

Actuarial assessment of domestic violence recidivism risk among custody-based males: The Domestic Violence – Triage Risk Assessment Scale (DV-TRAS)

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Aim

To develop an automated risk assessment tool that can be used to rapidly estimate custody-based DV offenders' likelihood of DV recidivism, using official administrative data that are routinely collected by Corrective Services NSW.

Method

The model development sample included all males in NSW who served a custodial sentence associated with one or more DV convictions between January 2013 and June 2017 ($n = 6,100$). A series of regression models were used to test predictors of DV recidivism and develop optimal estimates of recidivism probability. The final model was validated using bootstrapping techniques and various tests of predictive validity.

Results

Significant predictors of DV recidivism included age; alcohol and other drug problems; markers of a more extensive general criminal history; being released without the possibility of parole; and Indigenous status, as well as DV-specific variables such as prior sentences involving DV convictions and breaches of protection orders. The final estimation model, which we named the DV-TRAS, showed acceptable discrimination performance for DV recidivism (AUC = .660; 95% CI = .646–.675) that was significantly better than routine assessments of general recidivism risk. Bootstrapping techniques indicated satisfactory stability of the model across simulated samples.

Conclusion

The DV-TRAS appears to be a viable tool to support case management decision making for custody-based DV offenders in NSW. Key tests of predictive validity indicated accuracy in discriminating DV recidivists that was significantly better than general risk assessments, and similar to that of established manual assessments of offence-specific risk, while allowing for substantial time and resource savings in generating estimates.

INTRODUCTION

Domestic violence (DV) refers to an individual's use of force to inflict emotional, sexual, psychological or physical injury on another person with whom the individual has a domestic relationship (Bouffard & Zedaker, 2016; Morgan & Chadwick, 2009). DV is a prevalent public health issue with significant costs to victims and the broader community. For example, a total of 32,078 DV-related assault incidents were recorded by NSW Police over 2020 (NSW Bureau of Crime Statistics and Research (BOCSAR), 2020). DV follows gendered patterns of offending, with the majority of victims involving women who are the intimate partners of male offenders (Cox, 2015); research has indicated that prior intimate partner violence (IPV) is one of the primary risk factors for women's victimisation in homicide (e.g., Campbell et al., 2003; 2007). Other instances of family violence often pose risks of harm to some of the most vulnerable members of the community, including children and elderly relatives (Ellsberg & Heise, 2005).

Growing recognition of and intolerance for the costs of DV has prompted an increase in services and strategies for addressing such offending behaviour. In NSW this has included the Domestic and Family Violence Blueprint, which was developed by the NSW Government in 2016 and covers a raft of reforms to approaches to DV at the victim support, criminal justice, and broader societal levels. This has been followed by a current NSW Premier's Priority to reduce DV reoffending by decreasing the number of people who reoffend by 25% by 2023.

Effective delivery of services to offenders and victims of DV, and through this the reduction of DV-related reoffending, requires accurate assessment of risk of recidivism. Assessment of DV-related recidivism risk is often used across jurisdictions for multiple purposes, including informing police and judicial decision making when responding to complaints and sentencing offenders,

and planning victim safety and support services (Hilton et al., 2010; Messing & Thaler, 2013; Nicholls et al., 2013). In the context of Corrective Services NSW, a key purpose of risk assessment is to support delivery of interventions to offenders that aim to address their criminogenic needs. In accordance with the risk principle of the Risk Need Responsivity (RNR) model of offender management (Bonta & Andrews, 2017), interventions are more likely to be effective if they are tailored to offenders' likelihood of recidivism and are targeted towards those offenders with the highest likelihood of recidivism. Adherence to the risk principle is also aligned with correctional agencies' objectives in most efficiently allocating limited intervention resources to large cohorts of offenders under their supervision.

The past two decades have seen a proliferation of tools that have been developed to assess risk of DV-related recidivism (Messing & Thaler, 2013), including outcomes such as likelihood of intimate partner re-assault and homicide. Recent reviews have indicated that available assessments have moderate performance in discriminating DV recidivists from non-recidivists (Graham et al., 2019; Hanson et al., 2007; Messing & Thaler, 2013). For example, Messing and Thaler (2013) concluded that the Ontario Domestic Assault Risk Assessment (ODARA; Hilton et al., 2004) had the best discrimination performance for IPV-related recidivism among sampled assessments, with average Receiver Operating Characteristic (ROC) Area under the Curve (AUC) statistics of $AUC = .666$ across 5 studies. Graham and colleagues (2019) similarly reported AUC statistics ranging between $.64-.77$ for the ODARA across 8 studies. There are indications that predictive performance of the ODARA may be further improved by including additional measures of psychopathy, as is the case with the Domestic Violence Risk Appraisal Guide (DVRAG; Hilton et al., 2008).

