The impact of the NSW Young Offenders Act (1997) on likelihood of custodial order

Wai-Yin Wan, Elizabeth Moore and Steve Moffatt

Aim: The aim of this study was to determine whether the introduction of the Young Offenders Act had any impact on (a) the probability that a young offender will receive a custodial order [1]; and (b) the time taken to receive a first custodial order. These two custodial outcomes were compared for Indigenous and non-Indigenous young people.

Method: The rates of a custodial order prior to and following the introduction of the Young Offenders Act were compared using a frailty model with Gompertz distribution. The times taken to receive the first custodial order prior to, and following the introduction of the Young Offenders Act were compared using the asymptotic failure rate of ever receiving a custodial order.

Results: The results show that while Indigenous young people are more likely to receive a custodial order as a juvenile (hazard ratio of 1.4) compared to non-Indigenous young people, the risk of receiving a custodial order fell for both groups after the introduction of the YOA (hazard ratio of 0.63). The results show that, after the introduction of the YOA, the risks of receiving a custodial order for both Indigenous and non-Indigenous young people dropped by 17.5 per cent and 16.3 per cent respectively. For Indigenous young people, 10 per cent of the pre-YOA cohort received a custodial order within 17 months of first proven court appearance, whereas after the YOA commenced this took 21 months. For the non-Indigenous young people, 10 per cent of the pre-YOA cohort received a custodial order within 36 months whereas after the YOA commenced this took 57 months.

Conclusion: The results suggest the YOA has been effective in diverting young people from custody (including Indigenous young people). The likelihood of ever ending up in custody reduced and the time taken to receive a custodial order after the first proven court appearance lengthened for both indigenous and non-indigenous young people after the introduction of the YOA .

Keywords: Young Offenders Act (1997), Indigenous status, juvenile, Youth Justice Conferencing, over-representation

INTRODUCTION

The *Young Offenders Act 1997* (YOA) created a hierarchy of sanctions designed to divert young offenders from the court system including warnings, police cautions and youth justice conferences (YJCs) (Bargen, Clancey & Chan, 2005). The legislation had four primary objectives: (i) to establish a scheme which offers alternatives to court proceedings; (ii) to provide a direct and efficient response to juvenile offending; (iii) to ensure YJCs utilise a community based approach involving all the affected parties, emphasises restitution and acceptance of responsibility by the offender, and meets the needs of the victim and the offender; and (iv) to address the over-representation of Aboriginal and Torres Strait Islander children in the criminal justice system through the use of warnings, cautions and YJCs.

The current study focuses on the fourth of these objectives. It is important to bear in mind when thinking about Aboriginal over-representation in custody that we are not concerned with the relative proportion of Indigenous versus non-Indigenous young people in custody. The aim of the YOA was not to reduce the number of Indigenous *relative to* non-Indigenous young people in custody but to reduce the overall level of Indigenous [2] detention. If the number of Aboriginal people in custody decreases, the rate per head of population also decreases and it is this objective that the YOA could reasonably hope to achieve.

Past attempts to assess whether the YOA has been effective in achieving this goal have been hampered by methodological difficulties. Chan and Luke (2005), for example, evaluated the effectiveness of the YOA in diverting young people from court by examining the number of young people referred to court in the three years preceding and the three years following commencement of the YOA, noting a decrease in referrals to court and an increase in cautions and warnings. This approach has the weakness that the number of persons referred to court is affected not just by the relative frequency with which various alternatives to court (i.e. warnings, cautions and conferences) are used, but also by the total number of juveniles coming to the attention of police. If this number increases significantly (in response to increased crime, for example), the diversionary benefits of warnings, cautions and conferences may be obscured. If, on the other hand, the number of juveniles coming to the attention of police falls, the rate of Indigenous custodial order could fall for reasons that have nothing to do with the effectiveness of warnings, cautions and conferences as diversionary tools.

In this report we take a different approach to assessing the effectiveness of diversion. If the YOA is effective in diverting young people from custody (including Indigenous young people), then the likelihood of ever ending up in custody (given apprehension by police) should be lower after the YOA than before. In this report we test this claim for Indigenous and non-Indigenous juveniles separately. Specifically, the study aimed to determine (after controlling for offender- and offence characteristics) whether the introduction of the YOA had any impact on:

(1) The probability that a young offender appearing before the justice system received a custodial order, and whether it impacted differentially on Indigenous versus non-Indigenous people; and

(2) The time taken for young offenders to receive their first custodial order and whether it impacted differentially on Indigenous versus non-Indigenous young people.

