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Change in offence seriousness across early criminal careers

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***Aim**: To investigate whether the crimes committed by offenders early in their criminal careers change in severity over consecutive offence episodes.*

***Methods**: Offence seriousness was measured across conviction episodes for a cohort of people born in NSW in 1994. We examined the relationship between offence seriousness and conviction episodes using two techniques. The first analysis involved stratifying offenders by total number of episodes and then using non-parametric tests to compare offence seriousness between and across episodes. The second analysis involved using group based trajectory modelling to investigate if there were groups of offenders who had different trajectories of offence seriousness over their first three conviction episodes.*

***Results**: Across all offenders, non-parametric tests showed no consistent relationship between offence seriousness and conviction episode. In contrast, group based trajectory modelling provided evidence for four offence seriousness trajectory groups: (1) an escalating group (16.1% of sample), (2) a low stable group (32.7% of sample), (3) a high stable group (26.0% of sample), and (4) a de-escalating group (25.2% of sample).*

***Discussion**: Group based trajectory modelling provided evidence that the relationship between offence seriousness and conviction episodes varies for sub-groups of offenders. Potential implications for understanding and informing the prevention of serious crime are highlighted. Limitations of this study and challenges for future research are discussed.*

***Keywords**: criminal careers, offence seriousness, trajectory modelling*

INTRODUCTION

Not all crimes that offenders commit are the same. Some crimes have very little direct impact on any individual or community, while others can cause enormous suffering and disruption. It is thus not surprising that crime seriousness is a fundamental consideration in policing and the administration of penalties in the court system, nor that remedial programs in the criminal justice system often target those offenders who have committed the most serious crimes. As such, offence severity is central to how the criminal justice system responds to offenders.

Overwhelmingly, prior research on criminal offending has focused on describing, comparing and predicting the rate, or number of offences, committed by offenders. As a result we know a lot about those who commit further offences (Piquero, Farrington, & Blumstein, 2007). However, we know considerably less about those who will go on to commit more serious offences (Liu, Francis, & Soothill, 2010).

In a recent book on criminal careers, Piquero et al. (2007) identify eight issues that are contentious or for which little research has been conducted - four of these issues relate directly to changes in the seriousness of the crimes committed by offenders in their criminal careers. Klein (1984), in a review of thirty-three studies of juvenile offence versatility and specialisation, reported that no relationship was found in any of the studies that tested for trends in offence seriousness across offence episodes or age. It is interesting that, despite the lack of evidence, one of the most strongly held beliefs about crime and criminals in society is that as offenders commit more crimes, the seriousness of their offences escalates (Francis & Liu, 2009).

Research on offence seriousness, like other areas of criminal career research, has increasingly been subjected to methodological critique (Britt, 1996; Liu et al., 2010). This is in part due to the wider availability of new statistical methods. Prior seriousness studies, such as those reviewed by Klein (1984),

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used basic statistical methods such as linear regression, analysis of variance and non-parametric tests of independence. These methods do not account for factors inherent in longitudinal crime data such as the non-independence of observations (because repeated observations are taken on the same individual) and underlying heterogeneity (different groups within the same cohort may show different trends in relation to offence seriousness). Newer techniques such as mixed effects models and latent class methods deal more effectively with these issues.

Using a latent class analysis method called group based trajectory modelling (GBTM) it is now possible to model unobserved heterogeneity in developmental trajectories. GBTM enables the identification and estimation of underlying groups with similar longitudinal trajectories (i.e. patterns of offending over time) (Nagin, 2005). In recent years, GBTM has been applied extensively to investigate if specific groups of offenders within populations follow different offence frequency trajectories over their criminal careers. This research has consistently found that groups of offenders follow particular offence frequency trajectories (van Dulmen, Goncy, Vest, & Flannery, 2009), commonly identifying a low rate group, a moderate rate adolescent desisting group and a high rate chronic group (Piquero, 2008). Despite GBTM's widespread use to investigate offence frequency, it has not specifically been used to investigate whether groups of offenders have different offence seriousness trajectories. Considering the findings for offence frequency, it is quite plausible that groups of offenders will show different patterns in the seriousness of offences committed throughout their criminal careers.

In the current study we investigate whether the crimes committed by offenders change in severity over consecutive conviction episodes. We do this using two analytical approaches. We first use non-parametric tests to investigate if, across offenders, there are significant changes in offence seriousness over consecutive conviction episodes. Specifically, this analysis aims to answer the question:

- Is there a consistent relationship between offence seriousness and conviction episodes across offenders?

