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Depression, anxiety and delinquency: Results from the Pittsburgh Youth Study

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ABSTRACT

Purpose: The main aim of this research is to investigate to what extent within-individual changes in anxiety and depression are related to within-individual changes in theft and violence.
Methods: The youngest sample of the Pittsburgh Youth Study (PYS), a prospective longitudinal survey of 503 boys followed up from age 7 onwards, was analyzed. Depression and anxiety were measured for boys from ages 11 to 16 as were moderate and serious forms of self-reported theft and violence. A hierarchical linear random effects model was used to investigate anxiety and depression as potential causes or outcomes of these forms of delinquency.
Results: The results showed that the between-individual correlations were consistently higher than the corresponding within-individual correlations, and provided little evidence to discern the directionality of the potential relationships between depression, anxiety and delinquency. Using a random effects approach, there was limited evidence that prior depression or anxiety was related to later offending, but there was evidence that offending (particularly theft and serious violence) was associated with later increases in anxiety, and to a lesser extent depression.
Conclusions: This study indicates that depression and anxiety were outcomes of offending. If replicated, this would suggest that evidence-based interventions which reduced offending would have a desirable influence in reducing depression and anxiety. However, interventions for depression should still form part of responsive interventions. More research which explores within-individual changes in longitudinal studies with repeated measures is needed.

1. Introduction

There has been an extensive amount of research on the relationship between mental health problems and delinquency (Fazel, Doll, & Långström, 2008; Hein et al., 2017; Kroll et al., 2002; McCormick, Peterson-Badali, & Skilling, 2017), with estimates of psychiatric disorders amongst justice involved youths ranging from 60 to 70% compared to 20% in community samples (Hein et al., 2017; Teplin, Abram, McClelland, Dulcan, & Mericle, 2002). A systematic review of the mental health disorders of over 16,000 young people in custody suggested that the most prevalent psychiatric conditions were externalizing disorders (e.g., conduct disorder, oppositional defiant disorder), internalizing disorders (e.g., depression, anxiety) and psychotic symptoms (Fazel et al., 2008).

While there is little doubt about the pervasiveness and magnitude of the relationship between mental health problems and delinquency, the directionality and the potential causal chains linking these disorders to delinquency remain elusive. It is possible that many externalizing disorders are actually early behavioral manifestations of delinquency. For example, the diagnosis of conduct disorder includes acts of antisocial and/or delinquent behavior, making any relationship with delinquency potentially tautological. Behavioral factors, such as conduct disorder or oppositional behavior, are extremely useful for identifying those young people who may benefit from interventions to address their emerging offending patterns, but they do not provide insight into the potential causes of delinquency, or what causal factors these interventions should address in order to reduce delinquency.

Internalizing disorders, particularly depression and anxiety, do not overlap with the definition of delinquency and therefore may form part of a causal process linked to delinquency. A number of studies have demonstrated that depression is positively related to delinquency, particularly violent crime (Fazel et al., 2015). For example, using data from the Pittsburgh Youth Study (PYS), Loeber, Farrington, Stouthamer-Loeber,

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and White (2008) found that depressed mood amongst boys was significantly related to later violence and theft at multiple time points from middle childhood to early adolescence. Similarly, in a study of 97 boys aged 12–17 admitted into custody in the UK, depression was found to be to be one of the most prevalent psychiatric disorders that they possessed (Kroll et al., 2002). The consistently identified relationship between depression and offending is particularly noteworthy, because epidemiological research suggests that depression in young males decreases significantly from ages 5 to 15 (e.g., Angold & Erkanli, 1996), while one of the most consistent findings in criminology is that offending increases over this same period of time (Loeber et al., 2008).

Anxiety has also been linked to later delinquency and offending (e.g., Fazel et al., 2008; Kroll et al., 2002). For example, using the oldest and youngest samples of the PYS Loeber et al. (2008) found that boys with low anxiety were less likely to subsequently self-report or to be officially identified as having committed violence. Alternatively, in the Cambridge Study in Delinquent Development, a prospective longitudinal study of 411 boys from London followed up from ages 8 to 48, Farrington (1988) found that boys from criminogenic backgrounds who had high levels of anxiety were significantly less likely to become offenders. High levels of anxiety and neuroticism have also been identified amongst so-called secondary psychopaths (e.g., Blackburn, 1975). Secondary psychopaths display similarly elevated levels of antisocial behavior and violence to primary psychopaths, but in the case of secondary psychopaths this behavior is attributed to their being emotionally overwhelmed.

