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Abstract | Individuals are far more likely to engage in antisocial behaviour during adolescence than any other period of their life. This paper presents selected results from two studies which used secondary data analysis to provide a theoretically informed picture of youths' decision-making process in relation to delinquency.

Study 1 focused on changes in adolescents' perceived rewards and delinquency involvement over four years. Results showed that high levels of perceived rewards go hand in hand with high levels of delinquency, but perceived antisocial rewards 'topped out' by age 14, suggesting that the best time to intervene is during early adolescence or late childhood.

Study 2 focused on anger control. Youth who were highly delinquency-involved were especially likely to report surges in anger on days when they experienced a stressor, pointing to a need for delinquency prevention programs aimed at emotion control, including cognitive reappraisal. Improving these skills should enhance youths' ability to navigate risk during the teenage years.

Antisocial behaviour during the teenage years: Understanding developmental risks

Kathryn Lynn Modecki, Bep Uink and Bonnie L Barber

Adolescent antisocial behaviour, including delinquency, illegal substance use and violence carry heavy social and economic costs in Australia (Williams et al. 2005). Individuals are far more likely to engage in antisocial behaviour during adolescence than any other period of their life. In fact, in Australia, the offending rate for adolescents is almost three times the rate of all other age groups (AIC 2013). Society's challenges in reducing adolescent antisocial behaviour underscore a fundamental reality: in order to effectively prevent these illegal and dangerous behaviours, we must adequately understand their causes (Moffitt 2005).

Theoretical advances

Recent advances in the psychological sciences point to a convergence of factors that exacerbate risk for initiation and escalation of antisocial behaviour during adolescence (Modecki & Uink 2017). Illustratively, significant up-ticks in problem behaviours during the teenage years may be at least partially attributable to developmental deficits in what psychologists term 'executive function' capacities (Luciana 2013). These capacities are innately tied to decision making, and allow youth control over impulses and behaviour.



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Yet adolescents' executive systems can easily become overwhelmed because of the considerable demands placed on these systems. For instance, adolescents are often attracted to novel and risky settings and they identify sizable social and emotional rewards from problem behaviour engagement. More generally, adolescents are susceptible to fluctuating emotions and often wrestle with intense emotional reactivity as they encounter setbacks and challenges. These burdens on adolescents' executive systems, in the form of disproportionate perceived rewards for antisocial behaviour and intense emotions, hamper adolescents' ability to modulate their 'internal traffic'. As described below, this may make it especially difficult for adolescents to rein in their impulses to engage in antisocial behaviours, including behaviours related to delinquency—defined here as illegal and antisocial behaviours of youth under the age of 18 (Luciana 2013; Modecki, Zimmer-Gembeck & Guerra 2017).

Arguably as a result of such burdens, adolescents are more susceptible to acting on their impulses and taking part in aggressive, illegal and risky behaviours, relative to either children or adults (Fine & Sung 2014; Luciana 2013). In environments featuring developmentally novel stressors, adolescents are at a disadvantage, because they lack a repertoire of skills with which they might prosocially navigate challenge. For instance, during the teenage years, critical skills such as decision-making (including optimal weighing of rewards versus risks) and emotional regulation remain under construction (Modecki 2017).

Strain and antisocial behaviour

Because youth with underdeveloped decision-making and less-controlled emotions lack the psychological resources to successfully resolve issues through conventional strategies, these stressful situations can be especially strong catalysts for problems (Simons et al. 2003). As a result, pursuing violence and illegal behaviours may be one way youth cope with the challenges of day-to-day life (Chassin et al. 2010).

Notably, youth living in economically disadvantaged settings experience added strains and stressors as they navigate day-to-day life. Stressors including family difficulties, perceived injustice, neighbourhood disorganisation, and less-effective social institutions, amplify the common developmental challenges with which youth must cope (Uink et al. 2018). These and other cumulative strains may trigger youth to act out in the form of violence and other antisocial behaviours (Agnew 2001; Simons et al. 2003). In fact, criminologists have long pointed to the experience of 'strain' as a salient explanation for crime.

