Abstract

This study assessed the longitudinal costs of offender trajectories in Queensland (Australia) to provide policymakers with evidence that could be used to promote the use of crime prevention programs. Few studies have assessed these costs and minimal research has been conducted outside the United States. The study addressed three research questions: (1) What are the monetary costs of crime? (2) What is the optimal number of offender trajectories in an Australian offender cohort? and (3) What are the monetary costs of officially recorded offending for individuals on different offender trajectories? The Semi-Parametric Group-based Method (SPGM) was used to determine the number of offender trajectories in the Queensland Longitudinal Database. This database included 41,377 individuals who were born in 1983 and 1984 and guilty of offences in Queensland that were committed when aged 10 to 25 years old. The costs of crime were assessed using two approaches. First, criminal justice system costs were estimated based on the number and type of contacts that individuals had with the criminal justice system as well as the length of any supervision served. Second, wider social and economic costs were assessed based on offence type. Results indicated that there were five offender trajectories, including two chronic, one moderate and two low trajectories. When costs were applied to the offender trajectories, offenders in the two chronic groups were 4.8% of the cohort but accounted for 41.1% of the total costs. On average, each chronic offender cost between $186,366 and $262,799 by the time they turned 26 years old, with 60% of the costs accounted for by the criminal justice system. On average, each chronic offender cost over 20 times more than offenders in the two low offending groups. These findings provide further evidence for the potential benefits of implementing interventions that target chronic offenders.

Keywords: costs of crime, offender trajectories, longitudinal
Introduction
The criminal careers paradigm has been described as one of the most visible areas of scholarship within criminology (DeLisi and Piquero, 2011). Within this field, studies have been conducted in many jurisdictions focused on the nature, pattern and correlates of offending over the life-course (see DeLisi and Piquero, 2011). These studies aim to improve understanding about how offending develops over the life-course and factors that can potentially be manipulated to hinder initiation, hasten desistence and reduce career length (Blumstein et al., 1986; Piquero et al., 1999, 2001). Research examining these dimensions has been aided by statistical techniques, such as the Semi-Parametric Group-based Method (SPGM) (Nagin and Land, 1993).

The SPGM identifies different groups, each with their own trajectory, to capture the variation in offending in the data (Kreuter and Muthén, 2008). In his review of over 80 studies which employed this technique, Piquero (2008) drew four main conclusions. First, research identifies at least two offender groups: an adolescent-peaked pattern and a chronic offender pattern. Research also typically identifies a late-onset chronic group, which begins offending during adolescence and continues offending into adulthood. Second, the trajectory method typically identifies between three and five groups, slightly more in studies using self-reports of offending than official records. Third, a sample size of greater than 500 provides robust categorisation of groups. Finally, there tends to be a low-rate group, a high-rate group and a moderate-but-declining group. While the findings from trajectory studies are clearly important for policy and practice, understanding the longitudinal cost of different criminal careers may further improve the usefulness of this research (Cohen, et al., 2010a). Assessment of these costs can be used by advocates and policymakers to determine the potential viability of crime prevention programs, the benefits of which are unlikely to be seen for some time (Cohen, 1998). Findings therefore promote long-term thinking about appropriate responses to offending beyond the short-term election cycle.

Few studies have assessed the costs of criminal careers. Given the potential to promote the use of costly developmental and targeted interventions, earlier research focused on estimating the cost of high-end or chronic offenders. Cohen (1998) estimated the costs that would result from a life of crime by estimating and then applying costs to index offences. A ‘bottom-up’ costing approach was used which involved assessing the value of specific cost categories that result from crime, including victim costs, criminal justice system costs and the cost of forgone earnings by the offender. Findings indicated that each career criminal cost between US$1.5 and US$1.8 million in 1997, with half (50%) of the cost resulting from reduced quality of life. DeLisi and Gatling (2003) adjusted the costs to account for inflation.
and applied the costs to a sample of 500 habitual offenders from a large urban jail in western United States. Each offender had over 30 arrests and costs were applied to index offences. Findings indicated that each offender costed over US$1.14 million in 2002. Welsh et al. (2008) costed the most chronic and serious offenders in the Pittsburgh Youth Study, who represented 10% of the sample. Findings indicated that each boy imposed US$793,000 to US$861,000 in victim costs to age 17 in 2000. Victim costs included tangible financial losses (i.e., damaged or stolen property, medical expenses and lost wages) as well as intangible costs (i.e., reduced quality of life, pain and suffering).

Cohen and Piquero (2009) used data from the Second Philadelphia Birth Cohort to estimate the monetary value of saving high-risk youth from offending. The cohort followed all people born in Philadelphia during 1958 from ages 8 to 26. Offences were based on police contacts, and multipliers were used to account for offending that did not result in police arrest. An important contribution of this study was that a ‘top-down’ costing approach was used which was based on the public’s willingness-to-pay to reduce crime. This approach produces higher estimates than when bottom-up costing approaches are used, because it includes collateral costs relating to fear of crime (i.e., crime prevention expenditure, avoidance behaviour and insurance costs) and loss of social cohesion. The value of saving a 14-year-old high risk youth from a life of crime was found to be between US$2.6 and US$5.3 million in 2007.