We then employ GBTM (Nagin, 2005) to explore if there are separate groups of offenders within the sample that follow different offence seriousness trajectories. Through this analysis we seek to answer the following questions:

- How many offence seriousness trajectory groups best fit the data?
- What is the form or shape of the trajectories for each group?
- Which characteristics distinguish offenders in the different trajectory groups?

METHODS

DATA SOURCES AND SAMPLE

A birth cohort sample was used to minimise confounding due to factors such as generational changes in the seriousness of offending, or interactions between age and the number of offences committed. The New South Wales (NSW) Registry of Births, Deaths and Marriages provided identifying information (full name and date of birth) for all people who were registered as being born in NSW in 1984. This cohort was linked to the Re-offending Database (ROD) maintained by the NSW Bureau of Crime Statistics and Research (BOCSAR). ROD consists of linked individual offender-level data for all finalised criminal appearances in NSW courts from January 1994 (Hua & Fitzgerald, 2006). The 1984 birth cohort was chosen for linking as it is the first birth cohort for which ROD has complete records for all offences committed since the age of 10 years (i.e. from 1994), which is the legal age for criminal responsibility in NSW. While ROD is a reliable source of offending in NSW, we acknowledge that due to interstate and international migration, offending histories for some individuals in the cohort could be incomplete.

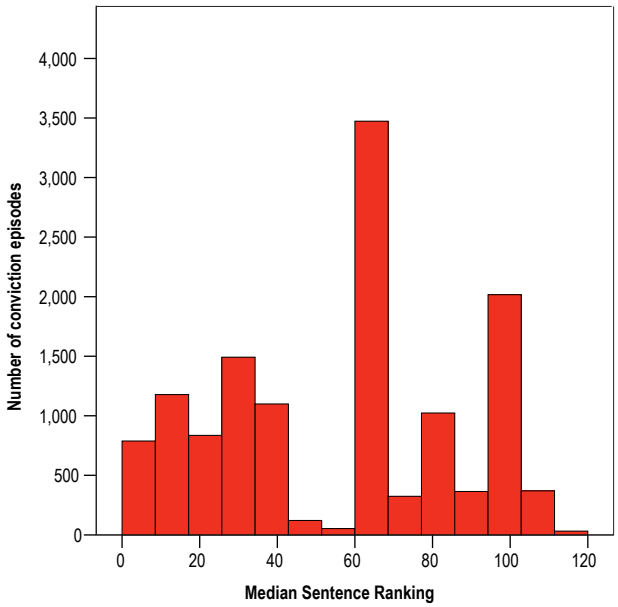
The base sample for the study were offenders from the 1984 NSW birth cohort who had at least two conviction episodes before June 30, 2009. A conviction episode relates to a finalised court or Youth Justice Conference (YJC) matter in which an offender was found guilty of at least one offence. It was important to include YJC matters in the sample as after the introduction of the *Young Offenders Act 1997* (NSW) (YOA) many criminal matters previously finalised in the courts were being finalised through YJCs. While formal cautions were also introduced in the YOA, we did not include formal caution offences as we assumed that prior to the YOA many of these offences would have been dealt by way of informal warnings and cautions.

In addition, based on the type of the most serious offence, some conviction episodes were not counted. Motor vehicle regulatory offences were not counted as their inclusion led to changes in offence seriousness related primarily to greater access to motor vehicles at 17 years of age. Breach of justice order offences were also excluded as they relate as much to prior offending as current offending. There were 8,090 offenders who had one or more conviction episodes for relevant offences. Table 1 provides a frequency count of offenders by total conviction episodes for offenders with at least two conviction episodes for relevant offences between the age of ten and June 30, 2009.