METHOD

DATA

To address the two research questions, we used data from the NSW Re-Offending Database (ROD) which contains information on each person who has been dealt with by way of a police caution or a Youth Justice Conference (YJC) since 1998 and every person who has had a court appearance since 1994. For further details concerning ROD see Hua & Fitzgerald, (2006). We selected two cohorts; one whose first proven contact[3] (subsequently referred to as first proven Children's Court appearance) with the criminal justice system occurred before[4] the introduction of the YOA and one whose first proven contact

with the criminal justice system occurred after[4] the introduction of the YOA. The year of the first proven court appearance is critical to this study as it determined whether offenders were entitled to treatment under the YOA or not. Young offenders with a first proven Children's Court appearance that occurred before the introduction of the YOA (1994-1998) were classified in the pre-YOA group; otherwise they belonged to the YOA group. Note that, in order to participate in a YOA treatment, the offender must admit the offence.

AIM 1: It was important to have a complete[5] juvenile proven appearance court record[6] for all individuals included in the study. Data on all individuals who turned 10 in the period 1994 to 2003 were extracted from ROD. Individuals with multiple proven appearances across the observation period appeared multiple times in the analysis of Aim 1. The study therefore included all individuals who had turned 10 years of age (the age of criminal responsibility in NSW) in or after 1994 (i.e. whose date of birth was on or after 1 January 1984) and had turned 18 before the end of 2011 (i.e. whose date of birth was before 1 January 1994). This resulted in data on 29,085 individuals and 66,296 records (as some individuals had multiple records within the criminal justice system). The data generated 6,278 custodial sentences. On average the first (for those who received at least one) custodial sentence was received after 2,877 days (range from 377 days to 3,639 days). For some young people, the survival time was longer than 2,922 days (8 years) as their case was finalised after they turned 18.

AIM 2: To address Aim 2 (whether time from first proven court appearance to first custodial order changed after the introduction of the YOA), we identified all young people at their first proven Children's Court appearance before or after the introduction of the Act. Each observation[7] represented a young person's first proven Children's Court appearance, which was followed up to the end of 2011 to see what percentage ultimately received a first custodial order. This included 870 individuals from the pre-YOA period and 1,937 individuals from the YOA period. The young offenders were placed into one of four groups, according to the time of their first conviction and Indigenous status. The groups were Indigenous pre-YOA, Indigenous YOA, non-Indigenous pre-YOA and non-Indigenous YOA. Note that the designation 'pre-YOA' refers to the timing of the first contact. Offenders designated 'pre-YOA' may, and in many cases will have had contacts with the criminal justice system after the YOA.

ANALYSIS

A frailty model was used to assess Aim 1 (i.e. whether there were any changes in the probability that a young person would receive a custodial order after the YOA).[8] The advantage of frailty models in the current context is that they allow us to control for unmeasured individual differences in the likelihood of failure (reoffending). The frailty model used in the current study

includes both time-independent risk factors (e.g. Indigenous status, sex) and time-dependent risk factors. Full details of the model specification have been provided in Appendix A1.

Aim 2 investigated the impact of the YOA on time to first custodial order. This is based on the cumulative proportion of young people receiving a first custodial order at any given number of months after first conviction. Not every convicted juvenile will end up in custody. We seek to estimate the asymptotic proportion [9] of young people receiving a first custodial sentence in either the juvenile or adult systems. A maximum likelihood estimation procedure using three parameters in a Gompertz functional form was fitted to the data on the time taken (in months) from a young offender's first proven court appearance to first custodial order. This model accounted for the differential follow up period of the pre-YOA and YOA cohorts and was fitted separately for young people within the four groups; Indigenous pre-YOA, Indigenous YOA, non-Indigenous pre-YOA and non-Indigenous YOA groups.

DEPENDENT VARIABLES

Time since previous proven Children's Court appearance: This variable was used in the frailty model for Aim 1. The time at risk began when the young offenders turned 10 years of age so the starting point corresponds to the date they turned 10. The time (measured in days) for the first record is the time from a young offender's 10th birthday to the first proven Children's Court appearance. The time for the later records was counted onwards since the previous proven Children's Court appearance. An event occurred if the current appearance resulted in a custodial order. An observation was censored if the young offender did not receive a custodial order in their last proven Children's Court appearance.

Cumulative failure rate (for first custodial order) at time (measured in months) since first proven Children's Court appearance: For Aim 2, the observed cumulative failure rate, fitted to the model at the observed values of time enables us to predict the parameter of interest P [9] (the limiting value of the cumulative failure rate when time since first proven appearance becomes large).

INDEPENDENT VARIABLES

In the following list, variables denoted with a '*' were defined as time-dependent covariates in the frailty model:

Indigenous status: Whether the young person had ever been identified as being of Aboriginal or Torres Strait Islander descent in ROD.