While the available risk assessment tools have reasonable predictive validity, they pose a number of challenges to routine use. They are often time and labour intensive, requiring extensive reviews of police or sentencing case notes as well as other sources of information such as victim or offender interviews. Administration of assessments often requires extensive training, and in some cases – such as assessment of psychopathy – may require administrators with specific qualifications, such as psychologists (Hilton et al., 2008). Relatedly, a previous review indicated that assessments were administered incorrectly in the majority of observed cases, involving issues such as substitution or omission of items and misapplication of tests to specific settings (Messing & Thaler, 2013). A large proportion of validation studies for DV risk assessment measures have also been conducted by researchers, and the impacts of assessment fidelity on their accuracy could be expected to increase in applied field settings (Graham et al., 2019).

Administration of most DV risk assessments require consideration of a range of offender, victim and situational variables. These can include relatively dynamic or context-specific factors that require a degree of clinical skill to collate and interpret, such as indications of hostility or coercive control, victim perceptions of imminent risk, familial histories, and victim access to supports (see Nicholls et al., 2013, for a review). However, there are also items in DV risk assessments that index features of the offender and the offence which may be readily accessed through official criminal justice records. For example, the ODARA contains items pertaining to the offender's official history of DV-related and other violent offending; their prior experiences of incarceration; and failures of conditional orders or restraining orders (Hilton et al., 2004). This poses an opportunity to standardise or automate aspects of DV risk assessment involving use of official data streams, with attendant implications for time costs and fidelity of administration.

Automation of DV offender risk assessments using official criminal justice data has been the subject of limited attention in prior research. Fitzgerald and Graham (2016) used NSW Criminal Court records to examine predictors of DV recidivism, and develop a predictive model estimating likelihood of recidivism, among 14,660 adults who had been convicted of any DV-related offence and sentenced to a non-custodial order in NSW. They found the resulting model had acceptable discrimination performance at $AUC = .701$, which is similar to or better than the average performance of clinician-administered risk assessments identified in previous reviews (Messing & Thaler, 2013; Graham et al., 2019).

The present study

Consistent with other studies that have sought to automate official criminal justice records to derive actuarial assessments of risk (e.g., Raudino et al., 2018; 2019; Xie et al., 2018), the model developed by Fitzgerald and Graham (2016) illustrates the utility of this approach for DV recidivism. There remain challenges in applying such a model to case management of DV offenders by Corrective Services NSW, however. Existing risk assessments utilise variables that are not routinely collected by or accessible to Corrective Services NSW, which limits opportunities to rapidly calculate risk estimates on the basis of readily available data streams. In addition, many assessments, including the model reported on by Fitzgerald and Graham (2016), were developed and validated with community-based offenders and thus may not generalise to custodial applications. DV offenders who receive custodial orders tend to have higher risk of recidivism, and may have different circumstances and presenting risk factors both motivating and resulting from imposition of a custodial sentence (Hilton et al., 2010), compared to offenders who receive community orders.

The primary aim of this study is to develop a risk assessment tool that can rapidly estimate likelihood of DV-related recidivism among offenders in NSW who receive custodial sentences in relation to index convictions for DV offending. To achieve this, we identified a range of predictors for DV recidivism based on a review of the literature and sources of information available from Corrective Services NSW operational databases. By modelling the multivariate relationships between these variables and DV recidivism we aimed to derive probability estimates of offenders' likelihood of reoffending that can be automatically calculated from Corrective Services NSW data sources. These estimates formed the basis of the risk assessment tool, which we have named the Domestic Violence – Triage Risk Assessment Scale (DV-TRAS). It is intended that the DV-TRAS may support operational decision making around offenders' eligibility and priority for DV-related interventions as part of custodial case management.

A secondary aim of the study was to explore the role of variables that pertain to an offender's DV-specific history, as compared to more general characteristics and criminal history, in the prediction of DV recidivism. DV has been associated with a range of offence-specific risk factors (e.g., Capaldi et al., 2012), which suggests that risk estimates for DV recidivism may be improved by assessing variables that index offenders' DV-related behaviours and histories, relative to more generalised assessments of risk for any recidivism. There is relatively limited evidence comparing the performance of offence-specific and general risk assessments for DV-related outcomes, however. Early reviews of available assessments indicated that measures of general recidivism, or nonspecific violent recidivism, may be viable for estimating risk of specific outcomes such as IPV (e.g., Hanson et al., 2007; Nicholls et al., 2013). It is consistent with this literature that Corrective Services NSW has historically employed assessments of general recidivism risk to inform case management

decisions about a range of offenders, including those with DV offences.