Table 1. Number of offenders by total number of conviction episodes

Total conviction episodes	Offenders	
	Number	Per cent
2	1,384	42.2
3	683	20.8
4	375	11.4
5	212	6.5
6	148	4.5
7	118	3.6
8	83	2.5
9	63	1.9
10	53	1.6
11	37	1.1
12	33	1.0
13	22	0.7
14	17	0.5
15 +	54	1.6
Total	3,282	100.00

Figure 1. Distribution of Median Sentence Ranking values for the most serious offences in all conviction episodes for offenders with two or more convictions



OFFENCE SERIOUSNESS

Offence seriousness was measured using the Median Sentence Ranking (MSR) developed by the NSW Judicial Commission and BOCSAR (MacKinnell, Poletti, & Holmes, 2010). The MSR was derived by rank ordering offence types using the median actual penalty received by offenders with no prior record in New South Wales courts. The MSR has a range from 1 for the least serious offence to 120 for the most serious offence. For example, the MSR for graffiti is 3, theft is 39, aggravated robbery is 102 and manslaughter is 117. The MSR has been compared with other similar indexes of offence seriousness, including the National Offence Index (NOI), and was found to be more accurate than the NOI in predicting court outcomes (MacKinnell et al., 2010). However, it needs to be noted that due to the ranking procedure used to derive the scale, the MSR can not be assumed to have interval scale properties so that an offence with an MSR of 70 is not necessarily twice as serious as an offence with an MSR of 35.

To illustrate the range and distribution of the Median Sentence Ranking, Figure 1 provides a histogram of the MSR values for the most serious offences in all conviction episodes for offenders with two or more convictions. As shown, there is a major peak in the MSR distribution at 60 that relates to non-aggravated assault being by far the most common offence.

NON-PARAMETRIC ANALYSES

Non-parametric tests are used to investigate whether there are differences in offence seriousness over consecutive conviction episodes among stratified samples of offenders. Offenders were divided into seven groups according to whether they had 2, 3, 4, 5, 6, 7 or 8 total conviction episodes. Offenders with more than 8 episodes were not included as the resulting groups were too small for reliable analyses.

Changes in offence seriousness between all adjacent conviction episodes within each strata were assessed by conducting pairwise Wilcoxon signed rank tests with Bonferroni adjustment for multiple comparisons. For example, for offenders with 3 total convictions, we conducted separate comparisons between episodes 1 and 2, and also between episodes 2 and 3. We also conducted trend analyses across all relevant episodes within each strata group (i.e. for those with 5 total convictions, we test for a trend across episodes 1 to 5). Cuzick's (1985) extension of the Wilcoxon rank-sum test for analysing trends was used for these analyses.

GROUP BASED TRAJECTORY MODELLING

The purpose of applying group based trajectory modelling (GBTM) is to explore the proposal that groups of offenders follow different trajectories of offence seriousness over consecutive conviction episodes. As such, a result contrary to this proposal would be that GBTM identifies one group of offenders who follow a similar trajectory path in terms of the seriousness of their offences ('the counterfactual'). A result affirming this proposal would be the identification of two or more trajectory groups that follow different offence seriousness trajectories. We acknowledge at the outset that this is one of the first applications of GBTM to the investigation of change in offence seriousness, and that results should be interpreted with the exploratory nature of this analysis in mind.

Trajectory modelling was carried out using the guidelines provided by Nagin (2005) and the SAS procedure 'Proc Traj' (Jones, Nagin, & Roeder, 2001). The temporal variable in the model was the sequence of conviction episodes based on the court finalisation dates for each offender.[1] The outcome was the MSR value for each conviction episode, modelled using a censored normal distribution. We acknowledge that the distribution of the MSR scale only broadly approximates a censored normal distribution.[2]

Offence seriousness trajectories were investigated over conviction episodes 1, 2 and 3 using the sample of all offenders with at least three conviction episodes. Episodes 1 to 3 were chosen because it was the minimum number for which a meaningful analysis could be conducted while also ensuring a large sample size. It was necessary in selecting the sample to include offenders who had at least as many total convictions as the number of episodes explored, as the trajectory model procedure treats unobserved episodes as if they were missing at random. Including all offenders with three or more convictions, rather than limiting it to a subset (e.g., offenders with 3, 4 or 5 convictions), provides a more representative picture of trajectories for the population of offenders while also maximising the sample size. The sample of offenders investigated in GBTM was 1,898, with 5,694 observations across offenders and conviction episodes.

Model selection

Selection of the number of trajectory groups was primarily based on comparing the Bayesian Information Criteria (BIC) for models with between one and five trajectory groups. BIC scores are a measure of the amount of variation a model explains, relative to the number of explanatory variables in the model. Higher BIC scores indicate better models. Two BIC scores are reported for the GBTM models due to the interdependence between individuals and time in longitudinal data. Nagin (2005, p68) states that the true BIC value for a GBTM is actually bracketed between BIC(1) (computed with N being all observations across individuals and time), and BIC(2) (computed with N being all individuals). We thus base model selection on both BIC scores.