Adolescent antisocial behaviour and heterogeneity

Among adolescents, who are developmentally at risk for criminal engagement, there exists a subset of young people who continue these behaviours into adulthood. These youth, sometimes termed 'life-course persistent offenders,' also tend to begin antisocial activities at a very early age (Moffitt et al. 2002). During the teen years, life-course persistent offenders can be difficult to differentiate from youth whose engagement is limited to adolescence, because their behaviours during this period are relatively similar, except for violence (Moffitt 1993). A body of work has sought to disentangle those who continue to offend from those who do not, and to do so earlier in the life course. Among the distinguishing factors associated with more persistent involvement are negative emotionality at a

young age and 'state dependence', in which early involvement in problem behaviour leads to further problems (Nagin & Paternoster 2000). In addition, young people who persist in antisocial behaviours are more likely to come from low socio-economic backgrounds, given the numerous stressors and associated lack of supports endemic to these environments.

Indeed, one of the more intractable risk factors for persistence with crime beyond adolescence is being raised within circumstances of socio-economic adversity (Moffitt et al. 2002). Among other hazards, adverse social environments amplify risks for negative interactions with family, peers and school settings, which can lead young people onto developmental pathways of risk rather than resilience (Aguilar et al. 2000).

Individual characteristics: rewards and negative emotions

That said, scholars have also identified a number of individual risk factors for adolescent involvement in antisocial behaviour which exist across socio-economic gradients but exacerbate the risk associated with situational strains and early disadvantage. In particular, reward perceptions and negative emotions have received growing attention from developmental psychologists, because they are closely linked to teens' involvement in antisocial behaviour and because the development of these characteristics aligns with age–crime trends (eg Steinberg et al. 2009). Indeed, substantial evidence supports what many juvenile justice practitioners already suspect (Modecki 2017)—that a heightened focus on rewards and negative emotionality is associated with antisocial behaviour, and that these factors contribute to youths' crime to a degree that distinguishes them from adult offenders (Scott & Steinberg 2008).

Given that these individual risks—reward-bias and the tendency to experience intense negative emotions—appear to develop over time and are tied to antisocial choices, they represent risk factors that may be modifiable to prevent crime (Modecki 2009). As a result, understanding the development of these factors, and how they relate to involvement in antisocial behaviour across the teenage years, can inform intervention and prevention efforts. This report explores these factors in the context of unique data from Australian youth living in settings of economic disadvantage.

This report focuses on two studies which together provide a picture of factors that contribute to escalating problems during the teenage years. These factors are explored among a particularly high-value group for criminologists and policymakers—young adolescents in economically disadvantaged settings, a subset of whom could require significant time and resources due to their risk for engaging in antisocial behaviour. Both studies provide brief snapshots of how changes in these factors are linked with involvement in antisocial behaviour, and suggest novel ways that delinquency might be prevented among high-risk youth.

Study 1: How rewarding is delinquency?

Increasingly, adolescents' disproportionate involvement in antisocial behaviour has been attributed to their heightened sensitivity to rewards. That is, adolescents are more behaviourally disposed towards attaining emotional and social rewards from crime than any other age group (Shulman & Cauffman 2013) and a growing literature has identified the rewards of problem behaviour as having a particularly strong influence on youth delinquency (Modecki 2009; Smith et al. 2011).

Indeed, past research indicates perceived rewards may be a stronger predictor of offending than perceived risks, at least among juvenile offenders (Loughran et al. 2009). In prior research, Loughran and colleagues plotted average perceived rewards over three years, and showed that mean levels of perceived rewards remained relatively stable among incarcerated youth. Importantly, however, reward levels continued to correspond with levels of offending, in that youth who engaged in high levels of offending also perceived high rewards from crime, medium-level offenders perceived moderate rewards, and so on.