More recent studies have estimated the cost of different types of offenders based on their trajectories. This approach provides policymakers with information that can be used to assess and compare the potential cost-benefits of generic as well as targeted crime prevention interventions. In two follow-up studies based on the Second Philadelphia Birth Cohort, Cohen et al. (2010a, 2010b) used Nagin and Land’s (1993) Semi-Parametric Group-based Method to identify groups displaying unique offending patterns. In the first study, trajectories for the overall sample were produced and costs were assessed using both ‘bottom-up’ and ‘top-down’ approaches. Findings indicated that there were four trajectory groups, including a non-offender group (Cohen et al., 2010a). The high-rate chronic offender group constituted 3.1% of the sample but over 40% of costs. Each high-rate chronic offender was found to cost either US$515,382 or US$1.1 million by the time they turned 27, depending on whether intangible costs were included. Most of these costs were incurred during early adulthood (ages 18 to 26) rather than during adolescence (ages 8 to 17). In the second study, a ‘top-down’ costing approach was used and costs were examined based on sex and ethnicity. While a different number of trajectories were identified, 2.8% of males were found to be high-rate chronic offenders and they accounted for 37% of male offending
costs, or in excess of US$1.5 million each (Cohen et al., 2010b). Although 0.5% of females were chronic offenders, they accounted for 49% of female offending costs or US$754,440 each. Offending by African-Americans was found to be the most expensive out of any ethnic trajectory group and averaged in excess of US$1.6 million for each chronic offender.

Given that research focused on the costs of crime is sparse, the need for international replication has been noted (Piquero, et al., 2013). Only one study has assessed the costs of offending trajectories outside the United States. Piquero et al. (2013) used data from the Cambridge Study in Delinquency Development (CSDD) which included the convictions of 411 South London males aged 10 to 50 years old. Analyses indicated that there were five trajectory groups, including a non-offender group. Costs were applied based on the average cost per type of crime calculated by Brand and Price (2000). These estimates about the cost of crimes were considerably lower than those produced by other studies (Piquero et al., 2013). Findings indicated that the most costly stage of the life-course was mid-to-late adolescence. The high-rate chronic group was found to cost over 10 times as much as the low adolescence peak group. The average cost per high-rate chronic offender was US$95,241 while the average cost of the low adolescence peak group was US$10,210.

There is clearly a need for Australian research that assesses the costs of offender trajectories. This research is needed to help local policymakers assess the potential benefits that are likely to result from specific prevention programs, particularly those that involve intervening early in life and where the benefits are likely to accrue across the life-course. The applicability of international findings to Australia is questionable given jurisdictional differences in offence types, offence profiles, criminal justice system practices and monetary values. For example, the Australian system is unique with over half of young offenders diverted to cautioning and conferencing (Productivity Commission, 2012). The use of different practices impacts on cost estimates, as do differences in the cost of commonly used practices. In 2007, the average cost of prisoners in the United States was $30,600, while the average cost of prisoners in Australia was $83,549 (Kyckelhahn, 2011; Productivity Commission, 2012 Sabol and West, 2009). These differences highlight the need for additional research so that findings are useful for local policymakers.

**Current study**

In the current study, we aimed to estimate the longitudinal costs of offenders who followed different trajectories in Queensland (Australia) to provide policymakers with evidence that could be used to promote the use of crime prevention interventions. The study was based on the Queensland Longitudinal Database (QLD) which includes all officially recorded offences
committed by people born in 1983 and 1984 when aged 10 to 25 years old. Given the crime-age curve (Piquero et al., 2013), the database is likely to capture most offending and costs that would be incurred by the cohort over their life-course. Unlike most previous studies, a method for assessing the longitudinal costs of offenders had to be developed. Because a ‘top down’ costing approach based on willingness-to-pay could not be used without significant primary data estimation for Australia, a ‘bottom-up’ approach was adopted as this was feasible largely on the basis of various secondary data sources with only minimal primary data estimation. Two types of costs were assessed: (i) criminal justice system costs, which were based on the number and type of finalised criminal justice system events that individuals had and lengths of time under different types of supervision; and (ii) social and economic costs, which were based on the number and types of offences that individuals committed.

Specifically, the study addressed three research questions:

1. What are the monetary costs of crime?
2. What is the optimal number of offender trajectories in an Australian offender cohort?
3. What are the monetary costs of officially recorded offending for individuals on different offender trajectories?

**Data and methods**

The Queensland Longitudinal Database (QLD) was used in this study. This database was created to obtain the offending profiles of all individuals born in 1983 and 1984 who were guilty of an offence in Queensland between 1993 and 2009, when aged 10 to 25 years old. In Queensland, a person is not criminally responsible for offences committed before the age of 10 and an individual is considered a youth if aged 10 to 16 at the time of the offence (Youth Justice Act (Qld), 1992). The database was created by linking between several offence-based datasets which existed for each of the practices used to respond to offending in Queensland. These practices include formal police cautioning, police referred youth justice conferencing, youth court and adult court. The database includes dates when individuals had contact with each justice system practice, all offences for which individuals had contact, as well as court outcomes such as number of days sentenced to community-based orders (e.g., probation) or length of detention/incarceration. The database has been used extensively for research, with the processes used for data linkage and cleaning described elsewhere (Allard et al., 2010; Little et al., 2011). Findings reported elsewhere provide a detailed overview of the characteristics of the cohort and trajectory groups that were identified (Stewart et al., under-review).
The offender cohort included 41,377 individuals who had 108,758 finalised criminal justice events for 209,980 offences. Most individuals in the cohort were male (n=30,753, 74.4%) and non-Indigenous (n=27,641, 66.2%). Of individuals in the cohort, 14,607 (35.3%) had at least one formal caution by police, 242 (0.6%) had at least one police referred conference and 34,622 (83.7%) had one or more court appearance (Table 1). As a youth, 2,182 (5.3%) individuals in the cohort spent time under community based supervision while 220 (0.5%) had served a period of detention. As an adult, 4,875 (11.8%) had community-based supervision and 2,040 (4.9%) were incarcerated. Therefore, members of the cohort were more likely to have been under community based supervision or confined as an adult rather than as a youth.