Sex: Whether the young person was male or female.

YOA*: Whether a given proven appearance occurred in the pre- (1994-1998) or post-YOA (1999-2011) period. Note that

a young person could appear in both the pre- and post-YOA periods.

Guilty plea*: Whether or not a guilty plea was entered for the principal offence at each proven appearance, coded 0= No, 1= Yes.

Property offence*: Whether the principal offence at each proven appearance was a property crime as defined by the Australian and New Zealand Standard Offence Classification (ANZSOC) (Australian Bureau of Statistics, 2011) codes, coded 0= No, 1= Yes.

Violent offence*: Whether the principal offence at each proven appearance was a violent crime as defined by the ANZSOC codes (Australian Bureau of Statistics, 2011), coded 0= No, 1= Yes.

Justice offence*: Whether the principal offence at each proven appearance was against justice procedures as defined by the ANZSOC codes (Australian Bureau of Statistics, 2011), coded 0= No, 1= Yes.

Drug offence*: Whether the principal offence at each proven appearance was a drug offence as defined by the ANZSOC codes (Australian Bureau of Statistics, 2011), coded 0= No, 1= Yes.

Any concurrent breach of offences*: Whether the young person had any concurrent breach offences at each proven appearance as defined by the ANZSOC codes (subdivisions 151, 152, 153) (Australian Bureau of Statistics, 2011), coded 0= No, 1= Yes.

Age*: Age of the young person at each proven appearance.

Number of concurrent offences*: The number of proven concurrent offences at each proven appearance.

Number of prior conferences*: The number of completed prior YJCs recorded in ROD from 1998 and before current proven appearance.

Number of prior finalised court appearances*: The number of prior proven Children's Court appearances recorded in ROD from 1994 and before current proven appearance.

Number of prior custodial orders*: The number of prior custodial orders recorded in ROD from 1994 and before current proven appearance.

RESULTS

AIM 1: FRAILTY MODEL WITH GOMPERTZ DISTRIBUTION

Table 1 presents the demographic characteristics of the sample by Indigenous status. The majority of the sample was male (80%), with significant differences in the sex distribution between

Indigenous and non-Indigenous young people (χ^2=117.7, p<.001). Indigenous young people were significantly more likely to have their first court proven appearance at an earlier age (mean:15.3 v 16.1 years old; t=38.7, p<.001) and were more likely to have a greater mean number of custodial sentences over their criminal offending history compared to non-Indigenous young people (mean: 0.47 v 0.10; t=36.0, p<.001). Among those who never received a custodial sentence, non-prison penalties were given to 94.1% of non-Indigenous and 79.6% of Indigenous young people. Young people identifying as Indigenous were significantly more likely to have had more court appearances with conviction (mean: 2.15 v 0.77; t=53.6, p<.001) and more YJCs conferences (mean: 0.34 v 0.16; t=24.7, p<.001), compared to non-Indigenous young people.

Table 1. Demographic characteristics of the sample by Indigenous status

	Non-Indigenous (n=19,703)		Indigenous (n=9,382)	
Demographic characteristics	n	%	n	%
Sex				
Female	3,575	18.1	2,212	23.6
Male	16,128	81.9	7,170	76.4
			χ^2=117.7, p<.001	
Age at first proven appearance				
10-12	332	1.7	650	6.9
13	739	3.8	839	8.9
14	1,832	9.3	1,444	15.4
15	3,299	16.7	1,826	19.5
16	4,548	23.1	1,917	20.4
17	5,954	30.2	1,838	19.6
18-19	2,999	15.2	868	9.3
Mean (SD)		16.1 (1.5)		15.3 (1.8)
One tail test of means: $\mu_{non\text{-}indig} > \mu_{indig}$			t=38.7, p<.001	
Total number of custodial orders				
0	18,534	94.1	7,466	79.6
1	781	4.0	922	9.8
2	225	1.1	404	4.3
3 or more	163	0.8	590	6.3
Mean (SD)		0.10 (0.49)		0.47 (1.25)
One tail test of means: $\mu_{indig} > \mu_{non\text{-}indig}$			t=36.0, p<.001	
Total number of finalised court appearances before index proven appearance				
0				
1	12,838	65.2	3,513	37.4
2	3,447	17.5	1,786	19.1
3 or more	1,482	7.5	1,145	12.2
	1,936	9.8	2,938	31.3
Mean (SD)		0.77 (1.55)		2.15 (2.81)
One tail test of means: $\mu_{indig} > \mu_{non\text{-}indig}$			t=53.6, p<.001	
Total number of YJC before index proven appearance				
0	17,193	87.3	7,084	75.5
1	1,944	10.1	1,678	17.9
2 or more	516	2.6	620	6.6
Mean (SD)		0.16 (0.48)		0.34 (0.70)
One tail test of means: $\mu_{indig} > \mu_{non\text{-}indig}$			t=24.7, p<.001	

