		60 and older		All ages	
	n[c]	Recidivism[d] ± 95% CI	n[e]	Recidivism[e] ± 95% CI	n[e]	Recidivism[e] ± 95% CI	n[e]	Recidivism[e] ± 95% CI	n[e]	Recidivism[e] ± 95% CI	n[f]	Recidivism[g,d] ± 95% CI
L	177	7.5 ± 3.92	486	6.7 ± 2.7	321	5.5± 2.9	159	2.5 ± 2.8	112	0.0 ± 0.0	1255	5.4 ± 1.2
ML	216	12.8 ± 4.51	590	11.7 ± 3.3	260	6.7± 4.3	126	4.3 ± 4.4	56	3.0 ± 5.7	1248	9.7 ± 1.6
MH	117	26.2 ± 8.04	321	24.3 ± 5.9	124	13.8 ± 8.0	63	19.4 ± 16.1	25	4.8 ± 9.1	650	21.4 ± 3.2
H	42	40.3 ± 14.9	116	37.5 ± 11.9	71	25.7 ± 13.2	32	24.3 ± 22.6	11	9.1 ± 17.0	272	32.4 ± 5.6
All levels	552	16.2 ± 3.6	1513	14.4 ± 2.2	776	8.8 ± 2.5	380	7.5 ± 3.8	204	2.0 ± 2.3	3425	11.9 ± 1.1
Static-99[a]		2.6 (1.4)		2.6 (1.9)		2.4 (1.9)		2.3 (2.0)		1.9 (1.0)		2.6 (1.9)
A ± 95% CI[b]		0.68 (0.64–0.72)		0.68 (0.64–0.72)		0.66 (0.58–0.73)		0.76 (0.66–0.85)		0.70 (0.67–0.72)		0.70 (0.67–0.72)

Notes. [a]The first number in each cell of the 'Static-99' row indicates the average Static-99 score for the age group at the top of the column. The parenthesized number indicates the standard deviation. [b]The first number in the 'A ±95% CI' row indicates the area under the receiver operating curve. The parenthesized number indicates the confidence interval for A. [c]The entries in this column were obtained by multiplying the total number of young offenders ($n = 552$) from the 'All levels' row of the '18–24.9' column in Table 1 by the percentage of all offenders in Table 2 who were in each risk category; this percentage was obtained by dividing the sum of $R_j^+ + R_j^-$ by the sum of $N_{R+}{}^+ N_{R-}$ for each of the j categories of offenders from the second and fourth rows in Table 2. [d]The confidence intervals in this column were calculated by multiplying each $P(R^+|S_j)$ from the last column of Table 2 by $[1 - P(R^+|S_j)]$, dividing each product by the corresponding n from the second column of this table, taking the square root of this quotient and multiplying it by 1.96 (Wollert, 2006). [e]These entries were taken from Table 1. [f]These entries were obtained by summing n for each age group in each risk category. [g]Category-wise recidivism rates were obtained by multiplying each n in each specific age group by its recidivism rate, summing the results over all the age groups and dividing the sum by the number of offenders in the corresponding category (see footnote f).

time. Although Hanson (2006) has stated that the stability of these estimates 'will be unknown until they have been replicated', this view is erroneous and misleading in that confidence intervals have always been calculated for the primary purpose of appraising the degree of stability that characterizes one or more estimates.

These advantages would lead any statistician to conclude that the updated risk table for Static-99 is superior to the original risk table for the purpose of SVP risk assessment. Psychologists in general are also ethically obligated to 'use assessment instruments whose validity and reliability have been established for use with members of the population tested' (American Psychological Association, 2002, p. 13), to present evidence 'in a fair manner' in legal proceedings (American Psychological Association, 1991, p. 12) and to 'be well-versed as to the evidence of validity and reliability for the tests they use and prepared to provide a compelling rationale for their selection' (American Educational Research Association *et al.*, 1999, p.133). Consequently, evaluators who rely on original Static-99 over updated Static-99 for assessing the risk of sexual recidivism are breaching a number of ethical guidelines unless they are able to present an overwhelming body of evidence in support of this choice. Overall, we believe that evaluators should rely on the respecified table that is shown here as Table 3 because of the many reasons cited in the preceding paragraph.

The research reported in this article makes at least four contributions to sex offender risk assessment. For one thing, it again confirms the age invariance theory which, in turn, underscores the importance of concentrating treatment and supervision resources on the youngest offender groups. For another, it points up the value of Bayesian analysis for estimating the probability of sexual recidivism, an advantage that has been described in several other sources (Janus & Meehl, 1997; Donaldson & Wollert, 2008; Wollert, 2006, 2007). For still another, it gives evaluators a resource (Table 3) that is superior to updated Static-99 for deriving risk estimates for young offenders. Finally, it represents a step towards determining 'how best to consider age' (Hanson, 2006, p. 353) in the course of conducting sex offender risk assessments. Hopefully, Dr Hanson will eventually share the data he collected as a governmental servant so that this step may be supplemented by other steps such as (1) sorting the recidivism data reported under the L, ML, MH and H groups into specific score categories (i.e. 0, 1, 2, 3, 4, 5, 6, 7, etc.), (2) calculating the recidivism rates associated with the score and age combinations produced by this operation, (3) replicating the recidivism rates for these age and score combinations, (4) organizing the age and score combinations into risk levels and (5) more precisely estimating the recidivism rates associated with these levels by carrying out a logistic regression analysis of the type that has been applied to other actuarials used for the assessment of sexual recidivism (Woodworth & Kadane, 2004).

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