Research Bulletin

Corrective Services NSW
Corporate Research, Evaluation and Statistics

The Utility of Level of Service Inventory – Revised (LSI-R) Assessments within NSW Correctional Environments

Ian Watkins

The Level of Service Inventory – Revised (LSI-R) is an actuarial assessment tool designed to identify the offenders' risks and needs with regard to recidivism. That is, the LSI-R seeks to classify an offender's risk of re-offending as well as to identify their particular criminogenic needs. While the LSI-R itself has been extensively validated internationally its use within the NSW correctional environment remains relatively unsubstantiated due to methodological limitations of previous research. The current study sought to rectify limitations of previous studies and to provide a sound statistical evaluation of the instrument's psychometric properties with a sample of NSW custody-based offenders whose sentences were equal to or shorter than two years. In addition to evaluating the instrument's psychometric properties differences due to gender and Aboriginal/Torres Strait Islander (ATSI) status were also examined. The results revealed an encouraging pattern of discrimination with proportionally more recidivists in the high risk categories and proportionally more non-recidivists in the lower risk categories. An examination of offenders' criminogenic needs profiles revealed that the LSI-R did not meaningfully discriminate between males and females or between non-ATSI and ATSI offenders. While the instrument's predictive utility was acceptable with the majority of offenders, point estimates were notably lower with ATSI females. These findings are consistent with international research and provide empirical justification for the application of the LSI-R to specific populations.

KEY FINDINGS

- Of the 11,051 offenders assessed whose custodial sentences were equal to or shorter than two years, 3,694 (33%) were re-incarcerated within two years following release.
- Of the 3,374 recidivist male offenders, 341 (10%) were classified as low or low/medium-risk, 1,330 (39%) were classified as medium risk, and 1,703 (51%) were classified as medium/high or high risk.
- Of the 6,646 male offenders who did *not* re-offend, 2,329 (35%) were classified as low or low/medium-risk, 2,611 (39%) were classified as medium risk, and 1,706 (26%) were classified as medium/high or high risk.
- While differences on the LSI-R due to sex and ATSI status were observed, they were considered inconsequential due to their very low explanatory power (less than 7%) with regards to the observed variance in total LSI-R scores. These outcomes suggest that the groups scored similarly on the LSI-R.
- Measures of discriminative ability suggest that the LSI-R is performing similarly to its use internationally, with the highest point estimates observed with non-ATSI males and the lowest occurring with ATSI females. This means that the LSI-R is performing appropriately with non-ATSI males and females and ATSI males yet may *not* accurately predict ATSI female recidivism.
- Analysis of survival time by risk classifications revealed that as risk classifications progressively increase from low to high, the survival time in the community decreases. That is, high risk offenders re-offend at higher rates and do so *faster* than lower risk offenders.
- Estimates of the LSI-R's reliability (internal consistency) are satisfactory. This means that each individual item purported to measure the same underlying construct produced similar scores.

INTRODUCTION

The Level of Service Inventory – Revised is an actuarial assessment tool designed to identify the offenders' *risks and needs* with regard to recidivism. In other words, the LSI-R seeks to classify an offender's risk of re-offending as well as to identify their particular criminogenic needs. Within Australia, the application of the LSI-R adheres to the principles of risk, needs and responsivity that underlie offender assessment and rehabilitation (see Andrews and Bonta, 1994). These principles, posit that offenders posing a high risk of re-offending should receive higher intensity interventions including increased supervision and monitoring. These interventions should also be tailored to the offender's individual criminogenic needs with the aim of minimising overall recidivism and enhancing community security.

Based on a social learning model of crime, the LSI-R has 54 items, which are grouped into 10 subscales: Criminal History, Education/Employment, Finances, family/Marital, Accommodations, Leisure/Recreation, Companions, Alcohol/Drug, Emotional/Personal, and Attitude/Orientation. LSI-R total scores are generally used to predict recidivism (risk) whereas subscale scores are used to identify criminogenic needs.