RESULTS

NON PARAMETRIC COMPARISONS

Table 2 provides a summary of the results for the pairwise tests.[3] Comparisons are stratified according to the total number of conviction episodes, 2 through to 8. Median MSR values for each episode are presented, as well as Wilcoxon signed rank test statistics for the pairwise comparisons of consecutive episodes. For example, for those with 3 total episodes, median offence seriousness for episodes 1, 2 and 3 are shown, as well as test statistics for comparisons of episodes 1 and 2, and 2 and 3.

While 15 of the 28 tests had a coefficient in the direction of decreasing offence seriousness (indicated in the table by underlined text) only one difference was statistically significant - the decrease in seriousness between episodes 1 and 2 for those with 2 total episodes. The remaining 13 pairwise tests in Table 2 had a coefficient in the direction of increasing offence seriousness. Again only one difference was statistically significant – the increase in seriousness between episodes 5 and 6 for those with 6 total episodes.

Also shown in Table 2 are the results of the test for trend across episodes within total conviction strata. For example, the trend in offence seriousness across episodes 1 to 3 is examined for those with 3 total episodes, while for those with 4 total episodes the trend in offence seriousness across episodes 1 to 4 is assessed. The only significant trend test was for the group with 3 total episodes, indicating a decreasing trend in offence seriousness across the 3 episodes.

Overall the results from the non-parametric analyses indicate there is no consistent relationship between offence seriousness and conviction episodes among offenders who commit the same number of offences. Only two of the pairwise tests and one trend test were statistically significant. In addition, the reasonably consistent decrease in seriousness between episodes 1 and 2 could be due to how the justice system processes first time offenders. First time offenders who commit minor offences are often cautioned by police or have their charges dismissed in court, while repeat offenders committing a similar offence would be proceeded against. A consequence of such a process could be that the seriousness of offences in first convictions will be higher than for second convictions.

Table 2. Summary of pairwise comparisons and trend tests across conviction episodes, by total number of episodes

Total episodes	Median MSR Episode 1	Comparison Episode 1 v 2		Median MSR Episode 2	Comparison Episode 2 v 3		Median MSR Episode 3	Comparison Episode 3 v 4		Median MSR Episode 4	Comparison Episode 4 v 5		Median MSR Episode 5	Comparison Episode 5 v 6		Median MSR Episode 6	Comparison Episode 6 v 7		Median MSR Episode 7	Comparison Episode 7 v 8		Median MSR Episode 8	Trend test		Sample n
		Z	p		Z	p		Z	p		Z	p		Z	p		Z	p		Z	p		Z	p	
2	60	-2.4	.02*	54																					1,384
3	60	-1.2	.45	60	-0.8	.88	60																-2.05	.04*	683
4	60	-2.1	.12	60	0.1	.99	60	0.3	.99	60													-1.49	.14	375
5	60	-0.6	.99	60	-1.3	.54	60	0.4	.99	60	2.9	.16	60										-0.81	.42	212
6	60	-2.3	.12	60	-0.6	.99	60	-0.2	.99	51.5	0.2	.99	60	2.5	.05*	60							-0.85	.4	148
7	62	-2.2	.16	60	-0.6	.99	60	-0.4	.99	60	0.4	.99	60	-0.2	.99	60	1.2	.99	60				-1.46	.14	118
8	60	-0.3	.99	60	1.2	.99	60	-0.6	.99	60	0.11	.99	60	0.17	.99	60	0.6	.99	60	0.1	.96	60	-0.03	.97	83

Note. XX = Escalating seriousness; XX = De-escalating seriousness; * $p < .05$ with Bonferroni adjustment for multiple comparisons within total episode strata.

GROUP BASED TRAJECTORY MODELLING

Table 3 displays the BIC scores for models with between one and five trajectory groups. All trajectories were specified as having a quadratic functional form as recommended by Nagin (2005). As shown in the table, the four-group model had the highest score for both BIC(1) and BIC(2), with the two group model having the second highest for both. Comparing the four and two group models using Jeffrey's scale (see Nagin 2005, p69) on BIC(1) gives a Bayes factor of 3.03 indicating moderate evidence for the four group model. On BIC(2) a Bayes factor of 247.15 provides strong evidence for the four group model. On this basis, we select the four-group model for our trajectory analysis. Further information about model selection, including model diagnostics, can be found in the Appendix.