Insert Table 1 about here

Variables

**Offending.** The measure of offending was an admission, plea or finding of guilt for an offence. These findings related to all offences, rather than just the index or most serious offence. However, traffic and related offences and breaches of court orders were excluded. Traffic and related offences were excluded because most are dealt with via on-the-spot infringement notices and while more serious traffic offences may proceed directly to court, many represent contested less serious traffic offences. Therefore, they were excluded for the sake of consistency. Breach of court orders usually involve failure to comply with conditions such as the requirement to report. In Queensland, a youth is required to admit guilt to be eligible for formal police cautioning or police referred youth justice conferencing. Individuals may plead guilty or be found guilty for offences in court.

**Offence type.** Fifteen of the sixteen Australian and New Zealand Standard Offence Classification (ANZSOC) categories were included. These were: (1) Homicide and related offences, (2) Acts intended to cause injury, (3) Sexual assault and related offences, (4) Dangerous or negligent acts endangering persons, (5) Abduction and related offences, (6) Robbery, extortion and related offences, (7) Unlawful entry with intent/burglary, break and enter, (8) Theft and related offences, (9) Deception and related offences, (10) Illicit drug offences, (11) Weapons and explosives offences, (12) Property damage and environmental pollution, (13) Public order offences, (14) Offences against justice procedures, government security and government operations (excluding breaches) and (15) Miscellaneous offences. The one category excluded was Traffic and related offences.
**Age at time of offence.** As the date of offence was not always available, the age at the time of offence was calculated based on the individual's date of birth and the earliest recorded date for each offence. For cautioning and conferencing data, the date of offence was usually the date when the offence was reported to police. For court matters, the earliest date was either the date of lodgement or the earliest court appearance relating to the matter.

**Criminal justice system events.** Events were determined based on the date when offences were finalised and frequently several offences were finalised at one event. There were six types of events: (1) Formal police cautioning is a police diversionary response which is available for youth aged 10 to 16 at the time of their offence/s and involves the issuing of a warning, with a formal record being made of the event by police. (2) Youth justice conferencing is a form of restorative justice which involves police or court referral to a conference. It is available for youth aged 10 to 16 at the time of their offence/s and involves youth participating in a meeting with victims and others to repair the harm caused by their offending. It should be noted that conferencing was only available in a limited number of jurisdictions when the cohort were youth, as it was operating in pilot mode in Queensland until 2003. (3) The Childrens Court is a closed court that deals with offences allegedly committed by youth aged 10 to 16. (4) The Magistrates Court or lower court deals with most offences, having jurisdiction over summary or less serious offences. For serious offences, the court decides if there is enough evidence and which higher court should hear the matter. (5) The District Court deals with serious criminal offences, with findings of guilt determined by a judge or jury. (6) The Supreme Court is the highest court in Queensland and deals with the most serious offences, such as murder, manslaughter and serious drug offences.

**Court outcome.** For court events, outcomes were recorded. These included: (1) youth community-based supervision, (2) youth detention, (3) adult community-based supervision, and (4) adult incarceration. The number of days that youth and adults were sentenced to for each outcome were also recorded. Where more than one court outcome was recorded at an event because several offences were finalised (32.2% of events), it was assumed that sentences would be served concurrently and the most serious outcome for the event was used. Because data were only available for the number of days sentenced, it was assumed that youth would serve 60% of their detention sentence while adults would serve 80% of their incarceration sentence before being released under community supervision. These assumptions were based on advice provided by the relevant agencies about the applicable average proportions that would be subject to early release. Consistent with practice in
Queensland, individuals were assumed to serve 100% of time sentenced to community-based orders.

*Criminal justice system costs*

Criminal justice system costs were assessed based on the costs of finalised criminal justice system events and supervision costs. These were estimated using the Transactional and Institutional Cost Analysis (TICA) (Carey et al., 2006). This approach views offenders as consuming resources when they have transactions with, and are processed through, the criminal justice system. One strength of this approach is that it enables an assessment to be made about the cost of resources invested by multiple agencies. Although TICA is frequently used to assess costs at the micro-level, the approach was used to determine the average cost of practices as individuals flowed through the criminal justice system.

The average cost of police, court and supervision practices were assessed for youth and adults. Average police costs were calculated based on publically available information and an internal police time-in-motion study which assessed how long particular practices took for youth and adults. Five steps were used to assess the cost of police responses: (1) 35% of the 2010/11 police budget was directed towards crime management ($624,769,550) rather than other functions such as traffic management (QPS, 2009, 2011a). (2) Examination of police practices indicated that 9.3% of offences were dealt with by practices ‘other’ than cautioning, conferencing or court and this proportion was subtracted from the crime management budget (leaving $566,440,552) (QPS, 2011b). (3) The number of youths and adults cautioned, conferred and processed through the courts during 2010/11 were estimated, and total hours was calculated based on how long practices took in the QPS time-in-motion study (Table 2; DJAG, 2011a, 2011b; QPS, 2005, 2011b). On average, youth cautions and court appearances took police longer periods of time, reflecting the additional time taken for initial contact, transportation, time-out, conducting interviews, action time and administration. (4) The average hourly rate was assessed as $245.1, calculated by dividing the remaining crime management budget ($566,440,552) by the total time police spent processing offenders (2,311,118 hours). (5) The cost per event was calculated by multiplying the length of time that processes took police by the hourly rate.