The use of the LSI-R in NSW

In 2002 Corrective Services NSW (CSNSW) introduced the LSI-R as a means to assess the risk and needs of offenders. Arguments for the instruments widespread use asserted that, compared to unstructured professional judgments, LSI-R assessments afforded greater consistency and credibility regarding decisions made about offenders risk of re-offending. The measure now forms the basis for all assessments and case planning within CSNSW. In 2008/09, 37,221 LSI-R assessments were completed for a variety of purposes including pre-sentence and pre-release court advice reports. An LSI-R was completed on 85.4 percent of offenders with a new supervision order during the same financial year (CSNSW annual report, 2008/09). However, despite its widespread use, there is a scarcity of research validating the instrument within NSW correctional environments. This can primarily be traced to the longitudinal nature of validation assessments. That is, the instrument must be used with the population of interest *before* it can be validated against a sufficiently large scale sample.

Research examining the LSI-R within NSW

Numerous studies utilising international samples have investigated the psychometric properties of the LSI-R. Researchers have asked the question: Are LSI-R scores *reliable* and are they *valid*?

Whilst the majority of psychometric evaluations suggest that the LSI-R is a useful instrument with regards to measuring offenders' risks and needs, there is a paucity of rigorous evaluations establishing the LSI-R within Australia. A search of the extant literature revealed only three studies relevant to LSI-R predictions of *general* recidivism within *Australia*. Eyland, et al. (2009) examined the power of LSI-R assessments to predict recidivism within a large sample of NSW offenders. While their results did indicate some degree of predicative accuracy, the study had some methodological limitations; namely:

- Failure to control for an individual's eligibility to re-offend. That is, the follow-up period for each offender was not standardised
- Utilisation of a more liberal definition of recidivism than Andrews and Bonta's (1995) original LSI-R validation assessment, making comparisons to the original validation sample more problematic
- Boundary limits were not constructed around the length of sentence. CSNSW has administrative guidelines regarding custodial offenders incarcerated for less than 2 years. Assessments are based on their past 12 months in the community and not their current circumstances in custody. These guidelines were introduced in 2007 and span previous data captures,
- Statistical analyses did not differentiate between community and custody-based offenders.

In two similarly designed studies utilising NSW offender samples, Hsu, Caputi, and Byrne (2009) and Hsu, Caputi, and Byrne (2010) both failed to control for offenders eligibility to re-offend. They state that "*data on re-offending were retrieved from OIMS and gathered for the entire sample at the same date*". This limitation (not allowing all the sample as standardised 'time to fail') would necessarily distort classification accuracy. The utility of LSI-R assessments remains to be rigorously evaluated as appropriate data analyses must take all these factors into account.

Research Rationale

The three previous studies of NSW data have limited interpretations of NSW data results, therefore, CSNSW commissioned a further investigation into the LSI-R's utility within NSW.

Research Aims

The intention of the current project was to build on the previous studies conducted in NSW on LSI-R validity and reliability and further investigate the utility of the LSI-R within the NSW jurisdiction. Specifically, the current project aimed to:

- Establish CSNSW normative statistics
- Establish CSNSW criminogenic needs profiles
- Investigate differences in LSI-R scores due to sex and Aboriginal/Torres Strait Islander (ATSI) status, and
- Investigate the LSI-R's psychometric properties within CSNSW.

METHODOLOGY

The following methodology was designed to fulfil the aims and objectives of the research brief:

Data Source

The current research project used data retrieved from the CSNSW Offender Information Management System (OIMS). The sample consisted of the 11,051 offenders released from incarceration between January 2005 and January 2008, who had been incarcerated for less than 2 years and who had been assessed with the LSI-R instrument. Where offenders had multiple LSI-R assessments the latest was taken and used for the analysis.

Defining Recidivism

The current study uses Andrews and Bontas (1995) original definition of recidivism; *re-incarceration* following release. In addition the offender's eligibility to re-offend was controlled. That is, upon release offenders were followed for a *standardised* period of 2 years. This means that all offenders had equal time to re-offend.

RESULTS

Characteristics of the sample

- The mean age of the sample group was 33 years.
- 10,020 (91%) were male whilst 1,031 (9%) were female.
- 8,169 (74%) identified themselves as non-Indigenous while 2,882 (26%) identified themselves as Indigenous.
- The most common current offence was 'acts intended to cause injury' (26%), followed by 'offences against justice procedures, government security, and government operations' (19%), then 'theft and related offences' (10%).
- Of the 11,051 offenders assessed, 3,695 (33%) were re-incarcerated during the follow-up period of 2 years.