Using the youngest sample of the PYS, Defoe, Farrington, and Loeber (2013) used structural equation modelling to investigate the interrelations between hyperactivity, low academic achievement, depression, low SES and delinquency. Using a series of autoregressive cross-lagged models the authors concluded that hyperactivity and low SES were independent causes of low school achievement, which in turn caused delinquency. Depression was identified as an outcome of offending.

There is a growing acknowledgement that the mechanisms underlying the development of offending may be different for those of different ethnic and/or cultural backgrounds (e.g., Glynn, 2014; Jolliffe, Farrington, Loeber, & Pardini, 2016; Piquero, Jennings, Diamond, & Reingle, 2015). The aforementioned research on depression and anxiety based on data from the PYS included boys of African American heritage, but did not explore whether the mechanisms linking depression, anxiety and offending were similar to, or different from those of Caucasian backgrounds.

It is clear that an important relationship between depression, anxiety and delinquency exists, but the direction of the relationship, and whether these internalizing disorders might be best considered causes, correlates, or outcomes of delinquency remains uncertain. Elucidating the direction of this relationship is essential since if depression and anxiety are causally related to later offending, interventions to address these internalizing disorders (e.g., Townsend et al., 2010) would be expected to reduce the likelihood of later offending. Alternatively, if offending is causally related to later depression and anxiety then interventions which reduced offending would be expected to also reduce depression and anxiety.

Unfortunately, very little criminological research is able to contribute to the debate about the possible causal relationships between various explanatory factors and offending, because almost all research in criminology continues to use a between-individual approach. This legacy of the influential research of Glueck and Glueck (1950) is evident when risk factors of delinquents and non-delinquents are compared and when risk factors are correlated with levels of delinquency. In both cases, between individual differences in risk factors are compared with between-individual differences in delinquency to attempt to draw conclusions about the causes of delinquency.

The major problem with studies of variations between individuals is that it is incredibly difficult to disentangle the effect of the risk factor of interest (e.g. unemployment) from the effects of numerous other risk factors that are correlated with unemployment and that might also influence delinquency. For example, compared with employed people, unemployed people may be more impulsive, less intelligent, more unskilled, heavier drinkers and living in poorer housing even before they were unemployed.

There are a number of statistical approaches that have be employed in an attempt to draw causal conclusions from observational data, including variable by variable matching (e.g., Petersilia, Turner, & Peterson, 1986), regression techniques (e.g., Apel & Sweeten, 2010) and propensity score matching (Jolliffe & Hedderman, 2015), amongst others. For example, using the Cambridge Study in Delinquent Development, Murray, Blokland, Farrington, and Theobold (2014) used propensity score matching to model the probability of being convicted based on a host of individual, family and socioeconomic background characteristics. Individuals who had a conviction were then matched with those who did not on this probability, and the results showed that self-reported delinquency increased after a boy was first convicted (compared with unconvicted boys), in agreement with the theory that official labelling caused increased delinquency. While these approaches are improvements on more simplistic descriptive approaches to causality (as described by Moffitt, 2005), there is always the possibility that a critical variable, which explains the variation in the outcome between the two groups, was missed.

A more desirable way to examine the causes of delinquency is by comparing within-individual changes in risk factors over time with within-individual changes in delinquency over time. This is because, in studies of changes within individuals, all these pre-existing differences between individuals are held constant, making it much more possible to isolate the effect of the factor, for example, unemployment, on delinquency as an individual changes from being employed to being unemployed (and back again). Unfortunately, this method is rarely used in attempting to uncover the causes of crime because it requires repeated measures of both risk factors and delinquency in a longitudinal study.

The concept of cause fundamentally refers to the concept of change within individual units (e.g., Murray, Farrington, & Eisner, 2009). A risk factor X causes an outcome Y if, with some specified degree of probability, changes in X are followed by changes in Y. For example, parental separation may cause a decrease in the economic status of a family. As this example shows, the variables X and Y can be dichotomous (parents together or separated), continuous (family economic status) or of some other kind (e.g. with four categories).