Table 2 reports the results of the frailty model with Gompertz distribution, with hazard ratios and confidence intervals. The hazard ratio can be interpreted as the risk that a young person with a given characteristic will be sentenced to a custodial order relative to the reference group while keeping all other risk factors constant including the frailty α. For example, the hazard ratio on the 'sex' risk factor indicates that the hazard of receiving a sentence of custodial order for young male offenders is 2.10 times the hazard for young female offenders after adjusting for all of the other factors in Table 2 and the frailty. Hazard ratios that are significantly greater than 1.0 for a risk factor indicate that a young person with the corresponding risk factor would have a higher risk of receiving a custodial order than someone in the reference category, after accounting for other variables and frailty in the model. For time-varying risk factors such as age at index proven appearance, the hazard ratio explains the change in the hazard for a one unit increase in the corresponding risk factor.

All hazard ratios were significant except for those associated with a guilty plea and a drug offence. After controlling for covariates, the frailty model identifies a significant effect for the YOA, with the risk of receiving a custodial order at any point in time being reduced by 37 per cent after the introduction of the YOA. To test whether this effect depended on Indigenous status, an interaction term between the YOA and Indigenous status was included in the model but found to be non-significant (p=.229). It was therefore excluded from the model.

The results also indicate that Indigenous males have the highest hazard ratio (i.e., increased risk of a custodial order) of 2.85 relative to non-Indigenous females, followed by non-Indigenous

Table 2. Hazard ratios and confidence intervals for the frailty model with Gompertz distribution

Variables	Hazard ratio	95% confidence interval	p-value
Time independent variables			
Indigenous status	1.35	1.26, 1.45	<.001
Sex	2.10	1.88, 2.36	<.001
Time-varying variables			
YOA	0.63	0.49, 0.81	<.001
Guilty plea	1.00	0.93, 1.07	.978
Property offence	1.87	1.72, 2.04	<.001
Violent offence	2.62	2.40, 2.86	<.001
Justice offence	1.92	1.68, 2.20	<.001
Drug offence	0.80	0.59, 1.08	.148
Any concurrent breach offences	1.39	1.29, 1.51	<.001
Age = 14	0.25	0.21, 0.29	<.001
Age = 15	0.07	0.06, 0.08	<.001
Age = 16	0.02	0.014, 0.019	<.001
Age ≥ 17	0.0014	0.0012, 0.0016	<.001
Number of concurrent offences = 2	1.61	1.48, 1.76	<.001
Number of concurrent offences ≥ 3	3.28	3.06, 3.51	<.001
Number of prior YJCs = 1	1.11	1.02, 1.20	.011
Number of prior YJCs ≥ 2	1.13	1.01, 1.26	.038
Number of prior finalised court appearances = 1	4.36	3.89, 4.89	<.001
Number of prior finalised court appearances = 2	6.74	6.00, 7.58	<.001
Number of prior finalised court appearances ≥ 3	10.36	9.27, 11.58	<.001
Number of prior custodial orders = 1	2.97	2.72, 3.23	<.001
Number of prior custodial orders = 2	2.91	2.60, 3.26	<.001
Number of prior custodial orders ≥ 3	3.02	2.68, 3.40	<.001

males (hazard ratio: 2.10) and Indigenous females (hazard ratio: 1.35). For the age variables, younger age was found to be associated with a higher risk of receiving a custodial order (i.e., relative to the group aged less than 14 years, the hazard ratios are gradually decreasing with increasing age). Moreover, young people with more proven concurrent offences had a higher risk of receiving a custodial order. The model suggests receiving one or more YJCs increases the risk of a custodial sanction by about 10 percent compared to those receiving no YJCs. Compared with those who never receive a custodial order, young people who had a history of one or more custodial orders had an increased risk (increased by around 3.0) of receiving another custodial order. Similarly, an increase in the number of prior proven court appearances is associated with an increased risk of a custodial order (i.e., hazard increases by 4.36 for one prior finalised court appearance, by 6.74 for 2, and by 10.36 for more than 2).