Normative statistics

The current study investigated NSW normative statistics through an examination of the distributional proportions exhibited by male offenders with regard to risk classifications. This examination was not conducted with female offenders as the LSI-R's users manual does not specify risk category cut-off scores for female offenders. Of the 3,374 recidivist male offenders, 341 (10.2%) were classified as low or low/medium-risk, 1,330 (39.4%) were classified as medium risk, and 1,703 (50.5%) were classified as medium/high or high risk. Conversely, of the 6,646 male offenders who did *not* re-offend, 2,329 (35.4%) were classified as low or low/medium-risk, 2,611 (39.3%) were classified as medium risk, and 1,706 (25.7%) were classified as medium/high or high risk. **Table 1** presents the distribution of LSI-R classification categories by recidivism status. Alternatively **Figure 1** presents the percentage of male offenders with computed risk categories and re-offending outcome.

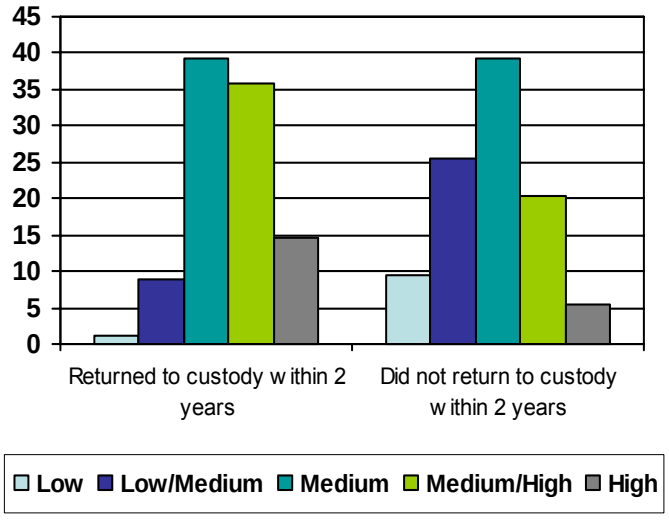
Table 1: Distribution of LSI-R classification categories by recidivism status of male offenders

2005/2008 LSI-R risk category (N = 10020)	Male offenders who re-offended within 2 years		Male offenders who did *not* re-offend within 2 years	
Low	1.2%	(39)	9.6%	(636)
Low/Medium	9.0%	(302)	25.5%	(1,693)
Medium	39.4%	(1,330)	39.3%	(2,611)
Medium/High	35.8%	(1,207)	20.3%	(1,348)
High	14.7%	(496)	5.4%	(358)
Total	100.0%	(3,374)	100.0%	(6,646)

Criminogenic needs profiles and their relationship with recidivism

In order to investigate LSI-R differences due to sex and ATSI status and the relationship between LSI-R components and recidivism, a multivariate analysis of variance (MANOVA) was conducted and point bi-serial correlations were computed. The MANOVA analysis revealed statistically significant main effects of sex and ATSI status, as well as a significant two-way interaction effect. However, the omnibus model accounted for only 6.7% of the variance in total LSI-R scores. Differences due to sex and ATSI status were deemed inconsequential due to their very low explanatory power. It should be noted, however, that ATSI offenders scored higher on every subscale except the emotional/ personal subscale. **Table 3** displays the means and

Figure 1: Percentage of male offenders with calculated LSI-R risk categories and re-offending outcomes



standard deviations of the LSI-R total and subscales scores by sex and ATSI status. While MANOVA analysis revealed no meaningful differences in LSI-R scores due to sex and ATSI status, point bi-serial correlations revealed typically smaller associations for females. Point bi-serial correlations provide a measure of co-variance between recidivism and each subscale with greater values indicating greater co-variance. That is, a positive correlation for criminal history indicates that as criminal history increases so do rates of recidivism. **Table 4** displays the calculated point bi-serial correlations as well as their 95% confidence intervals. The table shows that the observed correlations decrease in magnitude and significance when applied to female offenders. This means that the subscales of the LSI-R may not be appropriate for measuring the criminogenic needs of NSW females offenders. This is a significant finding and requires further research.

Psychometric evaluation

Psychometric evaluations typically primarily focus upon two concepts when investigating test properties; reliability and validity. These concepts reflect how well the LSI-R discriminates between re-offenders and non re-offenders (validity), as well as how well each test item measures the underlying construct (reliability/ internal consistency).