That said, previous research has only looked at averages at different points in time, and has not yet mapped developmental trajectories of reward perceptions, nor examined how such changes in reward perception may be linked to delinquency. Further, serious juvenile offenders may experience delinquency as differentially rewarding than community-based youth, because by the time young individuals have become incarcerated, they will have accumulated a broad range of benefits and costs from their crimes.

Thus, previous data do not answer questions about the developmental progression of perceived rewards and delinquency during adolescence, nor do they necessarily generalise to risks specific to youth still living in their communities. With a focus on disadvantaged youth in community settings, Study 1 explores a key question for criminal justice programs and policy: how do rewards drive behaviour (and vice versa) among these youth?

This report addresses some of the methodological challenges inherent in probing the link between perceived rewards and antisocial behaviour, by examining whether early levels of perceived rewards predict changing involvement in delinquency over four years. Importantly, the reverse is also examined: whether high levels of perceived rewards earlier in adolescence predict changes in delinquency over four years. In other words, this approach applies a developmental criminology lens to antisocial rewards and delinquency among low socio-economic status Australian youth during the teenage years.

Sample

Data were derived from multiple waves of a large-scale annual self-report survey of Western Australian youth, the Youth Activity Participation Survey (YAPS), funded by the Australian Research Council. Further details regarding data collection, the range of measures collected, and samples over time can be found in Modecki, Barber and Vernon (2013); Modecki, Barber and Eccles (2014); and Drane, Modecki and Barber (2017). Among YAPS participants, longitudinal data on antisocial rewards were available for one cohort of youth across four years (from grades 9–12, corresponding approximately with ages 13–18 years); see Table 1.

YAPS recruited schools across the state which covered a range of the socio-economic index computed annually by the Western Australian Department of Education. The Index of Community Socio-Educational Advantage (ICSEA) is calculated with data from the Australian Bureau of Statistics, based on the addresses of all students attending each school. This study includes students with average or below ICSEA, representing the bottom half of the spectrum of educational background (n=480). Thus, Study 1 draws on a sample of youth from average to extremely educationally disadvantaged backgrounds and uses annual longitudinal self-report data to examine perceived rewards and delinquency over time.

Measures

Perceived antisocial rewards were assessed using items from a valid construct which has successfully measured decision-making in adolescents (Parsons, Seigel & Cousins 1997). Youth were presented with the following:

Below is a list of behaviours that are illegal and/or dangerous. Some people might think that they have advantages or benefits. We are interested in whether you think they have advantages or benefits.

Four items were used to assess the perceived benefits of four illegal behaviours, such as shoplifting and illegal drug use. Youth responded on a Likert scale ranging from 0 (no benefits), to 4 (moderate benefits) to 8 (a lot of benefits). Internal reliability in this sample was good, and ranged from $\alpha=0.78-0.94$ across waves. This construct is referred to as 'antisocial rewards' or 'perceived antisocial rewards' throughout this report.

Delinquency was measured with a reliable (α ranged from 0.77–0.91 across waves) and valid construct that was adapted from a larger delinquency scale (Modecki, Barber & Vernon 2013) to assess key behaviours of interest, including damaging public property, police contact, physical fighting, and stealing. An example item includes:

In the past 6 months, how often have you gotten in a physical fight with another person?

Items were measured on an eight-point scale from 1 (none) to 8 (31 or more times).

Pubertal timing was also controlled in these analyses, given its links to the development of antisocial behaviours (eg Modecki, Barber & Eccles 2014). Pubertal timing was assessed using one item, taken from Dubas, Graber and Petersen (1991). This item assessed self-reported physical development relative to peers, with responses ranging from 1 (much later) to 5 (much earlier).