*Insert Table 2 about here*

Average costs per court finalisation in the Childrens, Magistrates, District and Supreme courts were based on figures provided in the Report on Government Services (Productivity
The average cost of youth conferencing was determined by dividing the overall youth conferencing operating budget ($9.3 million) by the number of referrals ($2,614) (Department of Communities, 2009). The cost of community-based supervision and detention for youth was assessed using the conservative estimate reported elsewhere (Bleijie, 2012; CAIR, 2008), while these costs were assessed for adults using costs provided in the Report on Government Services (Productivity Commission, 2012). Once the average cost per transaction was established, the cost per finalised event was calculated as the sum of all transaction costs necessary for a particular event to be finalised. For example, a finalised court event would include police and court costs.

**Wider economic and social costs**

Estimating the wider economic and social costs of crime is challenging and there is considerable variability in these costs depending on whether a bottom-up or top-down approach is used. While bottom-up approaches include a range of tangible and intangible costs, they result in lower estimates than top-down approaches (i.e., willingness-to-pay). Given the absence of published estimates based on willingness-to-pay in the Australian context, a bottom-up approach was used which involved updating an assessment about what these costs were in Australia during 2005 (see Rollings, 2008). Rollings (2008) estimated the average economic and social costs of crime for 12 offence categories. These costs included medical costs, costs of property loss or damage, costs of lost output and intangible costs. Costs that were excluded from the study were justice system costs, costs related to providing government services to victims, and security industry and insurance administration costs. The study acknowledged that there was likely to be considerable variation in costs within each offence category, so offence characteristics were taken into account when assessing costs. For example, most offences against the person involved assessing the number that would have resulted in injury requiring medical treatment or hospitalisation. Property offences were assessed separately for residential and commercial offences and took into account the number of offences that resulted in insurance claims.

Rollings' (2008) estimates were updated and mapped across to the ANZSOC. A review of the estimated cost of individual offence types indicated that a high cost was applied to fraud offences because of the methodology that was used to assess this cost. Unlike other offence types, the cost of fraud was estimated based on the average cost of this offence in three Australian jurisdictions ($21,360). As this takes into account the highly skewed nature of the cost of fraud offences, this cost was re-estimated for present purposes using the average median cost in the three jurisdictions reported in Rollings (2008) ($425). The estimates were then mapped across to the ANZSOC. Where more than one offence category in the original
assessment was included in one ANZSOC offence code, average costs for the offence code were calculated. Average costs were based on ratios developed to account for the frequency of each offence category in Queensland during 2010/11 (QPS, 2011b). These costs were then adjusted for inflation between 2005 and 2012 (RateInflation, 2012). Offence types that were not costed by Rollings (2008) were assigned nominal values consistent with their perceived nature and impact (Cohen and Piquero, 2009). While somewhat speculative, these values overcome the large number of offences (40%) that did not have a cost assigned to them. The implications arising out of assigning these costs are highlighted in the discussion section.

Analytic strategy
There were three steps involved in the analytic strategy. The first step involved estimating the average cost of criminal justice system events and the average social and economic costs of each offence type. Both of these costs are expressed in 2012 Australian dollars (near parity to United States dollars at the time of writing).

Second, a dataset was created to perform trajectory analysis. The dataset had the annual number of offences for each of the 41,377 offenders in the cohort based on their age at the time of offence. Nagin and Land’s (1993) Semi-Parametric Group-based Method (SPGM) was used to model the frequency of annual offences over the life-course using offence data between 1993 and 2009, when individuals in the cohort were aged 10 to 25 years old. The SPGM analysis was undertaken using the SAS procedure “PROC TRAJ” developed by Jones, Nagin and Roeder (2001). As the majority of individuals in the cohort offended for short periods of time, there was an excess of data cells with zero counts for offending. Because of this, the offending count data was distributed according to the Zero-Inflated Poisson distribution (Fergusson et al., 2000; Nagin, 1999). Additionally, a small number of individuals had high annual offence counts which exceeded 20 offences in a given year (n=630, 1.5%). These outliers were scaled to enable the trajectory analysis to converge.

Given the non-parametric nature of the procedure being used, it was necessary to specify the number of trajectory groups being modelled and their form prior to analysis. Thus, the development of the final model was necessarily iterative, with the process being repeated a number of times to determine the parameters that produced the best fit for the data. The final number of trajectories for the model was determined based on both the Bayesian Information Criterion (BIC) and the average probability of group assignment. The BIC increases as the model fit improves (incorporating the penalty for increases in the number of trajectories) while the average probability of assignment is higher for models with more
distinct trajectories (Nagin, 1999; Piquero, 2008). Thus, the model with the optimum number of trajectories needed to have a high BIC (relative to other model options) and an average probability of group membership that was as close to one as possible.

The third step involved assessing the costs of each offender trajectory. Costs were applied to each trajectory group based on the number and types of finalised criminal justice system events, number, types and length of supervision and the number and type of offences for which individuals had been convicted. Total costs were then calculated by adding the criminal justice system event costs and the associated social and economic costs.

**Results**

*The monetary costs of crime*

The first research question sought to estimate the monetary costs of crime. These costs were assessed using two approaches. Criminal justice system costs were assessed based on the number and types of contacts that individuals had as well as the number, types and length of court ordered supervision. Figure 1 presents average costs for the main transactions that individuals had with the criminal justice system. Transaction costs were added to calculate the cost per finalisation. For example, police cautioning only involves police expenditure (either $1,275 per youth or $1,103 per adult). However, the cost of individuals appearing in court requires police expenditure ($3,701 per youth or $2,696 per adult), court expenditure (depending on the level of the court) and possibly supervision costs which were assessed per day.