Arguably, the causes of delinquency could be demonstrated most convincingly in controlled experiments in which individuals were randomly allocated either to change, for example, from being unemployed to being employed, or to a control group who did not change. However, studying the causes of delinquency using these kinds of experiments is rarely feasible, and more commonly potential causes are identified in experiments designed to prevent or treat delinquency (Petrosino, Turpin-Petrosino, & Guckenburg, 2010). For example, unemployed young people could be randomly assigned to an employment program or to a control group, and the effects on unemployment and delinquency could be investigated.

In practice, however, prevention and treatment experiments are usually multi-modal, including several different interventions rather than simply targeting one risk factor such as unemployment (e.g., Redondo, Sanchez-Meca, & Garrido, 1999). This makes it difficult to identify the 'active ingredient' and to draw conclusions about causes from such experiments. Because prevention and treatment experiments can only be targeted on factors that can change within individuals, it might be argued that conclusions about causes based on variations between individuals may have no, or at least questionable implications for prevention or treatment.

Because of the problems of carrying out controlled experiments targeting only one risk factor, the causes of delinquency can be

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demonstrated most convincingly in within-individual quasi-experimental analyses in longitudinal surveys in which individuals are followed up before and after some presumed cause. For example, Farrington, Gallagher, Morley, St Ledger, and West (1986) showed that convictions increased during periods of unemployment compared with periods of employment, in agreement with the theory than unemployment caused crime. In both of these examples the potential cause was dichotomous.

In perhaps the first study that compared between-individual and within-individual correlations Farrington, Loeber, Yin, and Anderson (2002) analyzed the oldest sample of the PYS, a prospective longitudinal study of 506 boys followed up in seven data waves between ages 13.8 and 17.8. They found that, of 10 risk factors, all were significantly correlated with delinquency using between-individual correlations. However, only poor parental supervision, low parental reinforcement and low involvement of the boy in family activities were significant in forward-lagged within-individual correlations (i.e., where the risk factor in one year was correlated with delinquency in the next year). A replication using the Victorian cohort of the International Youth Development Study in Australia, was conducted by Hemphill, Heerde, Herrenkohl, and Farrington (2015). In this study of 563 participants (both males and females, aged 11–17), all but one of the forward-lagged correlations (family conflict) were statistically significant in the within-individual analyses, but these were relatively small in magnitude (ranging from $\rho = 0.04$ to $\rho = 0.38$). In comparison all of the between-individual correlations were significant and generally much larger in magnitude.

The main aim of the present article is to attempt to classify the direction of the relationship between depression, anxiety and delinquency by investigating whether the within-individual relationships of these factors with delinquency are similar to or different from the between-individual relationships. Because pre-existing extraneous influences on delinquency are confounded in between-individual correlations but controlled in within-individual correlations, it was expected that the between-individual correlations would be (misleadingly) greater. If a between-individual correlation is substantial and the corresponding within-individual correlation is negligible, this would suggest that the factor is not a cause of delinquency and is only correlated with delinquency because it is confounded with other causal factors.

2. Methods

This paper analyzes data from the youngest cohort of the PYS, a prospective longitudinal study of 503 boys (approximately half African American) followed up from age 6 to age 20. More details regarding the sample selection, study characteristics, and participants can be found in Loeber et al. (2008). The longitudinal follow–up of the youngest cohort consisted of interviews conducted with the boys and their primary adult caretakers (hereafter referred to as “parents”) and questionnaires completed by the parents and teachers. The retention rate of this study has remained consistently high, never falling below 82%, and 70% of the participants were interviewed across all 18 assessments.

In previous studies which compared between-individual and within-individual correlations (e.g., Farrington et al., 2002; Hemphill et al., 2015), between-individual correlations were calculated for each factor of interest and delinquency for each study year, and then aggregated to produce an overall estimation of the between-individual correlation (and the associated standard error). Similarly, separate within-individual correlations were calculated for each study participant for the factor of interest and delinquency and then aggregated to produce an overall estimation of the within-individual correlation (and the associated standard error). These between-individual and within-individual correlations were calculated when the factor of interest was measured at the same time as delinquency, but also both forward and backward lagged. The time ordering provided by forward lagged correlations, where the measured factor is compared to delinquency at a later time, period provides a much stronger test of the extent to which the factor might be causally related to later delinquency. Alternatively, backward-lagged correlations, where delinquency is compared to the measured factor at a later time period, provides a test of the extent to which delinquency might be causing changes in the factor.