There are, however, some indications that general risk assessments may underperform in assessing risk of DV recidivism, particularly in custodial settings. For example, Hilton and colleagues (2010) found that for custody-based offenders, the ODARA showed stronger predictive validity for DV recidivism compared to a version of the Level of Service Inventory – Revised (LSI-R: Andrews & Bonta, 1995), which in turn had discrimination accuracy that was not significantly better than chance. More recently, we (Howard & Zhang, 2020) examined the performance of general risk assessments that are routinely used by Corrective Services NSW in estimating risk of DV recidivism among offenders with index DV convictions. The results indicated that assessments had acceptable predictive validity for DV recidivism among offenders in the community, although discrimination performance was weaker for offenders in custody, and approached chance in some analyses. In light of these findings, the current study uses general risk assessments as a baseline for evaluating the performance of the DV-TRAS, and secondary analyses aimed to further explore the mechanisms by which offence-specific assessments may contribute to improvements in predictive validity.

METHODS

Sample

The sample used for this study was all male DV offenders who had commenced a custodial episode with Corrective Services NSW from 1 January 2013. Offenders were also required to have been released before 31 June 2017, to allow for a minimum survival period in the community of at least two years. Offenders were identified as eligible for the sample if one or more convictions attached to their index custodial episode involved DV offences, as indicated by a DV Lawpart code. For offenders with

multiple DV-related episodes over this period, only the first episode was included in the sample in order to prevent model violations associated with non-independence of observations. This resulted in a final sample of 6,100 offenders for analysis.

Data and measures

Offender and outcome variables were retrieved from the Corrective Services NSW Offender Information Management System (OIMS). OIMS is an operational database that maintains data on all offenders under supervision by Corrective Services NSW and includes information on offender demographics, historical and current offences, results of assessment, and other case management and administrative processes.

A range of potential predictor variables were identified based on a review of the relevant DV and risk assessment literature, and subsequently extracted from OIMS. Following initial data diagnostics and variable selection processes, the following variables were retained in the final risk prediction model. For the purposes of this study, we broadly distinguish between variables that pertain to the offender's general characteristics and criminal history, and variables that relate to their DV-specific history of offending.

General predictors included:

- Indigenous status: whether the offender had ever identified as being of Aboriginal and Torres Strait Islander cultural background (0 = no; 1 = yes).
- Age: calculated as the number of years between the offenders' date of birth and the index episode start date. For the purposes of modelling, age was recoded into a series of categories (< 25 years; 25–34 years; 35–44 years; 45+ years).
- Mental health history: this variable was derived from an item in the Corrective Services NSW Intake Screening Questionnaire, which is administered to all inmates upon their reception in correctional centres. Inmates are asked whether they have ever received treatment for a mental health disorder prior to entry into custody for the index episode (0 = no; 1 = yes).
- Substance use: a dichotomous variable obtained from the Corrective Services NSW Intake Screening Questionnaire. The item asked inmates whether they ever had an alcohol and/or drug problems prior to their current custodial episode (0 = no; 1 = yes).
- Episode length: length of time in custody in days. For the purposes of modelling this variable was transformed into the square root of the continuous value.
- Prior prison sentences: counts the total number of prison sentences prior to their current custodial episode.
- Most serious offence (MSO): derived from the Australian and New Zealand Standard Offence Classification (ANZSOC) and collapsed into three groups, being Homicide and related offences; Acts intended to cause injury; and Other¹.
- Parole status: expected eligibility for release from custody was coded into three categories, being automatic release without parole, State Parole Authority (SPA)-based parole, and court-based parole.
- Prior custody episodes: count of total number of custody episodes prior to the current episode.
- Copas rate: a modified version of the original Copas rate (Copas & Marshall, 1998), which calculated the aggregate total of prior custodial

¹ "Other" offences included sex offences, abduction, harassment, robbery, extortion, break and enter offences, theft, fraud, illicit drug offences, prohibited and regulated weapons offences, property offences, public order offences, traffic offences, breach of justice proceedings, and miscellaneous offences (see ANZSOC (2011)).

and community-based sentences as a function of the years between their first sentence and index sentence (see also Xie et al., 2018).

- Prior non-DV violent offending: total count of prior violent offences, excluding those associated with a DV Lawpart code.

DV-related variables that were included in modelling were:

- Prior DV-related sentences: count of total number of sentences involving DV-related convictions within the five years prior to the index episode.
- Prior breaches: count of total number of breaches of Apprehended Domestic Violence Orders (ADVOs), in addition to Apprehended Violence Orders (AVOs) in the last 5 years.
- Prior DV offences: count of the total number of DV offences within five years prior to index episode.
- Prior non-violent DV offences: count of non-violent DV offences in last 5 years.