*Insert Figure 1 about here*

Table 3 presents the social and economic costs of crime based on an update of Rollings (2008) assessment. In mapping the costs from the original assessment to the ANZSOC, attempted homicide was included as assault as per Rollings (2008) original assessment. Six offence types in the original assessment were subsumed by two ANZSOC codes: “Theft and related offences” included four theft types and “Property damage and environmental pollution” included criminal damage and arson. The ratios developed and applied to offences subsumed by ANZSOC categories took into account how frequently these offences occurred in Queensland during 2010/2011. As previously discussed, the 2005 cost of each offence was then adjusted for inflation to determine the 2012 cost and nominal costs were applied to offence types that were not costed based on their perceived nature and impact (Cohen and Piquero, 2009).
Offender trajectories

The second research question sought to determine what the optimal number of offender trajectories was for an Australian offender cohort? Models with three to six trajectories were created and the BIC and average group membership probabilities for each of the models were examined. The optimal model included five or six groups. The six group model had a higher value for BIC (-363979.7) while the five group model had a relatively high value for BIC (-365761.3) and a similar probability of group membership (>0.7). Examination of the form of the trajectories indicated that the six group model split the chronic offender trajectory into two groups, but did not add to interpretation. Consequently, the model with the smaller number of groups was selected for ease of interpretation (Fergusson et al., 2000). Estimates of each component were examined to ascertain the form (i.e., cubic, quadratic, linear and intercept terms) of the five trajectories. Most terms were significant at the 0.05 level and all but one of the trajectories had a significant cubic term. While a linear term was found to have greater significance for this group, all five groups were assumed to be described best by cubic functions because of the possible impacts of truncation at age 26 and incarceration for this older group.

Figure 2 displays the five offender trajectories identified by the model. Individuals in groups one and two offended less frequently, with individuals in group one averaging 2.1 offences (SD=1.5) and individuals in group two averaging 2.0 offences (SD=1.5). Group one peaked during adolescence when individuals were aged 15 or 16 while group two had adult onset where individuals were aged over 17 years old. These groups accounted for most of the cohort, with 30.6% of the cohort in group one and 53.3% in group two. Group one was labelled “adolescent peaking (low)” while group two was labelled “adult onset (low)”. The third group had adolescent onset of offending when individuals were aged 12 or 13, with high levels of offending which peaked when individuals were aged 20 to 21 years old. On average, individuals in the third group were convicted of 31.7 offences (SD=23.9). Only a small proportion of the cohort was in this group (1.8%), which was labelled “adolescent onset (chronic)”. Group four had adolescent onset when youth were aged 11 to 14 years old with moderate offending. On average, each individual in group four was convicted of 12.5 offences (SD=7.2). This group included 11.3% of the cohort and was labelled “adolescent onset (moderate)”. The fifth group involved early onset and high levels of offending (M=46.4 offences, SD=42.8 offences), with offending peaking when individuals were aged 16 years old. This group included 3.0% of the cohort and was labelled “early onset (chronic)”. 

 Insert Table 3 about here
The cost of offender trajectories
The third research question sought to determine the monetary costs of officially recorded offending by individuals on different offender trajectories. Table 4 presents these costs. Over four-fifths (83.9%) of the cohort were in the two low offending groups, but these groups accounted for less than one-third (30.4%) of total costs. Approximately one-tenth (11.3%) of the cohort were in the adolescent onset (moderate) group, who accounted for 28.5% of the costs. Each individual in the moderate group generated a total cost $69,611, with criminal justice system costs accounting for two-thirds (70.3%) of this cost. While 4.8% of the cohort were in the two chronic groups, they accounted for 41.1% of the total costs. On average, each individual offender in the chronic groups cost more than three times as much as someone in the moderate group and over 20 times more than individuals in the two low offending groups. On average, each individual in the adolescent onset (chronic) group generated a total cost of $186,366 while each individual in the early onset (chronic) group cost $262,799. Individuals in the early onset (chronic) group cost the criminal justice system the most as they had more finalised criminal justice system events and more days under community-based supervision and in detention as youth. Individuals in this group also cost the most in wider economic and social costs because they were more likely to have been guilty of a higher number of offences. Individuals in this group accounted for over half (54.9%) of the ‘unlawful entry with intent’ offences, which was the fourth most costly offence type.

Discussion
This study estimated the longitudinal costs of criminal careers using a Queensland-based offender cohort that included the guilty findings of people born in 1983 and 1984 for offences that took place when these individuals were between the ages of 10 and 25 years old. Despite the need for localised research, few studies have assessed the cost of offender trajectories outside the United States. The focus on estimating such longitudinal costs for jurisdictions other than the United States is of considerable interest in Australia, where a segment of these costs were estimated at $35.8 billion in 2005 (Rollings, 2008). The costing methodology that was developed in this study to assess these costs may prove useful for future researchers and policymakers who are interested in producing estimates of these costs. In addition, there is a need for international research focused on the costs of crime.
given that this research can be used to underpin evidence based policy and because research in this field is sparse. The study addressed three research questions: (1) What are the monetary costs of crime? (2) What is the optimal number of offender trajectories in an Australian offender cohort? and (3) What are the monetary costs of officially recorded offending for individuals on different offender trajectories?