The analytic approach of this study is similar to those used previously, but has been adjusted in line with recent developments in multi-level modelling. Using a random effects model, the mean delinquency and depression and anxiety score for each study participant, as well as the within-individual deviation from this score in each year (e.g., the mean score versus the group mean centered score) were calculated. This approach allows for the estimation of the within-individual and between-individual association for the comparison of delinquency with depression and anxiety. This random effects specification also adjusts for any other unmeasured confounders in a manner similar to a fixed effects model (e.g., Bell & Jones, 2015). An autoregressive error structure, which accounts for possible correlated errors between measurements from adjacent years, was also included.

This approach means that unlike the work of Farrington et al. (2002) and Hemphill et al. (2015), the correlations and partial correlations calculated here are based on regression model outputs, rather than simple correlations. As the hierarchical model was specified with a mean score for each person (across all waves of data for that person) and the deviation from this mean at each measurement occasion, the resulting regression coefficients have a unique interpretation, which includes the within person effect of depression on offending, for example, and the group level (in this case between person) effect of depression on offending. The resulting standardized regression coefficients are therefore similar to what we think of as the within-person correlation and the between person correlation (or partial correlation when we include other confounders). In other words, we don't actually calculate the correlations like Farrington et al., 2002, rather model estimated correlations are presented.

However, to aid interpretation and for comparability with the seminal work of Farrington et al., 2002 and Hemphill et al., 2015, some correlations and partial correlations (standardized coefficients) were derived post-estimation following the approach outlined in Raudenbush and Bryk (2002, p290). That is: Standardized coefficient, $\beta\_i^* = \beta\_i\,(\sigma\_(x\_i)/\sigma\_y)$. For the within-individual correlation, σ_y is the total SD of y (e.g., level 1 + level 2 from an empty multilevel model). For the between-individual correlation, σ_y is the level 2 SD of y.

Two strategies were employed to address the skewness that is commonly found in self-reported offending (e.g., Jolliffe & Farrington, 2014), which was also evident in this data. The first approach was to cap the number of offenses reported for each of the offense types to 20. The second strategy, designed to approximate the approach of Farrington et al. (2002), who used Spearman's ranked correlations (ρ), was to use ranked versions of the data in the random effects model.

2.1. Measures

2.1.1. Depressed mood

This construct was the sum of 13 items on the Recent Mood and Feelings Questionnaire administered to the youth (Angold, Costello, Messer, and Pickles, 1995). The items covered criteria for a diagnosis of major depression according to DSM III-R, including feeling lonely, crying a lot, and feeling unhappy. The construct was made once a year, from ages 11 to 16. The alpha reliability of this measure was 0.80.

2.1.2. Anxiety

This construct measured the youth's anxious behaviors. It included seven items reported by the parent, eight items from the youth's teacher and seven items from the youth reporting on behaviors such as ‘clings to adults’, and ‘nervous, high-strung or tense’. If any informant answered

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'sometimes' or 'often', the youth was scored positive for that behavior. This construct was also available each year from ages 11 to 16. The alpha reliability of this measure was 0.72.[1]

2.1.3. Offending

Information about the boy's offending came from a measure which combined self, parent and teacher reports. The boy's self-reported offending came from the Self-Reported Delinquency Scale (SRD), and information from the parents about the boy's offending was obtained from an extended version of the Child Behavior Checklist. Information from the teachers about the boy's offending was obtained from an extended version of the Teacher Report Form. This combined measure was used to estimate the prevalence of offending, however, the frequency of offending was only based on the boys' self-reported offending (Loeber et al., 2008).

Violence and theft were divided into the following levels of seriousness, which reflect steps on the overt and covert pathways (see Loeber et al., 1993).

Moderate Violence: gang fighting.