For all variables involving prior DV-related offences, we applied an upper limit of five years as the recording period. This is because DV Lawpart codes began to be systematically recorded in OIMS from 2007. As a result, identification of specific DV-related offences was not possible prior to this time. All DV-specific variables were transformed into rates to offset differences in offenders' opportunity for related outcomes over the previous 5 years. Specifically, counts of priors (e.g., offences) over the last 5 years were divided by years since the age of 18, with an upper limit of 5 years. Variable modelling diagnostics indicated that transformation of these count variables into rates improved associations with reoffending outcomes, compared to using raw counts alone.

The outcome variable was a dichotomous measure of whether or not DV offenders were recorded as having any return to Corrective Services NSW within

2 years for a new DV offence. This was calculated from OIMS based on the first reconviction with a DV Lawpart code resulting in a new custodial or community-based order that was registered following release from the index custodial episode. Recidivism was censored at two years release from the index custodial episode and any later instances of DV reoffending were excluded.

Of the 6,100 offenders in the sample, a total of 30.6% returned to Corrective Services NSW with a new DV-related conviction ($n = 1865$) within 2 years of release.

Statistical analyses

Model development

A series of steps were used to identify an appropriate set of predictor variables for use in the DV-TRAS predictive model. First, we examined bivariate relationships between explanatory variables and the dependent variable as an initial selection method, using a series of binary logistic regression models. Variables were selected for further consideration if they had a significant bivariate relationship with DV recidivism. Regression models were also used to compare deviance between different calculations, transformations or aggregates of variables to identify the best-fitting variable.

Secondly, parameter estimates for DV reoffending were examined after entering predictors into a multivariable regression model. In order to avoid overfitting to the model development sample (e.g., Babyak, 2004), all predictor variables were entered into the model simultaneously and sequential modelling was not used. The regression equation resulting from the multivariable regression model was used to generate an estimate of each offender's probability of DV recidivism, which formed the basis of the DV-TRAS score.

Model validation

Validation of the final model included tests of relative accuracy in predicting DV recidivism outcomes, or discrimination, as well as tests of absolute accuracy, or calibration. Discrimination performance was assessed using the Receiver Operating Characteristic (ROC) area under the curve (AUC) statistic. As a rule of thumb for interpreting discrimination characteristics of offender risk assessments, AUC values of up to .556 represent a small effect size; up to .639 represent a medium effect size; and up to .714 represent a large effect size (Rice & Harris, 2005). Calibration was assessed using the Hosmer–Lemeshow test, which indicates the goodness of fit or extent of deviation between observed and expected rates of recidivism among score groups.

To validate the external predictive accuracy of the model, we compared the discrimination performance of the DV-TRAS to other risk assessment tools that are used by Corrective Services NSW to support case management and decision making for custody-based offenders. These included the total score derived from the LSI-R, a clinician-administered assessment that estimates risk of general recidivism from 54 items spanning 10 domains of static and dynamic risk factors (Andrews & Bonta, 1995). We also examined performance in comparison to the Custody TRAS, which is an automated actuarial tool previously developed by CRES to assess risk of general recidivism, defined here as any return to custody with a new conviction within 2 years, among people who have received custodial sentences in NSW (Raudino et al., 2019).

We also validated the model by testing stability of associations between predictors and recidivism across different samples. To simulate this we used the bootstrapping technique. This technique replicates the process of sampling from an underlying population by drawing multiple samples from the original dataset. Regression coefficients

and error values for the final model was tested against results derived from 5,000 replications of the sample, which were drawn from the original dataset with replacement.

RESULTS

Logistic regression modelling was used to estimate the multivariate relationships between predictors and likelihood of an offender's return to Corrective Services NSW within 2 years for a new DV offence. The results of this model are given in Table 1. Odds ratios given in the table can be interpreted so that values of more than one indicate a positive association between the predictor and likelihood of recidivism, whereas values between zero and one indicate a negative association between the predictor and likelihood of recidivism.

Examination of general individual characteristic and criminal history variables entered into the logistic regression model indicated that DV recidivism was significantly associated with younger age; Indigenous status; having a shorter index custodial episode length; being ineligible for parole as part of SPA determinations or court based release; having a greater number of prior custodial episodes, and greater density of prior sentences as represented by the Copas rate. For instance, offenders who were younger than 25 years were about twice as likely to return to Corrective Services NSW within 2 years of their release for a DV offence compared to the reference group, which was offenders who were 45 years and older.

Results for the DV-specific predictors indicated that likelihood of repeat DV offending was significantly associated with having a higher rate of prior sentences involving DV-related convictions over the preceding five years, and having a higher rate of breaches of apprehended DV and other violence orders over the preceding five years.

Table 1. Regression coefficients for the final model predicting return to Corrective Services NSW with a new DV conviction within 2 years.