Table 1: Demographic characteristics of Study 1 participants

Age at grade 9: M(SD)	14.42 (0.38)
Gender (% female)	57.3
School(s) socio-economic range (ICSEA)	815–1,000

Source: YAPS collection 2011 [data file]

Analyses

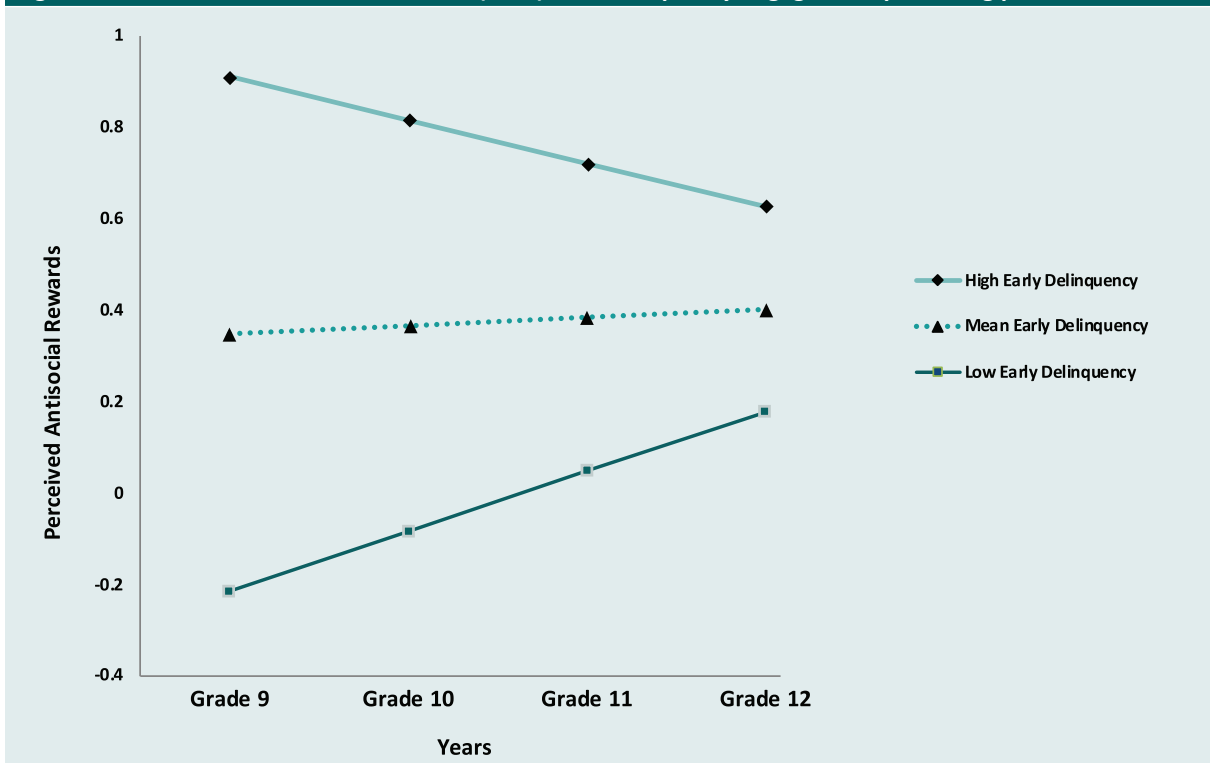
Analyses involved modelling an unconditional latent growth curve of perceived antisocial rewards across grades 9–12, followed by a conditional model in which covariates (gender, pubertal timing) and predictors (early, grade 9 delinquency) were added. Next, the same models were run with delinquency as a latent growth curve and early (grade 9) perceived rewards as the predictor. All models were run in Mplus version 7.1 both with maximum likelihood estimation and then with Bayes estimation. For more detailed analyses and comparisons with alternative analytic approaches, see Modecki and Uink forthcoming.

Results

First, perceived rewards were relatively stable across grades 9–12; however there was significant inter-individual variation in early levels of rewards in grade 9. Adding covariates and predictors to the model showed high early perceived rewards was associated with higher early delinquency involvement (intercept, $p < 0.001$). Importantly, other factors were also associated with subsequent change in perceived rewards over four years.