Serious Violence: Robbery, attacking to hurt or kill, or forced sex.

Moderate Theft: Stealing a bicycle or skateboard from the street, stealing things worth more than $5 from a store, joyriding, purse snatching, stealing from a car, or dealing in stolen goods.

Serious Theft: Breaking and entering or auto theft.

These variables were available each year from ages 11–17.

3. Results

Table 1 shows the number of boys available at each year along with the prevalence and frequency of both the moderate and serious forms of theft and violence. For example, of the 467 boys interviewed at age 11, 31 boys (out of 467; 6.6%) reported 66 incidents of moderate theft (2.1 offenses per offender). Generally, there was an increase in the prevalence and frequency of the different types of offenses up to about age 14 to 15, followed by a decrease. Table 1 also shows the average scores and standard deviations of the measures of depression and anxiety at each age. Depression decreased from age 11 to age 13, but was then relatively constant thereafter. Anxiety decreased from age 11 to age 16. Because the frequency of offending was highly skewed, Spearman's Rho (ρ) was used to calculate the mean stability correlations from each year to the next. Depression (ρ = 0.45) and anxiety (ρ = 0.42) were the most stable over time, while moderate violence (ρ = 0.10) was the least stable.

Table 2 shows the within-individual and between-individual correlations (ρ) when the frequency of the various offense types were compared with depression and anxiety measured in the same time period.[2] While all of the correlations were significant (except between serious violence and anxiety), the between-individual correlations were much larger (ranging from ρ = 0.41 to ρ = 23), probably indicating the bias introduced by numerous other between-individual confounds. The strongest within-individual relationship for depression was with total offending (ρ = 0.05), and for anxiety the strongest was with serious theft (ρ = 0.03).

As previously mentioned, forward-lagged within-individual correlations provide more valid information about the potential causes of delinquency than contemporaneous correlations. Table 3 shows the forward-lagged within-individual and between-individual correlations for the comparisons between depression and anxiety versus offending in the following year. It can be seen that all of the between-individual comparisons were significant, and ranged from ρ = 0.30 (anxiety and later total theft) to ρ = 0.45 (depression and later total offending). Conversely, none of the within-individual comparisons was significant.

Table 4 presents the backward-lagged within-individual and between-individual correlations, where the types of offending were compared to later depression and anxiety. Once again, all of the between-individual correlations were significant and of moderate magnitude. None of the within-individual correlations between offending and later depression was significant at the $p < .05$ level. However, the within-individual correlations between moderate and total theft and later anxiety were significant, suggesting that these offense types were predictive of later increases in anxiety.

Table 5 extends the analyses conducted in Table 3 by also including the forward-lagged effect on offending (allowing for stability over time), and the concurrent effect of the explanatory variable (depression/anxiety). That is, when evaluating whether prior depression, for example, predicts subsequent offending, the model also controls for current levels of depression and offending, and adjusts for prior levels of offending. Similarly, Table 6 shows the backward-lagged effect, or the evaluation of whether prior offending predicts subsequent levels of depression or anxiety while controlling for current levels of offending and depression/anxiety, and adjusting for prior levels of depression/

Table 1
Mean scores at each age.

	Age	11	12	13	14	15	16	17	M stability Cor. (ρ)
	N avail	467	472	462	457	445	434	430	
Mod theft	Prev	6.6	12.1	14.1	14.7	15.1	12.7	8.6	
	Freq	2.1	5.0	23	17.8	30.9	6.3	14.1	0.225
Serious theft	Prev	2.1	3.8	3.5	5.9	4.7	4.4	4.2	
	Freq	3.6	2.8	6.4	11.6	7.5	2.8	7.2	0.166
Total theft	Prev	7.5	13.3	14.3	15.3	15.1	13.6	9.5	
	Freq	2.9	5.3	24.2	21.5	33.3	6.8	15.9	0.329
Mod viol	Prev	7.1	6.8	8.9	8.1	6.1	4.8	1.4	
	Freq	2.2	4.3	3.7	6.2	14.6	9.2	3.0	0.101
Serious viol	Prev	4.5	3.4	5.4	5.3	5.6	5.8	2.6	
	Freq	1.8	3.8	3.0	6.6	5.1	6.8	6.1	0.181
Total vol	Prev	9.6	8.7	12.3	11.2	9.4	8.3	3.7	
	Freq	2.5	4.8	3.9	7.6	12.5	10.1	5.3	0.326
Total offending	Prev	14.8	17.8	20.8	21.0	19.1	18.7	11.6	
	Freq	3.1	6.4	18.9	19.7	32.4	9.4	14.7	0.378
Depression	M	3.1	2.4	2.2	2.1	2.2	2.2		0.450
	sd	4.2	3.3	3.1	3.1	3.2	3.3		
Anxiety	M	3.5	3.1	2.9	2.7	2.5	2.4		0.416
	sd	2.1	2.0	2.0	2.0	1.9	2.0		