Criminal justice system costs were estimated based on the number and types of finalised events and the number and types of supervision that individual offenders experienced. Wider social and economic costs were based on the number and types of offences for which individuals were convicted. Consistent with the findings of Piquero's (2008) review of trajectory research, five offender trajectories were identified. The offending patterns of these groups were similar to those found by prior research. There was an adolescent-peaked group that offended at low levels (30.6% of cohort), an early-onset chronic group (3.0% of cohort) and an adolescent-onset chronic group (1.8% of cohort). Additionally, there was an adult-onset group that offended at low levels (53.3% of cohort) and an adolescent onset group that offended at moderate levels (11.3% of cohort). When costs were applied to the five groups, the chronic offending groups accounted for a disproportionate amount of costs. Adolescent onset (chronic) and early onset (chronic) offenders were 4.8% of the cohort, but these two types of offenders combined accounted for 41.1% of total costs. On average, each chronic offender cost $233,912. Approximately one-tenth (11.3%) of the cohort were in the adolescent onset (moderate) group, but 28.5% of the costs were accrued by members of this group. On average, each adolescent onset (moderate) offender cost $69,611. Four-fifths (83.9%) of the cohort were adolescent peaking (low) or adult onset (low) members, and 30.4% of total costs were accrued by members of these groups. On average, each offender in these low offending groups cost $8,559 or $10,740 respectively.

Therefore, most offenders only have one or two officially recorded offences but there is a small group of costly offenders who begin offending early in life or during adolescence and offend at high rates. These findings highlight the potential savings that would result from extending the use of diversionary practices to include adults who have had limited contact with the system or who commit relatively less serious offences. On average, each police caution costs $1,103 while each Magistrates finalisation costs $3,090 plus any supervision costs. Savings resulting from the more widespread use of diversion could be redirected to ensure that appropriate evidence-based programs are available for those who commit more serious offences or for those who have more sustained contact with the criminal justice system. There are a range of therapeutic interventions which focus on the family or the ecological environments of young people which are quite effective for reducing offending
While these programs have different target populations and involve different practices, evidence from meta-analyses suggests that programs focusing on the family reduce offending by between 13.3% and 52.0% (Aos et al., 2001; Drake et al., 2009; Latimer, 2001; Lipsey and Wilson, 1998; Welsh and Farrington, 2006; Woolfenden et al., 2001). Programs which adopt a Multi-Systemic Therapy (MST) framework reduce offending by between 7.7% and 46.0% (Aos et al., 2001; Curtis et al., 2004; Lipsey and Wilson, 1998; Littell et al., 2005). Given the efficacy of these programs, they are likely to be cost-effective particularly if targeted towards those on costly chronic offender trajectories.

The current study produced lower estimates than Cohen et al. (2010a) but higher estimates than Piquero et al. (2013). In the current study, the average cost of each adolescent onset (chronic) offender was $186,366 and the average cost of each early onset (chronic) offender was $262,799. Cohen et al. (2010a) reported that each chronic offender cost $515,382 or $1.1 million in 2007, depending on whether a bottom-up or top-down costing approach was used. Piquero et al. (2013) reported that each high-rate chronic offender cost $95,241 and each very low rate chronic offender cost $21,576 in 2003. In the current study, each adolescent onset (moderate) offender cost $69,611. Cohen et al. (2010a) reported that each offender in the adolescent peaked group cost $429,356 or $885,050 while Piquero et al. (2011) found that each offender in this group cost an average $40,933. In the current study, each adolescent peaking (low) offender cost $8,559 and each adult onset (low) offender cost $10,740. The least expensive offender reported by Piquero et al. (2013) was the low adolescent peak offender who cost $10,210 while for Cohen et al. (2010a) it was the very low rate chronic offender who cost $78,125 or $144,996.

These variations in cost estimates reflect three differences between the studies. First, there are differences in the length of the criminal career that have been studied. The current study focused only on offences for which individuals were found guilty of when aged 10 to 25 years old. Thus, a similar time-frame was captured by the current study as Cohen et al. (2010a), who examined police contacts between the ages of 8 and 26. Piquero et al. (2013) captured offending across a larger proportion of the life-course by focusing on convictions between the ages of 10 and 50. Examining criminal careers for longer periods of time should result in higher cost estimates, particularly for chronic offenders. However, Piquero et al. (2013) produced lower estimates than Cohen et al. (2010a, 2010b) because of the lower cost estimates for the different types of offending. Second, there are differences in the types of offences included and the way that offences were counted. The current study included all guilty findings in the trajectory analysis with the exception of traffic and related offences and breach offences. Previous studies have focused on specific offence types. Piquero et al.
focused on “theft, theft from a motor vehicle, sex offense, assault, robbery, burglary and vandalism convictions”, therefore excluding a lot of offending that occurred. Cohen et al. (2010a, 2010b) focused on an index of most serious offences rather than all offences, therefore not capturing less serious offending where individuals had been convicted of multiple offences. Third, the overall cost of trajectories is largely dependent on the estimates produced for specific types of crime and there is considerable variability in these estimates. For example, previous studies have estimated that each assault costs between $16,586 and $85,000 (Cohen et al., 2010a; Piquero et al., 2013). The current study estimated that each assault cost $2,062 in wider social and economic costs plus the criminal justice system event and supervision costs, which are not attributable directly based on crime type.

Despite differences between the studies examining the cost of offender trajectories, there are two consistent findings. First, chronic offender groups consume a high proportion of total costs. In the current study, the chronic groups were less than 5% of the cohort and accounted for 41.1% of total costs. Cohen et al. (2010a) found that 3.1% of their cohort were on a chronic offending trajectory and they accounted for 41.43% of costs, depending on whether a top-down or bottom-up costing approach was used. Piquero et al. (2013) found that the chronic offending groups represented 12.7% of the sample but over 52.6% of the costs. Second, each individual on a chronic offending trajectory costs significantly more than individuals on low offending trajectories. In the current study, each chronic offender was found to cost over 20 times more than individuals in low offending groups. Previous studies reported that chronic offenders cost over 10 times more than individuals in low offending groups (Cohen et al., 2010a; Piquero et al., 2013).