That is, early puberty was associated with subsequent increases in antisocial rewards (intercept, $p = 0.04$) and high levels of early delinquency involvement were associated with subsequent declines in rewards (linear slope, $p < 0.001$). As described in Figure 1, this effect of delinquency on rewards represents a ‘bouncing back’ effect, as youth who engaged in high levels of delinquency early on appear to experience a ceiling effect. Even so, these youth with high levels of early delinquency involvement still perceived antisocial behaviour as most rewarding, at a rank-level, across the four years. Even by the end of high school, the different categories of youth failed to converge in their perceived antisocial rewards.

Figure 1: Interaction between maturation (time) and delinquency engagement predicting perceived rewards



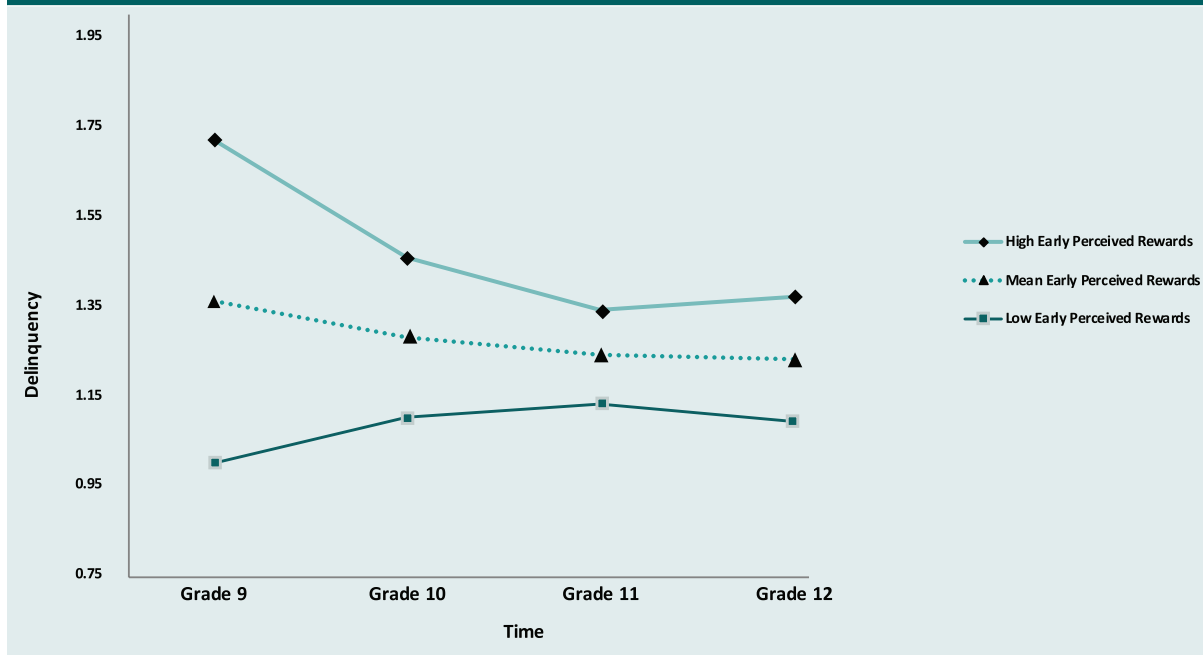
Source: YAPS collection 2011 [data file]

Second, delinquency underwent curvilinear change across four years, following a u-shaped curve. There was also significant inter-individual variation in early levels of delinquency in grade 9. Adding covariates and predictors to the model showed high early perceived rewards were associated with high early levels of delinquency involvement (intercept, $p < 0.001$).

High levels of perceived antisocial rewards were also associated with subsequent declines in delinquency over the first few years (linear slope, $p < 0.001$) followed by increases over the last few years (quadratic slope, $p < 0.001$).

Figure 2 demonstrates the interaction between maturation (time) and early perceived rewards predicting delinquency involvement. Youth who perceived high levels of antisocial rewards early on, were already engaging in high levels of delinquency. These youth declined in their delinquency involvement over the next few years of high school, followed by a slight upturn in grade 12. Again, despite declines in delinquency over four years of high school, the sub-set of youth who perceived many rewards from crime in 9th grade remained the most delinquency involved, at a rank-level, across all years.