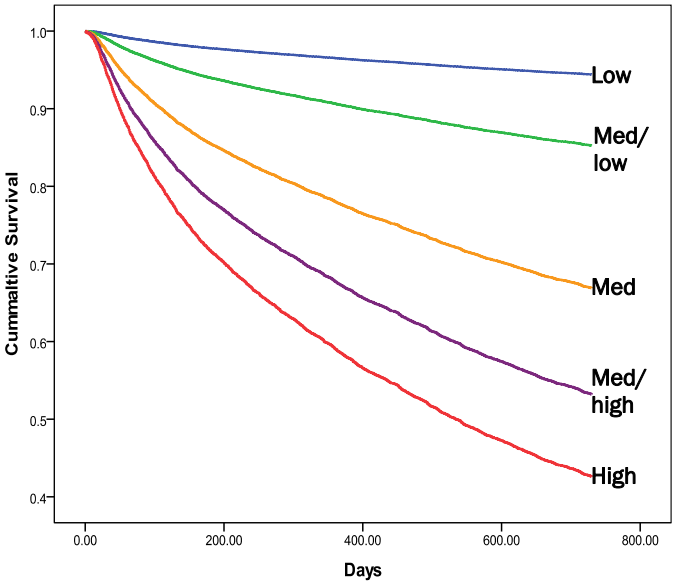
Validity

While the previous Australian research pertaining to the utility of LSI-R assessments computes measures of validity based upon binary logistic regression modelling procedures, the current study investigates validity via receiver operator characteristic (ROC) analysis. Such procedure produces what is know as a "ROC curve", which plots true positive rates against false positive rates displaying the trade-off between sensitivity and specificity for all cut off values. This method was chosen as it has been shown to be base rate invariant, as well as being independent of selection ratios (Rice and Harris, 1995). These qualities are particularly important as re-offending base rates vary as a function of sex and ATSI status. ROC analysis provides a measure of discriminative accuracy with greater values indicating greater discriminative ability. The observed area under the curve (AUC) statistics can be interpreted as the probability that a randomly selected recidivist would have a higher LSI-R score than a randomly selected non-recidivist. **Table 2** presents the observed AUC values split by sex and ATSI status as well as their 95% confidence intervals. AUC statistics for calculated risk classifications could not be computed for female offenders as the cut-off points are not specified in the LSI-R users manual.

Table 2: (AUC) values and 95% confidence intervals split by sex and ATSI status by recidivism status

	LSI-R total score	LSI-R calculated risk classification
Non-ATSI males	**.694** (.682 - .707)	**.682** (.670 - .695)
Non-ATSI females	**.687** (.642 - .731)	N/A
ATSI males	**.655** (.634 - .676)	**.636** (.614 - .658)
ATSI females	**.597** (.542 - .652)	N/A
Overall	**.690** (.680 - .700)	**.677** (.666–.687)

Figure 2: Survival rates as a function of time.



In order to compare the AUC values, 95% confidence intervals were computed and visually contrasted. The results suggest that the only differences in discriminative ability were between the non-ATSI males and the ATSI females, with lower AUC values observed for ATSI females. These comparisons, however, must remain tentative as comparing the overlap of 95% confidence intervals is not a direct test of departure.

In addition to discriminative validity, the current study investigated the relationship between survival time in the community and risk classifications via Cox regression analysis. The analysis revealed that as risk classifications increase, the survival time in the community decreases. This means that offenders receiving higher risk classifications re-offend more quickly and at greater rates than those receiving lower risk classifications. All tests were statistically significant at the 0.05 alpha level. **Figure 2** presents survival rates as a function of time.

Reliability

Reliability analysis revealed that the internal consistency estimates for LSI-R subscales range from adequate (Cronbach's alpha for the accommodation subscale = 0.509) to good (Cronbach's alpha for the Education/Employment subscale = 0.784). That is, the LSI-R exhibits acceptable reliability. This means that each individual item purported to measure the same underlying construct produced similar scores. These findings are similar to those reviewed by Andrews and Bonta (1995).

DISCUSSION

The current study investigated the utility of LSI-R assessments within NSW correctional environments. The study sought to establish CSNSW normative statistics by examining the pattern of discrimination exhibited by the LSI-R. This examination revealed an encouraging pattern, with proportionally more recidivists in the high risk categories and proportionally more *non*-recidivists in the lower risk categories. While this pattern is encouraging, it is inconsistent with results reported by Eyland, et al. (2009). Several factors may account for this discrepancy, namely;

- The current study used a more contracted definition of recidivism; defined as *re-incarceration* following release as opposed to returning to prison or supervision of CSNSW.
- The studies differed in their criteria for sample inclusion (sentence length less then 2 years to accommodate for CSNSW LSI-R guidelines regarding incarcerated offenders).
- *Standardisation* of eligibility to re-offend as opposed to collecting recidivism data based on a set of data.