Variable	b	SE	Wald	p	OR	[95% CI]
Constant	-.79	.15	29.72	<.001	.45	-
Indigenous status						
No	1				1.00	
Yes	.24	.06	15.45	<.001	1.28	[1.13-1.45]
Age						
45+	1				1.00	
<=24	.68	.12	33.64	<.001	1.99	[1.57-2.51]
25-34	.51	.11	22.48	<.001	1.67	[1.35-2.06]
35-44	.30	.11	8.16	.004	1.35	[1.09-1.66]
Mental health history						
No	1				1.00	
Yes	-.02	.10	.04	.847	.98	[.80-1.19]
Substance use						
No	1				1.00	
Yes	.42	.08	26.62	<.001	1.53	[1.30-1.80]
Episode length	-.07	.01	102.17	<.001	.93	[.92-.95]
Prior prison sentences	-.001	.01	.04	.85	.99	[.99-1.01]
Most serious offence						
Other	1				1.00	
Serious violent offence	-.12	.07	2.50	.11	.89	[.77-1.03]
Intent to injure	.03	.07	.20	.65	1.03	[.89-1.19]
Parole Status						
None	1				1.00	
SPA parole	-.42	.23	3.27	.07	.66	[.42-1.04]
Court based release	-.25	.08	10.32	.001	.78	[.67-.91]
Prior custodial episodes	.04	.01	13.74	<.001	1.05	[1.02-1.07]
Copas rate	.35	.12	7.82	.005	1.42	[1.11-1.82]
Prior non-DV violent offences	.06	.07	.750	.38	1.06	[.93-1.22]
Prior DV-related sentences	.18	.09	3.99	.04	1.20	[1.00-1.44]
Prior breaches	1.27	.36	12.81	<.001	3.56	[1.77-7.16]
Prior DV offences	-.28	.25	1.26	.26	.76	[.46-1.23]
Prior non-violent DV offences	-.07	.33	.04	.842	.94	[.49-1.80]

Model validation

Figure 1 shows the distribution of DV-TRAS scores among the study sample. The mean predicted probability of DV recidivism in the sample, as estimated by the DV-TRAS, was .31 ($SD = .12$) with a range of .03 - .97.

To test model calibration we used the Hosmer-Lemeshow test statistic. The test value was not statistically significant ($X^2(8) = 5.981, p = .649$), indicating that there were non-significant differences between observed and estimated rates

of DV recidivism for offenders within each of the score groups.

Discrimination performance for DV recidivism within 2 years was assessed using AUC statistics. The AUC generated by the overall DV TRAS model was .660 (95% CI = .646-.675). This corresponds to a medium to large effect size in discriminating DV reoffenders from non-reoffenders on the basis of DV-TRAS scores.

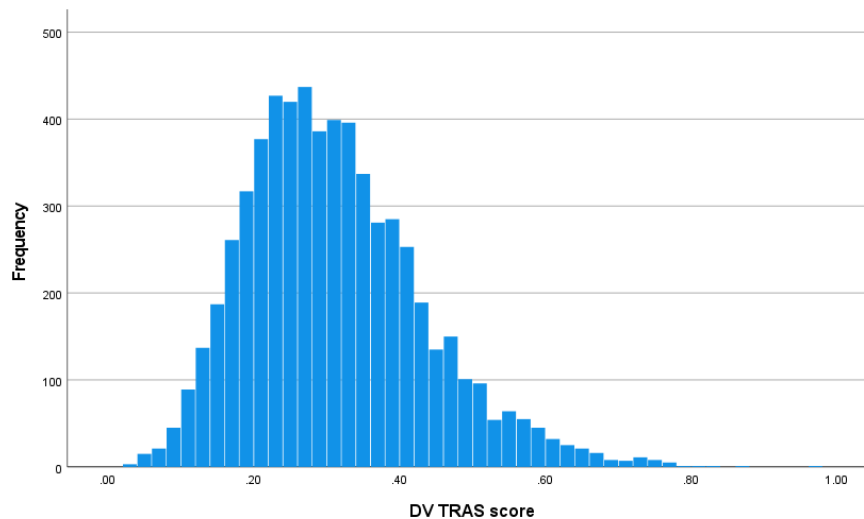


Figure 1. Distribution of DV-TRAS probability estimates for the study sample.

As a source of comparison, discrimination performance for DV recidivism was also examined among other available risk assessments commonly applied to custody-based offenders by Corrective Services NSW, including the Custody TRAS ($n = 6100$) and the LSI-R ($n = 4632$)². Results are given in Table 2. It can be seen that the DV-TRAS had better discrimination for DV recidivism compared to both the Custody TRAS and the LSI-R. In both cases the 95% confidence intervals did not overlap, indicating that the DV-TRAS had significantly stronger predictive validity for DV recidivism compared to the Custody TRAS and LSI-R.

Considering that the Custody TRAS and LSI-R were initially intended to estimate risk of general recidivism as opposed to DV-specific recidivism, as well as the potential value of understanding DV offenders' general recidivism risk in addition to offence-specific risk, we also compared discrimination performance of each of the measures

for any return to Corrective Services NSW with a new sentence within 2 years of release (see Table 2).