Table 2
Bivariate comparisons in the same time period.

	Within			Between		
	B	S.E	ρ	B	S.E	ρ
Depression						
Moderate theft	0.103***	0.030	0.035	0.559***	0.080	0.360
Serious theft	0.149**	0.047	0.032	0.799***	0.142	0.294
All theft	0.109***	0.030	0.038	0.544***	0.076	0.368
Moderate violence	0.107**	0.038	0.029	0.493***	0.120	0.215
Serious violence	0.118**	0.044	0.027	0.833***	0.134	0.325
All violence	0.129***	0.034	0.039	0.517***	0.091	0.295
All crime	0.128***	0.026	0.050	0.495***	0.064	0.399
Sample size	3135			485		
Anxiety						
Moderate theft	0.076*	0.035	0.025	0.400***	0.087	0.272
Serious theft	0.166**	0.055	0.035	0.701***	0.151	0.275
All theft	0.081*	0.034	0.027	0.391***	0.083	0.280
Moderate violence	0.101*	0.043	0.027	0.444***	0.127	0.209
Serious violence	0.096+	0.050	0.022	0.753***	0.142	0.317
All violence	0.077*	0.038	0.023	0.439***	0.097	0.270
All crime	0.068*	0.031	0.026	0.341***	0.069	0.291
Sample size	2700			480		

+ p < .1.
* p < .05.
** p < .01.
*** p < .001.

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Table 3
Forward-lagged correlations.

	Within			Between		
	B	S.E	ρ	B	S.E	ρ
Depression						
Moderate theft	−0.014^{+}	0.014*	−0.013**	0.169***	0.024	0.440
Serious theft	0.00s0	0.009	0.000	0.082***	0.014	0.377
All theft	−0.008	0.014	−0.007	0.181***	0.025	0.429
Moderate violence	−0.002	0.011	−0.003	0.061***	0.016	0.279
Serious violence	0.011	0.009	0.016	0.084***	0.014	0.391
All violence	0.008	0.012	0.008	0.117***	0.021	0.322
All crime	−0.002	0.016	−0.002	0.221***	0.029	0.438
Sample size	2606			478		
Anxiety						
Moderate theft	−0.004	0.014	−0.004	0.108***	0.024	0.273
Serious theft	0.001	0.009	0.001	0.074***	0.015	0.321
All theft	−0.007	0.014	−0.006	0.120***	0.026	0.279
Moderate violence	0.003	0.010	0.004	0.057***	0.016	0.265
Serious violence	0.010	0.009	0.014	0.080***	0.015	0.345
All violence	0.007	0.012	0.008	0.103***	0.021	0.279
All crime	−0.007	0.015	−0.005	0.155***	0.029	0.305
Sample size	2558			476		

$^{+}$ p < .1.
* p < .05.
** p < .01.
*** p < .001.

Table 5
Forward-lagged correlations (adjusted for original levels of factor and offending).