An examination of offender criminogenic needs profiles split by sex and ATSI status revealed that while significant differences were observed, the variance accounted for by the statistical model was inconsequential. That is to say, Andrews and Bonta's claim of gender and ethnic neutrality is confirmed within the current sample. This means that the LSI-R does not appear to discriminate between males and females or non-ATSI and ATSI offenders. Each group scored similarly on the LSI-R. While the different groups may have scored similarly, it should be noted that the LSI-R does not appear to function as well with ATSI females. There is a notable decline in the LSI-R's predictive power when applied to female ATSI offenders. This may be due to ATSI females manifesting different criminogenic needs than those measured by the LSI-R. ATSI females as a group appear to have different pathways to offending than the other groups. This finding requires further research.

While the distributional proportions exhibited by offenders is encouraging, investigating the LSI-R's psychometric properties within NSW required more detailed analyses, including the calculation of point bi-serial correlations, ROC analysis, Cox regression, as well as measures of reliability (internal consistency). When taken together the results suggest that the LSI-R exhibits acceptable psychometric properties when applied to a sample of NSW custody-based offenders. That is, there is a good likelihood that a randomly selected recidivist would have a higher LSI-R score than a randomly selected non-recidivist and that higher LSI-R scores are associated with increased rates of recidivism. As risk classifications progressively increase from low to high, rates of recidivism increase and survival time in the community decreases. These estimates are similar to those obtained when analysing international samples (Flores, Lowenkamp, Smith, & Latessa, 2006; Lowenkamp, Levine, & Latessa, 2009; Manchak, Skeem, & Douglas, 2008).

The results of the current study should be interpreted within the risk, needs, and responsivity theoretical framework. Higher risk offenders, as identified by the LSI-R, should receive high intensity interventions. Conversely, low risk offenders should receive low intensity or no intervention. This study reinforces that it is appropriate for CSNSW to use the LSI-R to adhere to the risk principle and rehabilitative practice. Furthermore, the unique LSI-R profile exhibited by each offender will assist service providers in tailoring intervention plans in CSNSW.

Table 3: LSI-R total and subscales means and standard deviations split by sex and ATSI status.

LSI-R Dimension	Non-ATSI males (n=7555)	Non-ATSI females (n=614)	ATSI males (n=2465)	ATSI females (n=417)
Criminal history	6.1 (2.2)	5.7 (2.3)	7.1 (1.8)	6.6 (1.9)
Education/Employment	6.0 (2.6)	6.6 (2.2)	7.3 (2.1)	7.4 (1.6)
Financial	1.4 (0.8)	1.7 (0.5)	1.6 (0.6)	1.8 (0.4)
Family/Marital	1.7 (1.3)	2.3 (1.2)	2.4 (1.2)	2.6 (1.1)
Accommodation	1.0 (1.0)	1.2 (1.0)	1.3 (1.0)	1.6 (1.0)
Leisure/Recreation	1.5 (0.7)	1.7 (0.6)	1.7 (0.6)	1.8 (0.5)
Companions	2.1 (1.2)	2.5 (1.2)	2.5 (1.1)	2.6 (1.0)
Alcohol/Drug problems	5.0 (2.3)	5.2 (2.4)	6.0 (1.8)	6.0 (1.7)
Emotional Personal	1.4 (1.4)	2.0 (1.5)	1.3 (1.4)	1.9 (1.5)
Attitudes/Orientation	1.5 (1.4)	1.4 (1.4)	1.9 (1.2)	1.8 (1.5)
LSI-R total score	27.7 (9.2)	30.2 (8.7)	33.0 (7.6)	34.2 (6.3)

CONCLUSION

Collectively, the results of the present study indicate that the LSI-R is functioning similarly to its use internationally. The test appears to assign higher risk levels to offenders more likely to re-offend for the majority of offenders. This finding is encouraging and provides empirical evidence for the continued application of the LSI-R to all populations; including non-ATSI males and females and ATSI males in NSW. When applied to NSW ATSI females, however, the LSI-R's appropriateness is questionable. The magnitude of the LSI-R subscale correlations and the instruments discriminative ability regarding recidivism is reduced for this population compared to the majority of offenders. This finding suggests that LSI-R assessments of risk may not be valid and may be misleading when applied to NSW ATSI females. Further research is required to investigate *why* the LSI-R is not functioning as well with this particular subgroup.