It can be seen that for custody-based DV offenders in the sample, the DV-TRAS returned higher AUC statistics for general recidivism within two years compared to both the Custody TRAS and the LSI-R. Again, confidence intervals for the AUC statistics indicated that the DV-TRAS had significantly better discrimination performance for general recidivism compared to the LSI-R, whereas there was some degree of overlap in confidence intervals between the DV-TRAS and Custody TRAS.

Model stability

Bootstrapping was used as the primary validation process for testing the stability of the model. Bootstrapping is a resampling technique that replicates the process of sample generation from an underlying population by drawing multiple random samples from the original dataset. Repeating the model estimation process on the multiple samples can then be used to examine the degree to which regression coefficients would be likely to vary across other random samples of the same population. As such, results can be replicated and findings can be generalised in the absence of multiple samples of unique data.

² We note that every offender in the sample had a Custody TRAS score ($n = 6100$); however only a subset received a valid LSI-R assessment ($n = 4632$) attached to their index custodial episode. To allow for a meaningful comparison of discrimination performance across the LSI-R and DV-TRAS, DV-TRAS statistics were also calculated for only those offenders who also had an LSI-R attached to their custodial episode.

Table 2. AUC statistics and 95% confidence intervals for DV recidivism and general recidivism for estimates derived from the DV-TRAS, Custody TRAS, and LSI-R.

Total sample (n = 6100)	DV recidivism		General recidivism	
	AUC	[95% CI]	AUC	[95% CI]
DV-TRAS	.660	[.646-.675]	.697	[.684-.710]
Custody TRAS	.598	[.583-.613]	.674	[.661-.687]
LSI-R sample (n = 4632)				
DV-TRAS	.667	[.660-.684]	.700	[.685-.715]
LSI-R	.570	[.552-.587]	.629	[.613-.645]

Simulations were repeated 5000 times by redrawing samples of the same size as the development sample with replacement. A logistic regression model consisting of the 15 predictors included in the DV-TRAS (see Table 1) was fitted to each sample. The estimated regression coefficients, and the averaged (bootstrapped) standard errors and 95% confidence intervals based on the empirical sampling distributions created by bootstrapping for 5000 replications are reported in Table 3. These confidence intervals depict the range of plausible regression coefficients (converted into odds ratios) one might encounter from other random samples.

Bootstrapping results indicated model coefficients and estimates of distribution of error that were closely aligned to those derived from the original sample. The standard errors and 95% confidence intervals had small ranges, as can be expected given the relatively large samples involved. The differences in error ranges between the development model and the bootstrapped empirical distribution estimates were negligible for all variables, which suggested that the model can be replicated with a high degree of optimism.

Contributions of general and DV-specific predictors

A secondary aim of the current study was to examine the extent to which explanatory variables relating to the offenders' general characteristics and criminal history, and variables relating to the offenders' DV-specific behaviours, contribute to prediction of DV recidivism risk. To assess this we

first conducted a blocked logistic regression model for DV recidivism, where general predictors were entered in block 1 and DV-specific predictors were entered in block 2. Results indicated that both the block of general predictors ($\chi^2 = 391.91$; $p < .001$) and the block of DV-specific predictors ($\chi^2 = 36.52$; $p < .001$) contributed significant explanation of variance in the outcome.

We also examined the discrimination performance of general predictors and DV-specific predictors separately for DV recidivism outcomes. The block of general predictors returned an AUC for DV recidivism of .653 (95% CI = .638 - .668). Addition of the DV-specific predictors to the model derived a marginal and non-significant increase in discrimination performance (AUC = .660; 95% CI = .646-.675).

DISCUSSION

The aim of this study was to develop a risk assessment tool that could rapidly estimate custody-based DV offenders' likelihood of DV recidivism on the basis of available variables recorded in Corrective Services NSW operational databases. The resulting tool, which we have named the DV-TRAS, showed positive indications of predictive validity in discriminating DV recidivists from non-recidivists. The key AUC statistic indicated discrimination performance that was of moderate to large effect size (Rice & Harris, 2005), and similar to the performance of established manual assessments (e.g., Messing & Thaler, 2013).

Table 3. Comparison of regression coefficients and error terms from the predictive model, and averaged coefficient values and empirical distributions of error terms from the bootstrapped regression models.