AIM 2: RATE OF EVER RECEIVING A CUSTODIAL ORDER AND TIME TO RECEIVE FIRST CUSTODIAL ORDER

Table 3 and Figures 1 to 4 summarise the estimated proportions of Indigenous and non-Indigenous young people likely to ever receive a custodial sentence, conditional on whether their first proven court appearance occurred before or after the introduction of the YOA. Figures 1 to 4 show the fit of the data to the estimated Gompertz function. The flattening effect after a long period of time elapsed from the first proven court appearance shows that a limiting proportion of offenders are predicted to receive a custodial sentence. The estimates for the three defining Gompertz parameters were all highly significant (*p*<0.0001). This allowed us to predict the asymptotic rate of ever receiving a custodial order for the four groups after the follow up periods. The 95% confidence intervals stated in Table 3 (and up to 99.9% confidence intervals not listed) for the four asymptotes show that all estimates were significantly different (*p*<.001). The predicted limits for the rate of ever

receiving a custodial order are given in Table 3. Figures 3 and 4 show that the observed cumulative failure rates are expected to continue higher to reach the predicted limit, but Figures 1 and 2 for Indigenous young offenders indicate that the observed failure rate has almost reached the predicted limit after 150 months. This comparison indicates that the non-Indigenous cohort was predicted to be older by the time they reach the limiting failure rate, which can also be observed by the tapering differences for the Indigenous Figures (1 and 2) compared to the non-Indigenous Figures (3 and 4).

The results highlight a significant post YOA drop in the asymptotic failure rate of ever receiving a custodial order for both Indigenous and non-Indigenous young people. The marginal change was not significantly different [10] across the two groups of offenders from the pre-YOA to the YOA period (a drop of 17.5% for Indigenous compared to 16.3% for the non-Indigenous group).

Using the predicted cumulative percentage of ever receiving a custodial order as shown in Figures 1 to 4, we tabulated the time taken for different proportions of young people within each cohort to receive their first custodial order. Table 4 indicates that, after the YOA was introduced, it took 21 months for 10 per cent of the Indigenous offender cohort to receive their first custodial order. This is four months longer than the time taken for the same proportion of the pre-YOA Indigenous cohort to receive their first custodial order. Table 4 also indicates that it took 57 months for 10 per cent of the YOA non-Indigenous young offenders to receive their first custodial order compared with 36 months prior to the YOA. This might seem to suggest that the effect of the YOA on the time to the first custodial penalty is larger for the non-Indigenous cohort than for the Indigenous cohort. The percentage change from each baseline, however, is not significantly different for the Indigenous and non-Indigenous groups. [10]
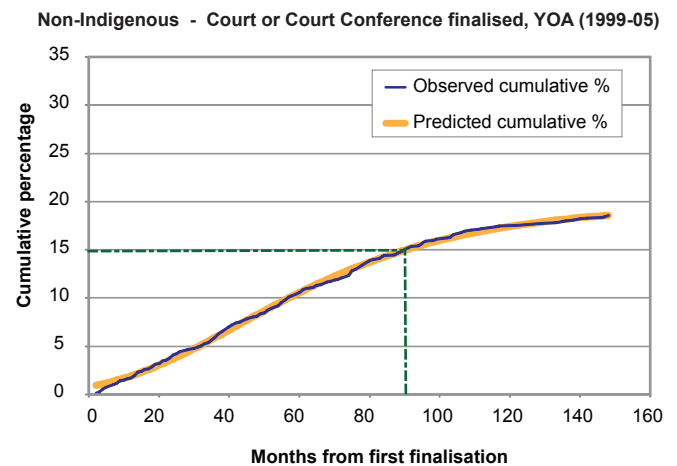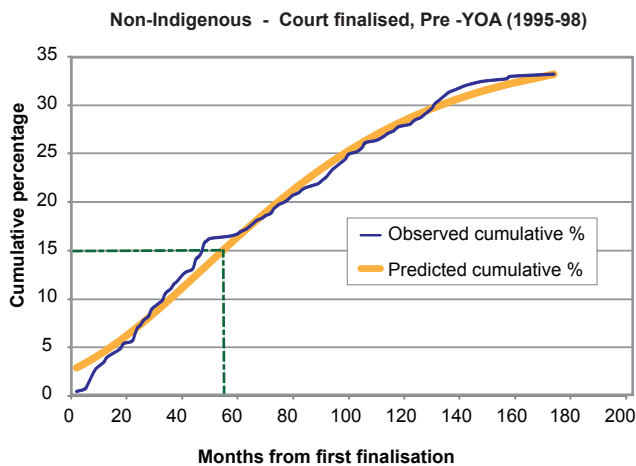
Table 3. Estimate of the asymptotic rate of receiving a first custodial order following first proven Children's Court appearance before and after the introduction of YOA