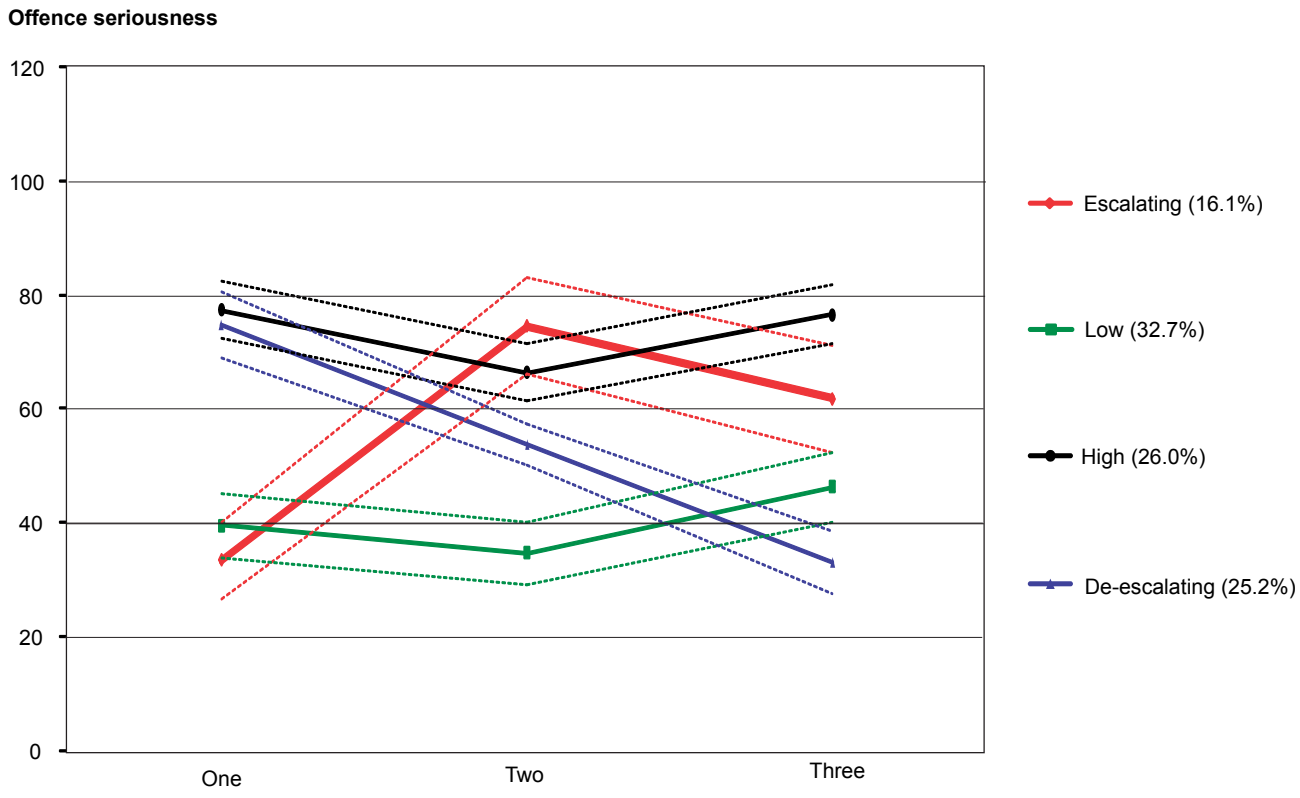
Table 3. Bayesian information criteria for models with one to five trajectory groups

Trajectory groups	BIC(1) (N=5,694)	BIC(2) (N=1,898)
One group	-27573.38	-27571.18
Two groups	-27559.49	-27555.10
Three groups	-27562.46	-27555.87
Four groups	-27558.38	-27549.59
Five groups	-27574.06	-27563.08

Offence seriousness trajectories

A plot of the offence seriousness trajectories for the four groups is shown in Figure 2. For each group the bolded line represents the estimated offence seriousness trajectory, and the lighter lines around each trajectory depict the upper and lower 95 per cent confidence intervals. In the first 'escalating' group (comprising 16.1% of the sample) average offence seriousness is low for the first episode (32.2), but then rises to a relatively high level for conviction episode 2 (74.5) and 3 (61.8). In the second 'low seriousness' group (comprising 32.7% of the sample), average offence seriousness remains below 46.3 across the three conviction episodes. In the third 'high seriousness' group (making up 26% of the sample), average offence seriousness remained above 68 across all three conviction episodes. In the fourth 'de-escalating group' (comprising 25.2% of the sample), average seriousness drops from 74.7 for episode 1 to a low of 33 for episode 3.