Figure 2: Interaction between maturation (time) and perceived rewards predicting delinquency involvement



Source: YAPS collection 2011 [data file]

Overall, Study 1 findings highlight that early adolescents' perceptions of delinquency's rewards are not necessarily enduring. Rather, for those adolescents whom police and justice personnel are most likely to encounter (who are already engaging in relatively high levels of delinquency early in adolescence), these rewards diminished over time. That is, for these youth, perceived rewards appeared to hit a ceiling by 9th grade. This suggests that delinquency may 'lose its shine', and these young people gradually desist from antisocial behaviour. Indeed, adolescents high in early perceived rewards also reported rapid declines in delinquency from grade 9–11, such that grade 9 represented a developmental peak for engagement in antisocial behaviours. Although these young people were the most frequent offenders at each time point, this subset of adolescents are likely to be largely representative of 'adolescent-limited' offenders, given their overall pattern of desistance.

That said, early offenders represent a high-value target for law enforcement. As described further in the conclusion, addressing anticipated benefits from crime as a preventive strategy early on (prior to the transition to high school) could prove useful.

For youth low in early delinquency, however, perceived rewards tended to increase over time, perhaps a reflection of perceived ties between social status and rule-violating behaviours (Rebellion 2006). Although adolescents did not nominate specific perceptions related to the benefits of illegal behaviour, previous work suggests that impressing peers is indeed a salient identified reward from crime (Modecki 2009). Those adolescents who were low in early perceived rewards reported increased delinquent behaviour across the remainder of high school, reflective of a developmental norm of at least some low level problem behaviour engagement (Modecki 2017). That said, these adolescents remained lowest in delinquency—in terms of rank—at each time point, so that early low levels of perceived reward as well as early low levels of delinquency involvement appear to characterise youth on a fairly auspicious developmental trajectory, at least in terms of averting crime involvement.

Study 2: Are emotional responses and adolescent delinquency linked?

Not only are rewards of crime especially salient to adolescents' antisocial decisions, but emotion also plays a role. The emotional variability of adolescence is well documented and this developmental period is characterised by relatively poor emotional control (Caffman & Steinberg 2000). However, significant variability between young people also exists. That is, some adolescents are better able to temper their emotions than others are and some youth are less emotionally reactive than others when encountering setbacks and challenges (Uink, Modecki & Barber 2017). More specifically, adolescents who are delinquency-involved tend also to be distinguished by especially intense emotional responses to aggravations and annoyances, and can show large deviations (in terms of highs and lows) in their emotions (Plattner et al. 2007; Uink et al. 2018).

Indeed, previous survey research shows that adolescents who are better able to temper their emotions also make fewer antisocial decisions and engage in fewer delinquent acts (Caffman & Steinberg 2000; Modecki 2008, 2009). Moreover, among juvenile offenders, developmental improvements in emotional control are associated with subsequent decreases in and desistance from antisocial behaviour (Chassin et al. 2010; Monahan et al. 2009).

This link between emotional control and delinquency is important for a number of reasons. Understanding young people's responses to strains and hassles is highly germane to delinquency prevention, because these can trigger emotional and behavioural responses associated with 'acting-out'. Thus, learning to be less reactive to aggravations may help to diminish adolescents' aggressive and antisocial reactions to setbacks. More broadly, if at-risk youth are to steer away from involvement in the justice system, they will need the skills necessary to successfully navigate challenges in day-to-day life.

Sample

Study 2 takes a different approach to understanding antisocial behaviour during the teenage years, and examines a second developmental risk—emotional valence, here in relation to stress. Taking advantage of existing data from an intensive ecological momentary assessment (EMA) study with at-risk youth, this study examines how changes in emotions relative to typical daily emotions are linked to delinquent behaviour. By describing how delinquent youth (fail to) temper their emotional responses in the real world, findings provide practical insight for delinquency prevention and intervention programs and services (Modecki & Mazza 2017).