	Predictive model				Bootstrapped distribution estimates			
	B	SE	OR	[95% CI]	B	SE	OR	95% CI
Indigenous status								
No	1				1			
Yes	.246	.063	1.28	[1.13–1.45]	.246	.064	1.28	[1.13–1.45]
Age								
45+	1				1			
<=24	.687	.119	1.99	[1.57–2.51]	.687	.119	1.99	[1.58–2.51]
25–34	.511	.108	1.67	[1.35–2.06]	.511	.106	1.67	[1.35–2.05]
35–44	.301	.105	1.35	[1.10–1.66]	.301	.105	1.35	[1.10–1.66]
Mental health history								
No	1				1			
Yes	-.019	.100	.98	[.81]	-.019	.103	.98	[.80–1.20]
Substance use								
No	1				1			
Yes	.424	.082	1.53	[1.30–1.79]	.424	.082	1.53	[1.30–1.80]
Episode length								
	-.071	.007	.93	[.92–.94]	-.071	.007	.93	[.92–.94]
Prior prison sentences								
	-.001	.005	1.00	[.99–1.01]	-.001	.005	1.00	[.99–1.01]
Most serious offence								
Other	1				1			
Serious violent offence	-.118	.074	.89	[.77–1.03]	-.118	.074	.89	[.77–1.03]
Intent to injure	.033	.072	1.03	[.90–1.19]	.033	.072	1.03	[.90–1.19]
Parole Status								
None	1				1			
SPA parole	-.418	.231	.66	[.42–1.04]	-.418	.231	.66	[.42–1.04]
Court based release	-.246	.077	.78	[.67–.91]	-.246	.077	.78	[.67–.91]
Prior custodial episodes								
	.044	.012	1.04	[1.02–1.07]	.044	.013	1.05	[1.02–1.07]
Copas rate								
	.353	.126	1.42	[1.11–1.82]	.353	.124	1.42	[1.12–1.82]
Prior non-DV violent offences								
	.06	.069	1.06	[.93–1.22]	.06	.073	1.06	[.92–1.22]
Prior DV-related sentences								
	.183	.092	1.20	[1.00–1.44]	.183	.091	1.20	[1.00–1.44]
Prior breaches								
	1.271	.355	3.56	[1.78–7.15]	1.271	.352	3.56	[1.79–7.11]
Prior DV offences								
	-.279	.249	.76	[.46–1.23]	-.279	.248	.76	[.47–1.23]
Prior non-violent DV offences								
	-.066	.331	.94	[.49–1.79]	-.066	.345	.94	[.48–1.84]

Cross-validation using advanced bootstrapping techniques also indicated good stability of the model across samples.

The discrimination accuracy of the DV-TRAS was slightly lower than a previous model for estimating DV recidivism based on administrative data that was developed with NSW samples (Fitzgerald & Graham, 2016). An important distinction is that the DV-TRAS was developed and validated with custody-based

offenders as compared to community-based offenders. Previous studies have indicated that risk assessments may have poorer discrimination performance for DV recidivism with offenders in custody than those in the community (Hilton et al., 2010; Howard & Zhang, 2020). A potential explanation for this is that DV offenders in custody tend to have higher DV recidivism risk on average (e.g., Babcock & Steiner, 1999), which could reduce

variance in key predictor variables (Hilton et al., 2010). In addition, a challenge for DV risk assessments is that lower risk offenders may be less likely to engage in either repeat DV reoffending or general reoffending, whereas higher risk offenders tend to have elevated propensity for any reoffending, which may or may not involve DV (Bouffard & Zedaker, 2016; Cavanaugh & Gelles, 2005; Howard & Zhang, 2020). As a result, it may be increasingly difficult to distinguish DV recidivists from non-recidivists among samples where the average risk of general reoffending is relatively high.

Analyses indicated that the DV-TRAS had significantly better discrimination performance for DV recidivism compared to general risk assessment measures, including the LSI-R and the Custody TRAS. The real-world benefits of this increase to predictive validity can be observed through their application to hypothetical operational conditions. For example, Corrective Services NSW has previously adopted a threshold of .35 on the Custody TRAS as part of eligibility criteria for various behaviour change programs for custody-based males. In the study sample, this equates to selection of 3120 DV offenders, 36% of whom returned to Corrective Services NSW with new DV convictions within two years. Substituting the Custody TRAS with the same threshold from the DV-TRAS, this would equate to selection of 1934 DV offenders in the sample, 45.1% of whom returned with new DV convictions. As such, the DV-TRAS shows potential for focusing limited intervention resources on those DV offenders who are more likely to exhibit DV-specific recidivism. The DV-TRAS was also observed to have robust discrimination accuracy for general recidivism compared to the Custody TRAS and LSI-R, which has positive implications for concurrent use of the tool to help address risk of other reoffending outcomes among this cohort.

Interestingly, the results of this study suggested that inclusion of multiple DV-specific predictor variables in the DV-TRAS made only a limited independent contribution to the observed validity gains relative to general risk assessment tools. While DV-specific predictors explained significant variance in outcomes, this effect was small compared to general predictors and equated to a marginal increase in overall discrimination performance. Given these results, it appears that validity improvements shown by the DV-TRAS may be more substantially related to more precise modelling of general individual and criminal history factors to the cohort and outcome of DV recidivism, as opposed to the action of additional offence-specific predictors.