Figure 2. Estimated offence seriousness at each conviction episode for the four trajectory groups



Characteristics of offenders in each trajectory group

The final stage of the analysis involves investigating whether particular characteristics or criminal justice variables distinguish offenders in each trajectory group. To conform to the conventions of temporal ordering in predictive modelling, we only investigate variables in the model that were known at or before the first conviction episode: gender, Indigenous status and age at first offence (Nagin, 2005). Table 4 presents the descriptive and unadjusted statistics for the three variables across the four trajectory groups. More offenders in the high seriousness group were male, Indigenous and younger at their first offence. Unadjusted differences between the four groups were significant for Indigenous status and age at first offence, but not gender.

Table 5 summarises the multinomial logistic regression model predicting trajectory group membership. The adjusted regression results indicate that, in comparison to the low seriousness group, offenders in all other groups were younger at their first offence. In terms of gender and Indigenous status, the only differences were that males (approaching significance at p = .07) and Indigenous offenders (p = .04) were more likely to be in the high seriousness group in comparison to the low seriousness group.

Table 4. Bivariate comparisons of four trajectory groups on demographic variables

	Trajectory groups						
	Escalating	**Low**	**High**	**De-escalating**	**All**	**Test statistics**	
Chi square tests	**Percent** (frequency)					χ^2	**p**
Gender (Male)	85.90% (214)	84.80% (569)	87.60% (460)	82.80% (375)	85.20% (1,618)	4.74 (df 3)	.19
Identified Indigenous (Yes)	26.90% (67)	23.80% (160)	32.00% (168)	31.80% (144)	28.40% (539)	13.02 (df 3)	.01
Kruskal-wallis tests	**Median** (25% - 75% quartile)					χ^2	**p**
Age at first conviction (years)	17.6 (14.8-19.2)	18.2 (16.1-19.3)	16.8 (14.9-18.4)	16.7 (14.9-18.4)	17.4 (15.1-18.8)	70.8 (df 3)	.00
Total number in group	249	671	525	453	1,898		

Table 5. Multinomial logistic regression model predicting trajectory group membership from demographic information

						95% Conf. Interval	
Group	**Variable**	**RRR[a]**	**Std. Err.**	**z**	**p**	**Lower**	**Upper**
Low stable seriousness[b]	(reference group)						
Escalating seriousness	Sex (male vs female)	1.13	0.24	0.57	.57	0.74	1.72
	Indigenous (identified vs other)	1.06	0.19	0.34	.74	0.75	1.49
	Age at first conviction	0.9	0.03	-3.46	.00	0.85	0.96
High stable seriousness	Sex (male vs female)	1.37	0.24	1.8	.07	0.97	1.93
	Indigenous (identified vs other)	1.32	0.18	2.04	.04	1.01	1.72
	Age at first conviction	0.86	0.02	-5.96	.00	0.82	0.91
De-escalating seriousness	Sex (male vs female)	0.92	0.16	-0.49	.63	0.66	1.28
	Indigenous (identified vs other)	1.24	0.17	1.52	.13	0.94	1.63
	Age at first conviction	0.86	0.02	-6.13	.00	0.81	0.9

[a] RRR is an abbreviation for relative risk ratio and is interpreted in a similar way to an odds ratio (Gould, 2000).

[b] The low seriousness group is the reference group against which effects are estimated.

DISCUSSION

This study investigated whether offence seriousness changes across conviction episodes in the early criminal careers of a cohort of offenders. While there was no clear and consistent relationship across offenders, there was evidence for separate groups of offenders who follow different offence seriousness trajectories. Our results suggest that there is a group of offenders who commit primarily low seriousness offences (33%), a group who escalate from low to high seriousness offences (16%), a group that primarily commit high seriousness offences (26%) and a group that de-escalate from high to low seriousness offences (25%). We also found that those who were older at their first conviction were more likely to be in the low offence seriousness group, while those who were male and Indigenous were more likely to be in the high seriousness group. While this is the first application of GBTM to the issue of offence seriousness, these results suggest the method may provide important information for understanding variations in offending seriousness in the criminal careers of offenders.