	Number of young offenders	Asymptotes (predicted failure rate - receiving a custodial order (%))	95% Confidence Interval for estimated asymptotic failure rate	
Indigenous				
Pre-YOA (1995-1998)	445	66.6	[65.62	67.67]
YOA (1999-2005)	804	49.1	[48.52	49.76]
Non-Indigenous				
Pre-YOA (1995-1998)	425	35.9	[34.56	37.32]
YOA (1999-2005)	1,133	19.6	[19.39	19.84]

Figure 1 and 2. Cumulative percentage ever receiving custodial order (%) by months following first proven Children's Court appearance for Indigenous offenders
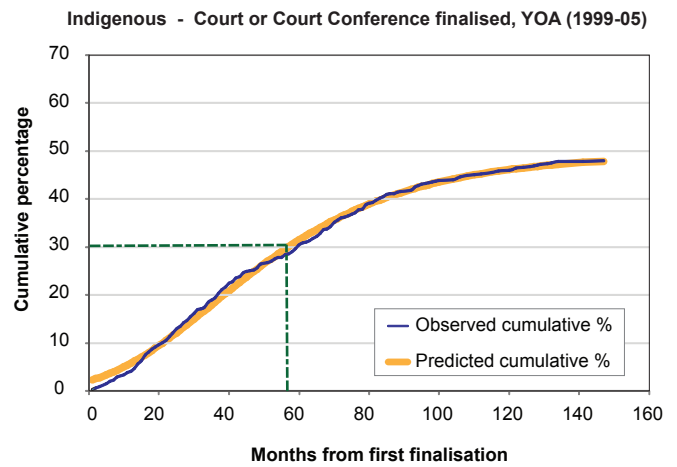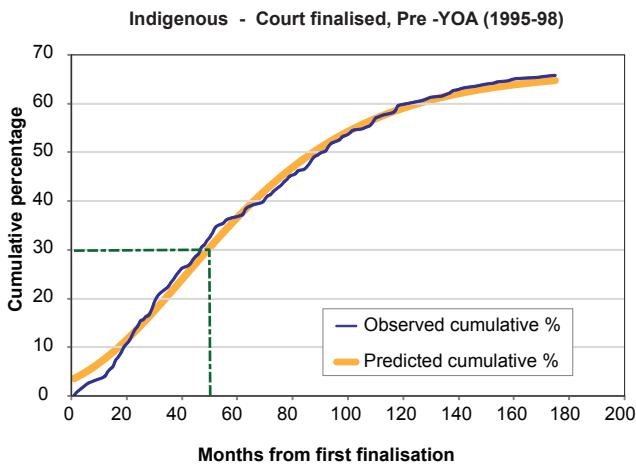
Figure 3 and 4. Cumulative percentage ever receiving custodial order (%) by months following first proven Children's Court appearance for non-Indigenous offenders

Table 4. Estimate of the time taken (in months) following first proven Children's Court appearance for proportion of cohort to receive first custodial order, before and after the introduction of YOA

Groups	Proportion of cohort					
	5%	10%	15%	20%	25%	30%
Indigenous						
Pre-YOA (1994-98)	5	17	26	34	42	49
YOA (1999-2005)	10	21	30	39	47	57
Difference in whole months	5	4	4	5	5	8
Non-Indigenous						
Pre-YOA (1994-98)	13	36	57	75	99	133
YOA (1999-2005)	31	57	91	>150	-	-
Difference in whole months	18	21	34	75	-	-

CONCLUSION

The YOA was designed (among other things) to divert young people (including Indigenous young people) from custody through a hierarchy of sanctions, including police cautions and YJCs. It could reasonably be expected to reduce the proportion of Indigenous young offenders ending up in custody or, at the very least, increase the time to the first custodial penalty.

The results suggest that this objective of the YOA has been achieved. They show that, while Indigenous young people are more likely than non-Indigenous young people to receive a custodial order, the risk of receiving a custodial order fell for both groups after the introduction of the YOA. In the absence of a comparison group (the YOA applies to all juveniles across the State), we cannot be sure that the fall in risk of a custodial order is attributable to the YOA but there were no other changes to the law surrounding the sentencing of juvenile offenders on or around the time the YOA was introduced that might have accounted for the change. It seems reasonable to assume, therefore, that the YOA is responsible for the fall in the risk of a custodial sentence.

Table 4 indicates that, after the YOA it took 21 months for 10 per cent of the Indigenous offender cohort to receive their first custodial order. This is four months longer than the time taken for the same proportion of the pre-YOA Indigenous cohort to receive their first custodial order. Table 4 also indicates that it took 57 months for 10 per cent of the YOA non-Indigenous young offenders to receive their first custodial order compared with 36 months prior to the YOA. This might seem to suggest that the effect of the YOA on the time to the first custodial penalty is larger for the non-Indigenous cohort than for the Indigenous cohort. The percentage change from the baseline, however, is not significantly different for the Indigenous and non-Indigenous groups, suggesting that the YOA has been equally effective in diverting Indigenous and non-Indigenous young people from custody.