The findings from the current study should be interpreted in light of five main limitations. First, the study was based on guilty findings and therefore does not include offending that is not reported to justice agencies or attributed to an offender. Unfortunately, no Australian estimates exist that would enable us to account for additional offending by the cohort based on the offences for which they had been found guilty. Second, the study was not able to take into account attrition of the sample through death or population mobility. It is likely that there were a number of people in the cohort who died or moved either into or outside of the state of Queensland that were included in the trajectory modelling. Taking attrition into account may result in some variation in the final model that is identified (Eggleston et al., 2004). Third, the study did not control for the effects of exposure time which may increase the proportion of individuals that would have been classified as persistent offenders (Piquero et al., 2001). Individuals in the cohort spent 1,445,787 days in detention or incarcerated. When
the number of days available for individuals in each group to offend is considered, individuals in the adolescent onset (chronic) group were incarcerated for 7.4% of the time while individuals in the early onset (chronic) group were incarcerated for 6.9% of the time. Individuals in the low and moderate groups were incarcerated for between 0.0% and 1.7% of the time.

Fourthly, average criminal justice system costs were used. Because there is a lack of detailed costing information, the study was not able to differentiate between fixed and unfixed costs or take into account factors that are likely to impact on cost. It could be argued that reduced offending may not result in the full cost saving because many costs are fixed. While this is true, the need for additional resourcing due to population growth may be delayed such as increasing the number of police officers, court houses or building new detention centres. Further, the study was not able to assess the extent that average costs would vary based on case-specific factors that are likely to impact on cost, such as whether the offender pleaded guilty, the offence type or the location of the offence.

Finally, the updated social and economic costs involved reassessing the cost of fraud offences and attributing nominal costs to seven offence types that were not originally costed. The cost of fraud offences were significantly reduced (from $21,370 to $517) because of the impact that costly outliers had on the estimates that were originally produced. Given the distribution of fraud offences across the five trajectories, re-estimating this cost had the impact of reducing the cost of the adolescent onset (chronic) group who committed over one-third (37.3%) of fraud offences. Attaching nominal costs to the seven offence types that were not originally costed had a similar impact on the average wider economic and social costs for four of the trajectory groups. If these costs were not included, the average social and economic costs for the four groups would have been between 7.2% and 15.1% lower. However, the inclusion of these costs had little impact on the early onset (chronic) offender group. If the cost of the seven offence types were not included, the average social and economic cost for this group would have been 3.7% lower ($95,168 rather than $98,802). This is likely an artefact of the more serious and costly offences committed by members of this group.

Despite these limitations, the findings of the current study are important as they promote long-term thinking about appropriate responses to crime and offending. They enable decision-makers to assess the potential cost-benefits of implementing crime prevention programs. Decision-makers can use information about the cost of programs and the cost of offenders to assess the likely cost-benefits of programs. For example, an early intervention
program could target 100 potential chronic offenders, cost $10,000 per participant and conservatively be held to prevent 10% of chronic offenders from developing a life of crime. This program could produce $1.4 million in savings by the time targeted individuals turned 26 years old, over half of which would be direct savings for the criminal justice system. It should be noted, however, that savings to the criminal justice system could be more modest depending on whether reductions were such that fixed costs could be reduced or off-set by reductions in future costs.

Additional research focused on the cost of offender trajectories in different jurisdictions is clearly needed to promote the use of this evidence within policymaking environments. The need for this research is apparent given jurisdictional differences in offence types, offending profiles, criminal justice system practices and the monetary costs of specific practices. Moreover, there is considerable difficulty assigning market values to intangible costs and little research which has adopted a top-down costing approach. Additional research which assesses the costs of crime and assesses intangible costs using methods such as willingness-to-pay will enable researchers to develop more valid and reliable cost estimates. The need for research which predicts future offending and differentiates offender trajectories based on risk factors is also essential to assist targeting of crime prevention programs.

In sum, this study developed and applied a methodology to assess the criminal justice system and wider economic and social costs of offending in Queensland. Criminal justice system costs were assessed based on the average cost of finalised events, which took into account the transactions that individuals had with the system and the cost of supervision. Wider costs were determined by updating a previous assessment of these costs (Rollings, 2008). Findings indicated that 4.8% of the cohort were chronic offenders and they accounted for 41.1% of total costs. On average each chronic offender cost $233,912, with criminal justice system costs accounting for over half of the costs. These findings provide evidence which can be used in Australia by decision-makers to advocate for the use of early intervention programs and programs which target individuals at-risk of offending.
References


Table 1. Number of distinct individuals and finalised events in the cohort

<table>
<thead>
<tr>
<th>Event/Type of Supervision</th>
<th>Number of distinct individuals</th>
<th>Number of events / days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caution</td>
<td>14,607</td>
<td>19,103</td>
</tr>
<tr>
<td>Police referred conference</td>
<td>242</td>
<td>259</td>
</tr>
<tr>
<td>Court appearance (finalised)</td>
<td>34,622</td>
<td>89,396</td>
</tr>
<tr>
<td>Court ordered conference^2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>41,377</td>
<td>108,758</td>
</tr>
</tbody>
</table>

Number of days (sentenced)