	Within			Between		
	B	S.E	Partial ρ	B	S.E	Partial ρ
Depression						
Moderate theft	−0.002*	0.013***	−0.002	0.002	0.079	0.004
Serious theft	0.006	0.008	0.009	−0.046	0.047	−0.208
All theft	0.009	0.013	0.008	−0.010	0.080	−0.024
Moderate violence	0.002	0.010	0.002	−0.033	0.058	−0.146
Serious violence	0.015^{+}	0.009	0.022	−0.020	0.050	−0.095
All violence	0.013	0.011	0.014	−0.018	0.064	−0.049
All crime	0.015	0.015	0.011	−0.075	0.088	−0.146
Sample size	2603			478		
Anxiety						
Moderate theft	−0.002	0.014	−0.001	−0.045	0.102	−0.112
Serious theft	0.006	0.009	0.009	−0.014	0.061	−0.061
All theft	−0.003	0.014	−0.003	−0.007	0.104	−0.016
Moderate violence	0.006	0.011	0.008	−0.126	0.080	−0.564
Serious violence	0.010	0.009	0.015	−0.212**	0.070	−0.902
All violence	0.011	0.012	0.011	−0.147	0.090	−0.388
All crime	−0.001	0.016	−0.001	−0.025	0.118	−0.048
Sample size	2186			476		

$^{+}$ p < .1.
* p < .05.
** p < .01.
*** p < .001.

anxiety. These models were estimated based on the ranked coefficients to reduce the impact of the outliers, and the models allowed for an autoregressive error structure.

The results (Table 5) show that none of the within-individual comparisons in which depression or anxiety was predicting the various types of offending was significant at the $p < .05$ level. In a directional, one-tailed prediction depression was associated with later serious violence. There was evidence that anxiety was associated with later serious violence between individuals. This suggests that there was very limited evidence of a direct causal association between prior depression or anxiety and later offending. However, when looking at the reverse Table 6, with offending predicting levels of depression and anxiety, there was evidence that total theft and serious violence predicted later increases in depression. Similarly, moderate, serious and total theft were significantly associated with later increased anxiety as was serious violence and total offending.

Given the strength of evidence which suggested that the direction of the relationship was from offending to later depression and anxiety (rather than from depression/anxiety to later offending) a final model was estimated which examined the relationship of the various offense types simultaneously to later depression and anxiety. These cumulative results of the impact of offending (Table 7) suggested that prior involvement in serious violence was associated with subsequent within-individual increases in depression. There was no clear indication that prior offending was associated with subsequent within-individual increases in levels of anxiety, however.

3.1. Ethnic differences

It was considered important to establish whether the between and within-individual associations for depression, anxiety and offending

Table 4
Backward-lagged correlations.

	Within			Between		
	B	S.E	ρ	B	S.E	ρ
Depression						
Moderate theft	0.036	0.033	0.012	0.511***	0.081	0.336
Serious theft	0.005	0.054	0.001	0.794***	0.143	0.296
All theft	0.038	0.033	0.013	0.514***	0.076	0.356
Moderate violence	0.027	0.041	0.008	0.490***	0.116	0.230
Serious violence	0.088^{+}	0.048	0.020	0.783***	0.131	0.326
All violence	0.024	0.036	0.007	0.495***	0.090	0.299
All crime	0.029	0.029	0.011	0.476***	0.063	0.396
Sample size	2636			478		
Anxiety						
Moderate theft	0.086*	0.040	0.028	0.401***	0.085	0.301
Serious theft	0.094	0.064	0.019	0.723***	0.149	0.305
All theft	0.080*	0.039	0.026	0.396***	0.080	0.313
Moderate violence	0.040	0.047	0.011	0.378**	0.120	0.199
Serious violence	0.108^{+}	0.057	0.024	0.750***	0.135	0.352
All violence	0.045	0.042	0.013	0.419***	0.093	0.285
All crime	0.072*	0.035	0.027	0.342***	0.067	0.324
Sample size	2221			477		

$^{+}$ p < .1.
* p < .05.
** p < .01.
*** p < .001.

Table 6
Backward-lagged correlations (adjusted for original levels of offending and factor).