Finally, we have taken a conservative approach in Aim 2 where inclusion in the sample data was restricted to young offenders aged 10 to 14 years at first proven court appearance.[7] Similar results were obtained when these restrictions were relaxed in order to test larger samples.

ACKNOWLEGEMENTS

NOTES

1   Here we use the term custodial order for both custodial orders imposed on juveniles and prison sentences imposed on adults.

2   The term 'Indigenous' is used throughout the report to refer to young people who were identified as Aboriginal and/or Torres Strait Islander.

3   This is the first contact at which the offender either admits the offence or is proven to have committed the offence.

4   We assumed that young offenders whose first proven court appearance occurred after 1998 had been exposed to outcomes determined under the YOA (as discussed in our Introduction), and these young offenders were flagged as belonging to the YOA group or treatment group, even though they may not have received an outcome specific to the YOA. We also assume that young offenders whose first proven court appearance took place before 1999 in the pre-YOA period would not be subject to the YOA penalties even though some of their subsequent proven appearances occurred after the introduction of the YOA.

5   This restriction was necessary to ensure full juvenile court records from age 10-18 were available in the data for all individuals in the selected cohorts.

6   Since we need to know a young offender's complete juvenile proven court appearances and given that ROD data commenced in 1994 we could only include young offenders who turned 10 in 1994, then 10 or 11 in 1995 etc. and secondly turned 18 before the end of 2011.

7   ROD data only commenced in 1994, it was necessary for this analysis to apply further age restrictions to ensure we captured the young person's first proven appearance and that the pre -YOA and YOA groups were of comparable ages. The pre-YOA group had to be restricted to those turning 10 years old in 1994, 10-11 years old in 1995, 10-12 years old in 1996, 10-13 years old in 1997, and 10-14 years old in 1998. To match the treatment group on age with the pre-YOA group, only young offenders in the YOA cohort aged 10-14 years old at the time of their first proven court appearance were included and to ensure we could follow an offender for more than five years after this appearance the latest year for proven first court appearance was set at 2005. In order to produce truly compatible groups these restrictions were imposed resulting in much less data available for Aim 2 when compared to Aim 1. However analysis was also carried out on the available samples when these restrictions were relaxed. [See conclusion.]

8   The frailty model deals with two main problems in the data. The first problem is state dependence which refers to the probability of the next custodial order being affected by

the occurrence of the previous ones. Another issue is the unobserved heterogeneity in the sample as individuals in the sample are not homogenous but heterogenous. That is, some young people may have some characteristics or backgrounds (unknown in the data) that made them more likely (more `frail') to receive a custodial order and experienced more frequent and rapid sanctions of custodial order (i.e., failure times). The frailty model in survival analysis is equivalent to the random effects model in regression analysis which seeks to adjust for any unobserved heterogeneity amongst the individuals in the sample not controlled for by the observed independent variables. Moreover, the hazard function of the current data is increasing over time which makes the exponential distribution inappropriate for modelling because the exponential distribution adopted in the Cox proportional hazards model assumes that the hazard function is constant over time. Our assumed frailty model assumes that the hazard function follows the Gompertz distribution which is suitable for modelling our data with a monotone hazard rate that increases exponentially with time.

9   The proportion of young people from the pre-YOA and YOA periods predicted to ever receive a custodial sanction was estimated for Indigenous and non-Indigenous young offenders separately. As very few young people receive a custodial order soon after their first proven appearance, the rate of receiving a custodial order was found to stay low at the beginning. The rate then tended to grow relatively quickly through a middle period and remain low towards the end, as the number of young people with a propensity for offending at a level serious enough to warrant custodial order is exhausted. The cumulative proportion of people receiving a prison sentence was therefore found to have a sigmoid pattern (i.e., S-shape). Several distributions were assessed to estimate the point at which custodial order rates reached their asymptote. The mathematical curve which was found to best accommodate these characteristics was the Gompertz function. The Gompertz function has the form of $Y(t) = P \exp(b \exp(c\,t))$ where P is the asymptotic rate of receiving custodial order (or failure) from first proven appearance, b and c are negative parameters where b sets an appropriate start time, c determines the rate of growth and t is our time variable expressed as whole months survived from first conviction until first custodial order.

10   A 95% confidence interval for the difference in Indigenous asymptotes produced confidence interval bounds of 16.26% and 18.74%, which contained the estimate (16.31%) of the difference for the non-Indigenous group, which was hypothesized to be the true difference for this test.