Thus, the second approach was to use intensive EMA data from cohort 1 of the Young and Well Cooperative Research Centre supported ‘How do you feel?’ study. Data were collected via smartphones from 109 low socio-economic status Australian youth (see Uink, Modecki & Barber 2017 for details of the study; see Table 2 for ‘How do you feel?’ cohort 1 participant details). Youth were texted five times a day for seven days and asked to provide their current emotion and whether they had experienced a recent hassle, among other details. Before and after EMA, the participants reported their recent delinquency involvement and completed other wellbeing indices to provide a picture of overall mental health.

Table 2: Demographic characteristics of ‘How do you feel?’ cohort 1 participants

Age: M(SD)	14.7 (0.92)
Gender (% female)	66.9
Socio-economic range (ICSEA)	900–1,000

Source: ‘How do you feel?’ data collection cohort 1 2013–14 [data file]

Measures

Delinquency was measured before and after EMA using 15 items that assessed how often participants had engaged in antisocial or aggressive behaviour and substance use. This measure has been used in previously published research on adolescent antisocial behaviour (Fredricks & Eccles 2006), and example items include: ‘About how often in the last 6 months have you used drugs?’ and ‘About how often...have you gotten in a physical fight with another person?’, where responses ranged from 0 (none) to 7 (31 or more times). Internal reliability at before and after EMA was excellent ($\alpha=0.85$, $\alpha=0.90$) and test-retest reliability was high ($r=0.88$). Participants’ scores from both surveys were averaged to create an antisocial behaviour score.

Daily hassles were measured during the EMA portion of the study by asking participants via smartphones, ‘Since you were last messaged has anything bad happened to you?’ at each sampling moment. The format of this question meant that participants reported on events that had occurred within the last two to five hours. A dummy variable was created based on this information, coded so that 0 means no bad events (hassles) that day, and 1 means one or more moderate to severe hassle(s) that day. Emotion was also measured during the EMA portion of the study, by asking via smartphones ‘Right now, how are you feeling?’ Participants rated how angry (among other emotions) they were feeling on a five-point scale, from 1 (not at all) to 5 (very much). Emotion was averaged across the day for this report.