As we discussed in the introduction, the seriousness of offences committed by offenders is fundamental to how the justice system responds to offenders. Offence seriousness is also an important consideration in how the public and policy makers perceive the problem of offending in the community. In this study, the GBTM analyses were conducted using a sample of offenders with at least three convictions before the age of 26, and as such, can be described as a sample of medium to high rate offenders. It is, however, relevant that the GBTM analysis identified that the largest group of offenders were those on a trajectory of committing primarily low seriousness offences (33% of the sample). In addition to this low seriousness group, another group comprising 25 percent of the sample was de-escalating so that by their third offence they on average committed low seriousness offences. It is quite likely that many in the public, as well as some policy makers, would perceive that substantially less than the estimated 58 per cent of offenders would be committing low seriousness offences at their third conviction episode.

In many ways, preventing people from committing serious offences is just as, if not more, important to the justice system as preventing people from committing new offences. It is possible that future research using the GBTM approach, and risk factor information about the social, psychological and developmental histories of offenders, may assist in predicting and better understanding what type of offenders progress to commit serious offences. For example, exploration could be conducted into whether being neglected or abused in early childhood was related to membership into the escalating or high seriousness trajectory groups. Information from such analyses may assist in identifying risk factors that could be targeted by policy makers to prevent serious crime in the community, while also informing the identification and treatment of offenders likely to commit serious crimes in the future. It is however acknowledged that offence frequency studies have sometimes found it challenging to predict trajectory group membership from early developmental risk factors (Kazemian, Farrington, & Le Blanc, 2009).

While encouraged about the possibilities for future research and application, we acknowledge this is the first examination of offence seriousness using GBTM, and the approach is not without reservation or limitation. Indeed, some have challenged the central premise of GBTM, that there exist a finite number of trajectories into which people can be classified (Raudenbush, 2005; Sampson & Laub, 2005). Also central to GBTM is the assumption that variation of the coefficients across individuals can be explained by group membership (Nagin, 2005). That is, unlike other methods such as growth curve models, GBTM does not allow for individual variation within groups (Kreuter & Muthen, 2008). The appropriateness of such assumptions and the application of other models, such as growth curve models, growth mixture modelling and non-parametric growth mixture modelling, to the study of offence seriousness are worthy of further exploration and debate.

In interpreting the trajectory groups in this study, it is important to acknowledge the possible influence of justice system processes on what we observed. For example, it is possible that the de-escalating trajectory group is related to how police process offenders with no prior convictions. Police may be more likely to initiate formal proceedings against a first time offender when they commit serious offences, while opting for informal cautions and warnings for less serious offences. Further, once offenders have prior convictions police may be more inclined to proceed formally, regardless of the seriousness of the offence. Such processes could have complex impacts on the trajectory model which are not easily deducted without additional research. As such, we recommend further research into these issues including the use of data sets that include more informal contacts with police and self-report data.

Applying GBTM to offence seriousness raised a number of specific challenges with regard to the research design. As mentioned previously, there is a necessity to select offenders who have at least as many total convictions as the number of episodes explored, as it can not be assumed that missing episodes (or non existent episodes) would be missing at random. Exploring trajectories over more episodes would require large samples of offenders with high rates of offending, and the resulting trajectory models would only be relevant to that specific portion of the offending population. It is also likely that the interactions between total conviction episodes, age at

each offence and periods in custody could impact on the GBTM results. Further research is required to investigate seriousness trajectories over additional episodes and with different research designs. Despite these considerations, we are confident that our research design, that investigated the first three conviction episodes of offenders with at least three convictions is a solid, justifiable basis from which to build knowledge on the topic.

Another important consideration in the research relates to the characteristics of the Median Sentence Ranking (MSR) used to measure offence seriousness. The MSR is a scale developed by rank ordering offences based on the median penalties received for offenders with no prior offences. As such, the scale does not have interval scale properties, so that an offence with an MSR of 70 is not necessarily twice as serious as an offence with an MSR of 35. In addition, the MSR only broadly conforms to a normal distribution so that large samples are required to obtain consistent estimates using parametric GBTM models. Further development of the psychometric properties of the MSR will assist in making more precise interpretations of the GBTM results.