This finding is consistent with other indications that a DV-related criminal history may not be a particularly strong indicator of repeat offence-specific behaviours for many offenders. People with histories of DV offending tend to have high general recidivism risk and criminal versatility, so that they may be more likely to engage in other reoffending behaviours than DV over a given timeframe (Bouffard & Zedaker, 2016; Cavanaugh & Gelles, 2005; Weatherburn & Rahman, 2018). The results do not necessarily imply that DV is not associated with offence-specific risk factors; however, they suggest that such factors may not be well captured by official indicators of past DV-related behaviour. The DV literature emphasises the importance of situational and relational factors in offending (e.g., Capaldi et al., 2012; Morgan & Chadwick, 2009), which can be highly dynamic and difficult to index in administrative records, particularly when accounting for the psychosocial disruption associated with incarceration. In this regard, use of actuarial tools such as the DV-TRAS to estimate risk may be supported by other assessments of acute and stable dynamic risk factors for DV recidivism after release from custody.

While the overall contribution of DV-related variables to predictive validity was relatively small, some individual variables were found to explain unique variance in DV recidivism outcomes. These included a broad index of DV-specific criminal history in the form of prior sentences involving DV convictions, in addition to prior breaches of apprehended DV and other violence orders. Breach of protection or other community orders has been found to be an important predictor of future DV elsewhere (e.g., Fitzgerald & Graham, 2016; Hilton et al., 2004; Kropp et al., 1995; Mason & Julian, 2009) and may have conceptual relevance to dynamic drivers of offence-specific risk, such as an established history of domestic conflict combined with the offender's unwillingness (or incapacity) to comply with rules intended to prevent them from perpetuating conflict or harm. Given that breaches of DV orders tend to be under-reported (Douglas, 2008), it is possible that prior breaches also reflect cases where there is increased police scrutiny of an offender, or victims who feel empowered to officially report past and future instances of offending behaviour (Dowling et al., 2018).

Other predictors of DV recidivism found in this study have also been demonstrated to predict general recidivism risk, such as age, problems with alcohol and other drugs, and having multiple prior criminal convictions and sentencing events (Andrews & Bonta, 1995; Bonta & Andrews, 2017; Gendreau et al., 1996). Being released from custody at sentence expiry was also associated with higher risk of recidivism, which may reflect the potentially protective effect of receiving parole supervision after release (Ooi & Wang, 2022). In addition, Indigenous status was positively associated with likelihood of return with a new DV conviction. Other Australian research has made similar findings (see Hulme et al., 2019, for a review) and identified needs for additional research and services to address the multiple complex factors associated with DV offending and victimisation in Indigenous communities. However, it should be noted that like

many static variables, Indigenous status was included in the model as a statistical proxy for covariance between individuals and recidivism only, and the study does not intend to convey information about the causal relationships between cultural factors and criminal justice outcomes.

Some other limitations of the study are noted. DV is a heterogeneous category of offences involving a range of situations, relationships and behaviours. This may correspond with heterogeneity in associations between offender characteristics and recidivism (although see Zhang & Howard, 2020), which could contribute to increased error in risk estimates. The DV-TRAS used a broad outcome criterion to support Corrective Services NSW objectives to address all forms of DV, although this decision was also prompted by the absence of reliable information about victim relationships in OIMS. In addition, the DV-TRAS was modelled for use with offenders in custody and may require modification before being used in community settings. This may be a fruitful area of future research given indications that assessments of DV recidivism risk can have higher predictive validity for offenders in the community (Howard & Zhang, 2020).

It is also noted that the DV-TRAS generates an index of probability of DV recidivism only, and does not provide information about the presence or severity of criminogenic needs. As previously mentioned, use of the DV-TRAS as an initial risk triaging tool may be complemented by additional assessment of dynamic risk, protective and responsivity factors. Similarly, the DV-TRAS was developed to estimate risk of reconviction, and may not be sensitive to risk of unreported or unprosecuted future DV-related behaviours.

Notwithstanding these limitations, the results of this study give promising indications that the DV-TRAS can be used to quickly and accurately estimate custody-based DV offenders' risk of recidivism. We found that the tool shows positive signs of

specificity to DV recidivism compared to assessments of general recidivism risk. Because the DV-TRAS only uses standardised variables that are routinely available in Corrective Services NSW operational databases, it has the potential to be automated within existing data systems to generate almost instantaneous estimates of risk for large numbers of DV offenders. The efficiency gains afforded by models such as the DV-TRAS may in turn allow for increased allocation of limited clinical resources towards case management and interventions to reduce DV offenders' likelihood of reoffending.

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