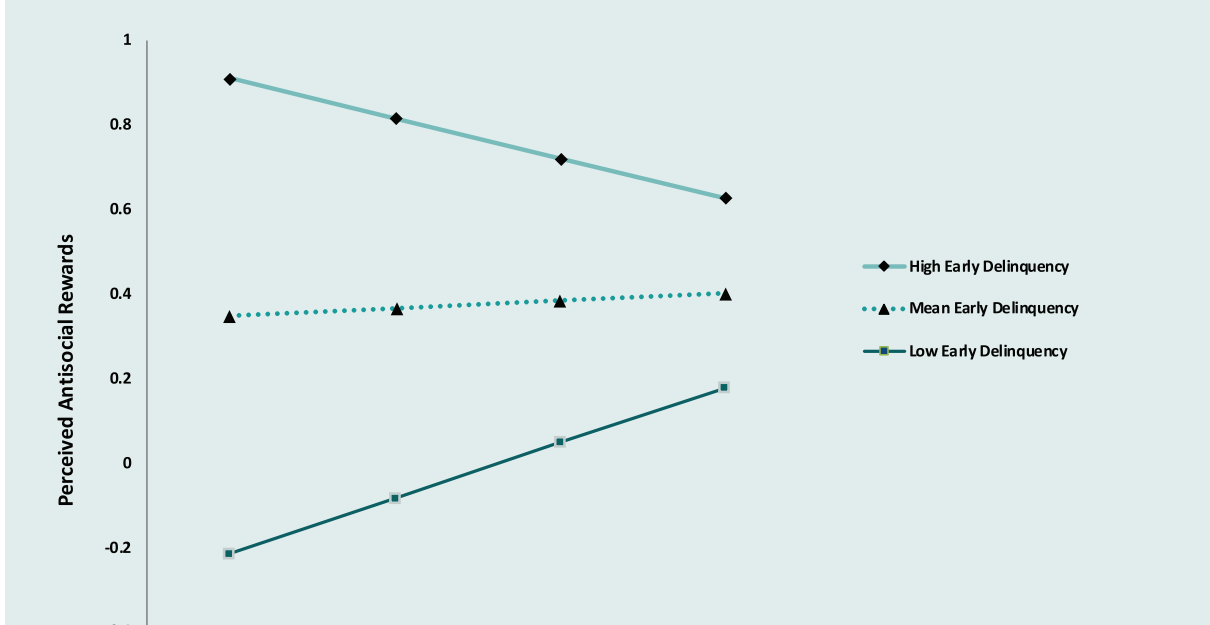
Analyses

Cross-level random slopes models were run within a hierarchical linear modelling framework in Mplus version 7.0, with delinquency at level 2, daily hassle (yes/no) as the level 1 predictor and day-level anger as the level 1 outcome variable.

Results

There was a significant cross-level interaction of hassles × delinquency for anger. As Figure 3 illustrates, youth who engaged in high levels of delinquency reported surges in anger on days they experienced a hassle ($b=0.614, p<0.001$). But low-delinquency youth did not change in their relative anger on days they ran into a hassle ($b=-0.176, p>0.05$). Thus, as expected, youth delinquency involvement was tied to surges in anger in relation to hassles.

Figure 3: Relations between experiencing of a hassle and daily level of reported anger (ranging from 1–5) for high and low delinquency youth



Source: 'How do you feel?' data collection cohort 1 2013–14 [data file]

That adolescents who engage in high levels of delinquency experience surges in anger on days when they experience a roadblock or challenge is not surprising at an intuitive level. But empirical support for this phenomenon represents useful evidence for researchers and practitioners alike. Daily links between experience of strain and surges in anger for young people who engage in delinquency mean that helping adolescents to better navigate hassles and strains may represent an important mechanism for improving resilience and coping. Importantly, too, high reactivity to strain suggests that these adolescents require better 'life skills' for effectively responding to stress. Given that adolescence is a critical developmental period for accumulating these skills, helping youth to improve emotional control and decision-making in response to difficulties should contribute to reductions in antisocial behaviours and more positive functioning overall (Modecki, Zimmer-Gembeck & Guerra 2017).

Conclusions

All told, findings across these two studies describe key developmental features of delinquency that could be further targeted in intervention and prevention programs to reduce adolescent crime.

First, programs and policies should work to reduce the salience of rewards for teenagers. One way to do so would be to highlight the temporary nature of antisocial rewards (such as impressing peers and an emotional 'rush'), while simultaneously highlighting crime's serious and long-term negative consequences (Modecki 2016, 2009). That said, efforts to counter teens' reward perceptions should be deployed early on, well before 9th grade (age 14), because by this stage youth appear to have already identified crime as especially rewarding.

Second, programs and services should focus on emotion regulation and anger control in particular, to improve young people's resilience and prevent delinquency (Landenberger & Lipsey 2005). Holistic approaches may be best suited to improving self-regulation and coping skills, including approaches that balance law enforcement with assisting youth and reconnecting them with supports from families, schools and communities.

These types of supports may be most effectively delivered in partnership with respected community members, by offering a range of support services, and by offering these within an open-door framework. In all, because offending among those in mid to late adolescence tends to be especially costly for society (Piquero, Jennings & Farrington 2013), these types of front-end interventions to divert youth from antisocial pathways early on should reap monetary and social benefits.

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Kathryn Modecki is a Senior Lecturer at Griffith University and Menzies Health Institute Queensland; data were collected while at Murdoch University.

Bep Uink is a PhD candidate at Murdoch University.

Bonnie Barber is Professor and Director of the Building Healthy Communities program in the Menzies Health Institute Queensland.

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GPO Box 1936
Canberra ACT 2601, Australia
Tel: 02 6268 7166

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