LIMITATIONS

While the current study sought to re-examine the utility of the LSI-R in light of the methodological limitations observed with previous research, certain limitations still exist. These include:

- The sample consisted only of custody-based offenders. The results may not hold for community based offenders.
- Sampled offenders were drawn from only one correctional jurisdiction. Thus, re-offences occurring in other states would not be captured.
- Where offenders had multiple assessments the *last* assessment was used in the analysis. These assessments may be artificially inflated/deflated due to statistical regression. The impact of this effect was not investigated.
- The impact of treatment was unable to be assessed. This means that sampled offenders may or may not have undergone treatment while incarcerated. Given that CSNSW targets medium to high risk offenders as those in most need for intervention, recidivism rates within these groups may be partly deflated.

Table 4: Point bi-serial correlations and 95% confidence intervals split by sex and ATSI status.

LSI-R Dimension	Non-ATSI males (n=7555)	Non-ATSI females (n=614)	ATSI males (n=2465)	ATSI females (n=417)
Criminal history	0.277** (0.26 to 0.31)	0.328** (0.26 to 0.40)	0.183** (0.15 to 0.22)	0.268** (0.18 to 0.36)
Education/ Employment	0.236** (0.22 to 0.26)	0.168** (0.09 to 0.25)	0.199** (0.16 to 0.24)	0.113* (0.02 to 0.21)
Financial	0.187** (0.17 to 0.21)	0.106** (0.03 to 0.19)	0.134** (0.10 to 0.17)	0.081 (-0.02 to 0.18)
Family / Marital	0.136** (0.11 to 0.16)	0.073 (-0.01 to 0.15)	0.144** (0.11 to 0.18)	0.042 (-0.05 to 0.14)
Accommodation	0.163** (0.14 to 0.19)	0.164** (0.09 to 0.24)	0.131** (0.09 to 0.17)	0.026 (-0.07 to 0.12)
Leisure / Recreation	0.160** (0.14 to 0.18)	0.045 (-0.03 to 0.12)	0.127** (0.09 to 0.17)	0.094 (-0.03 to 0.16)
Companions	0.175** (0.15 to 0.20)	0.186** (0.11 to 0.27)	0.158** (0.12 to 0.20)	0.041 (-0.06 to 0.14)
Alcohol/Drug problems	0.201** (0.18 to 0.23)	0.239** (0.16 to 0.31)	0.173** (0.14 to 0.21)	0.062 (-0.03 to 0.16)
Emotional Personal	0.051** (0.03 to 0.07)	-0.001 (-0.08 to 0.08)	0.068** (0.03 to 0.11)	-0.028 (-0.12 to 0.07)
Attitudes/ Orientation	0.174** (0.15 to 0.20)	0.092* (0.01 to 0.17)	0.176** (0.14 to 0.22)	0.109* (0.01 to 0.21)
LSI-R total score	0.306** (0.29 to 0.33)	0.271** (0.20 to 0.35)	0.270** (0.24 to 0.31)	0.175** (0.08 to 0.27)

** Correlation significant at the 0.01 level (2 tailed) ( ) 95% confidence intervals
* Correlation significant at the 0.05 level (2 tailed)

RECOMMENDAITONS

The following recommendations are made based on the findings of this study.

- The analyses presented in the current study should be repeated with a sample of community-based offenders.
- Further research into *why* the LSI-R is not functioning as well with ATSI females should be commissioned.

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ABOUT THE AUTHOR

Ian Watkins is a registered psychologist in Australia and an Honorary Associate/guest Lecturer at Macquarie University. He has worked within a specialised assessment unit within CSNSW and liaised as a statistical consultant on many research projects.

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Corporate Research, Evaluation & Statistics
Corrective Services NSW
GPO Box 31
Sydney NSW 2001

Telephone: (02) 8346-1556
Facsimile: (02) 8346-1590
Email: research.enquiries@dcs.nsw.gov.au
Web: http://www.correctiveservices.nsw.gov.au