Notwithstanding these considerations, the combination of the results from the non-parametric tests and the GBTM analyses highlight a potentially important insight into offence seriousness across early criminal careers. Similar to previous research, our non-parametric analyses suggested no consistent relationship between offence seriousness and conviction episodes. It could be concluded from this result that the crimes offenders commit from one episode to the next are random and unpredictable. However, our GBTM results suggest such a conclusion may be false. The GBTM results indicate that rather than an overall consistent relationship between offence seriousness and conviction episodes, the relationship varies for particular groups of offenders within the population. Some offenders continue to be convicted for relatively low severity offences; others are regularly convicted for high severity offences; while other groups move between high and low seriousness offences. As such, it suggests that distinct relationships exist between seriousness and conviction episodes for sub-groups of offenders.

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NOTES

1. Rather than using the most serious offence in a finalised court appearance for each offender as the temporal variable, we did consider using the most serious offence committed on any single day for each offender. In our data, however, a substantially greater number of offence dates as opposed to conviction dates were missing, hence the use of conviction dates. Where missing data is not a problem, our explorations indicated that the use of offence dates may be beneficial in terms of ensuring the temporal ordering of events and model fit.
2. We had concerns that the distribution of the MSR variable deviated from a censored normal distribution and that this could effect the trajectory modelling results. Using an inverse rank standardisation technique (Beasley, Erickson, & Allison, 2009) we were able to create a more normal distribution for the MSR, however such transformations also change the relative meaning of differences on the scale. Using the transformed variable, the shape of the four group trajectory model was substantively the same as with the original variable, although it was less clear whether the four or two group model had the best model fit. Considering the large sample size, general robustness of the censored normal model and concerns over the logic of using an inverse rank standardisation approach, we present as exploratory results the model using the original MSR scale. Further research of the psychometric qualities of the MSR, and other similar offence seriousness scales, is warranted.
3. It is worth explaining why a median seriousness score of 60 was so common across strata and episode combinations. As noted previously, non-aggravated assault (MSR= 60) was the most frequent offence and this was consistent across all strata and episode combinations. The combination of non-aggravated assault being the most frequent offence and having an MSR value in the middle of the MSR distribution leads to 60 commonly being the median.

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APPENDIX

MODEL BUILDING

Shape of trajectory groups

In addition to the selection of the number of trajectory groups, there is a requirement to select the statistical function to best model the shape of the trajectory for each group. Nagin (2005) recommends a quadratic function as the initial default functional form for all trajectories. Changes to the functional form (e.g., linear, cubic) for any trajectory groups are then compared with the default model using BIC scores and model fit statistics. Based on these criteria, we changed the functional form of the fourth trajectory group from a quadratic to a linear function. This change resulted in a BIC(1) of -27554.4, substantially greater than the BIC(1) for the default model of -27558.38. As shown in Table A1, all maximum likelihood parameter estimates for the final model were statistically significant.

Model diagnostics

We evaluated the adequacy of the model using the diagnostics recommended by Nagin (2005). The statistics for the diagnostics are displayed in Table A2. Nagin (2005) recommends that the average predicted probability (APP) for each group should be over .7, and the odds of correct classification over 5. For our model the APP for Group 1 and Group 4 were slightly below .7, however the odds of correct classification for these two groups was well above the recommended minimum of 5. Estimates of the percentage of offenders in each group were also similar based on both the maximum probability rule and the model parameters.

Table A1. Maximum likelihood parameter estimates for the four trajectory group model

Group	Parameter	Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
1	Intercept	-66.3	14.8	-4.5	0.00
	Linear	126.4	17.8	7.1	0.00
	Quadratic	-27.9	4.5	-6.1	0.00
2	Intercept	61.7	9.0	6.9	0.00
	Linear	-31.7	10.3	-3.1	0.00
	Quadratic	8.8	2.6	3.4	0.00
3	Intercept	111.0	8.7	12.7	0.00
	Linear	-44.1	9.9	-4.4	0.00
	Quadratic	10.9	2.5	4.5	0.00
4	Intercept	96.7	3.8	25.5	0.00
	Linear	-21.6	1.6	-13.2	0.00
	Sigma	27.0	0.4	66.4	0.00

Table A2. Diagnostic statistics for evaluating model adequacy

		Comparison of group percentages			
Groups	Average predicted probability	Based on maximum probability rule	Based on model parameters	Odds of correct classification	Number of offenders
Group 1	0.66	13.10%	16.10%	10.1	249
Group 2	0.70	35.40%	32.70%	4.7	671
Group 3	0.70	27.70%	26.00%	6.5	525
Group 4	0.68	23.90%	25.20%	6.2	453

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