<table>
<thead>
<tr>
<th>Number of days</th>
<th>Number of events / days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Youth Detention</td>
<td>220</td>
</tr>
<tr>
<td>Adult Incarceration</td>
<td>2,040</td>
</tr>
<tr>
<td>Youth community-based supervision^3</td>
<td>2182</td>
</tr>
<tr>
<td>Adult community-based supervision^3</td>
<td>4,875</td>
</tr>
</tbody>
</table>

^1 Includes all court levels: Childrens Court, Magistrates Court, District Court and Supreme Court
^2 Conferencing was operating in pilot mode until 2005/06 when it was implemented state-wide.
^3 Assessed as the most serious outcome for the finalisation
<table>
<thead>
<tr>
<th>Process</th>
<th>Youth</th>
<th>Adult</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Time (hrs)</td>
</tr>
<tr>
<td>Court</td>
<td>11,209¹</td>
<td>15.1</td>
</tr>
<tr>
<td>Caution</td>
<td>8,318³</td>
<td>5.2</td>
</tr>
<tr>
<td>Conference</td>
<td>1,014⁴</td>
<td>8.0</td>
</tr>
<tr>
<td>Total</td>
<td>220,622</td>
<td></td>
</tr>
</tbody>
</table>

¹ Number of youth who appeared in the Childrens Court (DJAG, 2011a)
² Number of defendants who appeared in the magistrates court (DJAG, 2011b)
³ There were 13,414 offences that were cautioned (DJAG, 2011a). As the average number of offences per caution is 1.55 (Allard et al., 2009), there were a total 8,943 caution events. While cautioning is generally only available in Queensland for youths, QPS statistics indicate that 93.01% of offences cautioned involved youths (QPS, 2011).
⁴ There were 1,042 conference events held (DJAG, 2011a). QPS statistics indicate that 97.3% of conferences involved youths (QPS, 2011)
Figure 1. Cost of justice system transactions
Table 3. Mapping Australian economic and social costs to Australian and New Zealand Standard Offence Classification (ANZSOC) codes and cost estimates

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Homicide</td>
<td>1,915,323</td>
<td>Homicide and related offences</td>
<td>1,915,323</td>
<td>2,329,919</td>
</tr>
<tr>
<td>Sexual assault</td>
<td>7,500</td>
<td>Sexual assault and related offences</td>
<td>7,500</td>
<td>9,123</td>
</tr>
<tr>
<td>Assault</td>
<td>1,695</td>
<td>Acts intended to cause injury</td>
<td>1,695</td>
<td>2,062</td>
</tr>
<tr>
<td>Burglary</td>
<td>2,869</td>
<td>Unlawful entry with intent</td>
<td>2,869</td>
<td>3,490</td>
</tr>
<tr>
<td>Robbery</td>
<td>2,300</td>
<td>Robbery, extortion and related offences</td>
<td>2,300</td>
<td>2,798</td>
</tr>
<tr>
<td>Theft of vehicles</td>
<td>7,024</td>
<td>Theft and related offences</td>
<td>1,241^a</td>
<td>1,510</td>
</tr>
<tr>
<td>Thefts from vehicles</td>
<td>1,004</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shop theft</td>
<td>123</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other theft</td>
<td>400</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fraud^b</td>
<td>21,370</td>
<td>Fraud, deception and related offences</td>
<td>425</td>
<td>517</td>
</tr>
<tr>
<td>Criminal damage</td>
<td>1,251</td>
<td>Property damage and environmental pollution</td>
<td>3,357^a</td>
<td>4,084</td>
</tr>
<tr>
<td>Arson</td>
<td>81,200</td>
<td>Abduction/harassment/other offences^c</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>against the person</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prohibited/regulated weapons and explosives offences^c</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Illicit drug offences^c</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dangerous and negligent acts</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>endangering persons^c</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Public order offences^c</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Offences against justice^c</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Miscellaneous offences^c</td>
<td>250</td>
<td></td>
</tr>
</tbody>
</table>

Sources: Rollings (2008); QPS, 2011

^a Highlighted indicates that cost was assessed by mapping original assessment to Australian standardised offence code which incorporates that offence, taking into account the number of each type of offence in Queensland during 2010/11

^b Original assessment was $21,370 which included high cost outliers. Reduced estimate calculated by averaging the median cost of fraud reported by three jurisdictions in Australia (Rollings, 2008).

^c Nominal values attached based on perceived nature and impact (Cohen and Piquero, 2009).
Figure 2. Offender trajectories
Table 4. Criminal justice system and wider economic and social costs of offender trajectories

<table>
<thead>
<tr>
<th>Group</th>
<th>Cohort Members</th>
<th>Justice System Costs</th>
<th>Wider Economic and Social Costs</th>
<th>Total Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>Z</td>
<td>Mean ($)</td>
<td>Group Costs</td>
</tr>
<tr>
<td>G1 Adolescent peaking (low)</td>
<td>30.6</td>
<td>12,669</td>
<td>4,431</td>
<td>56.1</td>
</tr>
<tr>
<td>G2 Adult onset (low)</td>
<td>53.3</td>
<td>22,059</td>
<td>7,722</td>
<td>170.4</td>
</tr>
<tr>
<td>G3 Adolescent onset (chronic)</td>
<td>1.8</td>
<td>754</td>
<td>132,531</td>
<td>99.9</td>
</tr>
<tr>
<td>G4 Adolescent onset (moderate)</td>
<td>11.3</td>
<td>4,654</td>
<td>48,899</td>
<td>227.6</td>
</tr>
<tr>
<td>G5 Early onset (chronic)</td>
<td>3.0</td>
<td>1,241</td>
<td>163,997</td>
<td>203.5</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>41,377</td>
<td>18,308</td>
<td>757.5</td>
</tr>
</tbody>
</table>