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APPENDIX

A1: FRAILTY MODEL SPECIFICATION

The frailty model is a model for the hazard function for each individual. The hazard function consists of three parts: frailty effect, baseline hazard and a non-negative function of covariates. The frailty effects allow for any unobserved heterogeneity amongst individuals and the baseline hazard describes how the risk of receiving a custodial order changes over time for the baseline variables. The function of covariates explains how the risk varies in response to the covariates. The full specification of the model included in the current study was as follows:

$$h_i(t|\alpha_i) = \alpha_i\, h_0(t) \exp(xb)$$

$$= \alpha_i \exp(\gamma t) \exp(b_1 x_1 + b_2 x_2 + b_3 x_1{}^* x_2 + b_4 x_3 + b_5 x_4 + b_6 x_5 + b_7 x_6 + b_8 x_7 + b_9 x_8 + b_{10} x_9 + b_{11} (x_{10}=14) + b_{12} (x_{10}=15) + b_{13} (x_{10}=16) + b_{14} (x_{10}\geq17) + b_{15} (x_{11}=2) + b_{16} (x_{11}\geq3) + b_{17} (x_{12}=1) + b_{18} (x_{12}\geq2) + b_{19} (x_{13}=1) + b_{20} (x_{13}=2) + b_{21} (x_{13}\geq3) + b_{22} (x_{14}=1) + b_{23} (x_{14}=2) + b_{24} (x_{14}\geq3))$$

In the model, α_i is the frailty effect and is assumed to be gamma distributed, $h_0(t) = \exp(\gamma t)$ is the baseline hazard, γ is the ancillary parameter of the Gompertz distribution, t is the survival time to next proven Children's Court appearance and $b_1,\ldots, b_{26}$ are the regression coefficients and $x_1,\ldots, x_{14}$ represent the covariates included in the model:

- x_1 = Indigenous status
- x_2 = Sex
- x_3 = YOA
- x_4 = Guilty plea
- x_5 = Property offence
- x_6 = Violent offence
- x_7 = Justice offence
- x_8 = Drug offence
- x_9 = Any concurrent breach of offences
- x_{10} = Age
- x_{11} = Number of concurrent offences
- x_{12} = Number of prior conferences
- x_{13} = Number of prior finalised court appearances
- x_{14} = Number of prior prison sentences

To justify the use of the frailty model, a likelihood ratio test for the presence of the unobserved heterogeneity was performed. The small p-value ($p<.001$) on the likelihood ratio test confirmed the presence of the unobserved heterogeneity amongst individuals and justified the use of the frailty model to account for this.

In the Gompertz model, the ancillary parameter γ indicates the shape of the hazard function. It is expected to be positive if the hazard ratio is increasing exponentially with time. The significance of the shape parameter of the Gompertz distribution was assessed to ensure the hazard function was appropriate. A positive shape parameter (one that is significantly greater than zero) would indicate an increasing hazard function over time. The test for proportional hazards (PH) assumption was assessed by the 'log-log' plots for all independent variables. The log-log plots produce -log[-log(survival)] curves for each category of a nominal or ordinal variable against log(analysis time). If the plotted lines are reasonably parallel, the PH assumption is not violated. The shape parameter (γ) for the Gompertz distribution, was significantly positive ($p<.001$, 95%CI: (0.0037, 0.0038)) and indicated that the hazard function increased with time. The PH assumptions were not violated as we obtained parallel patterns in the log-log plots for all covariates.

To identify any aberrant observations and to assess the model fit, the deviance residual was plotted against the linear prediction from the frailty model. Deviance residuals can be interpreted as the difference between the observed number of custodial order(s) and the expected number predicted by the frailty model. A randomly scattered pattern around zero in the residual plot indicates a good model fit. Any deviance residual whose absolute value is too large indicates that it is a potential aberrant observation. We examined the plot of the deviance residual against the linear prediction from the frailty model. When the censored observations, which were clustered near zero were disregarded, the remaining randomly scattered pattern around

zero in the residual plot suggests that the frailty model is a good model fit. Also, no aberrant observations were observed as the deviance residuals showed no exceptionally large absolute values.

Besides Deviance residuals, we plotted the empirical estimate of the cumulative hazard function using the Cox-Snell residuals as the time variable against the Cox-Snell residuals. A plot with a linear pattern of slope one would indicate that the residuals follow a standard exponential distribution and that the model fits the data. The empirical estimate of the cumulative hazard function when plotted against the Cox-Snell residuals was close to a straight line with a slope of one, indicating that the residuals roughly followed a standard exponential distribution and the model fitted the data reasonably well.

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