	Within			Between		
	B	S.E	Partial ρ	B	S.E	Partial ρ
Depression						
Moderate theft	0.057^{+}	0.031	0.019	−0.055	0.206	−0.036
Serious theft	0.057	0.051	0.012	−0.054	0.287	−0.020
All theft	0.065*	0.031	0.022	−0.045	0.194	−0.032
Moderate violence	0.048	0.038	0.013	−0.527	0.433	−0.243
Serious violence	0.127**	0.045	0.029	−0.159	0.342	−0.065
All violence	0.053	0.034	0.016	−0.320	0.292	−0.190
All crime	0.052^{+}	0.027	0.020	−0.184	0.180	−0.153
Sample size	2603			478		
Anxiety						
Moderate theft	0.106**	0.037	0.034	−0.281	0.254	−0.217
Serious theft	0.213***	0.060	0.043	−0.178	0.333	−0.078
All theft	0.105**	0.037	0.034	−0.176	0.237	−0.143
Moderate violence	0.083^{+}	0.043	0.023	−0.682	0.493	−0.372
Serious violence	0.109*	0.052	0.025	−0.322	0.444	−0.157
All violence	0.066^{+}	0.039	0.020	−0.380	0.366	−0.269
All crime	0.087**	0.032	0.033	−0.191	0.219	−0.186
Sample size	2186			476		

$^{+}$ p < .1.
* p < .05.
** p < .01.
*** p < .001.

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Table 7
Backward-Lagged effects (adjusting for original levels of all types of offending).

	Within		Between	
	B	S.E	B	S.E
Depression				
Moderate theft	0.035	0.036	0.293**	0.113
Serious theft	0.001	0.058	0.161	0.200
Moderate violence	0.024	0.042	0.120	0.135
Serious violence	0.103*	0.050	0.383*	0.176
Constant	7.342	38.063		
Random effects				
Between person	4941.8	444.8		
Within person	9797.7	298.2		
ICC	0.335			
Sample size	2636		478	
Anxiety				
Moderate theft	0.065	0.043	0.126	0.120
Serious theft	0.104	0.070	0.267	0.211
Moderate violence	0.028	0.049	0.004	0.142
Serious violence	0.069	0.060	0.542**	0.184
Constant	3.391	40.124		
Random effects				
Between person	4970.2	503.4		
Within person	11,952.8	404.9		
ICC	0.294			
Sample size	2221		477	

* $p < .05$.
** $p < .01$.

were similar for those who were Caucasian and African American. For example, previous research using the Pittsburgh Youth Study, has shown that African American boys were more likely to commit serious violence because of an over-exposure to various risk factors (Loeber et al., 2008; p202), and also that certain risk factors, such as physical punishment (Farrington, Loeber, & Stouthamer-Loeber, 2003), and low intelligence (Lynam, Moffitt, & Stouthamer-Loeber, 1993) may operate differently for African American and Caucasian boys. Table 8 shows the prevalence, frequency of offending for African American and Caucasian boys separately, along with the depression and anxiety scores. African American and Caucasian boys had similar levels of depression and anxiety, but African American boys, on average had a higher prevalence and frequency of offending, particularly for violence.

The direction and magnitude of the between and within-individual changes associated with depression and anxiety were examined separately for the approximately half of the sample that was African American and the half that were Caucasian. Generally, the Caucasian and African American boys were equally stable in their offending over the time period (mean stability correlation of 0.371 for Caucasian boys and 0.383 for African American boys), with the frequency and stability of violent offending slightly greater for African American boys, and the frequency and stability of theft greater for Caucasian boys. African American and Caucasian boys had similar levels and mean stability correlations for depression and anxiety.

Repeating the procedure described for the full sample (equivalent to Table 6), the overall results were broadly similar, in that for both ethnic groups the direction of the within-individual relationship was overwhelmingly from the various forms of offending to later changes in depression and anxiety. For example, serious theft amongst Caucasian boys was associated with significant increases in later anxiety ($\rho = 0.04$). Somewhat counterintuitively, however, serious theft amongst Caucasian boys was also associated with a significant decrease in later depression.

Overall, the correlations in the within-individual analyses in which offending predicted later depression and anxiety were stronger for African American boys. For example, the partial correlation for serious violence predicting later depression was 0.04 for African Americans compared with 0.01 for Caucasians. Both moderate and serious theft were associated with significant increases in anxiety for African American boys ($\rho = 0.05$ and $\rho = 0.07$ respectively) and moderate and serous theft were also associated with significant increases in depression ($\rho = 0.03$ and $\rho = 0.04$). For African American boys, serious violence was associated with significant increases in depression, but there was also evidence that depression was related to later serious violence.

Table 8
Mean Score at Each Age By Race

African American	Age	11	12	13	14	15	16	17	M stability cor. (ρ)
	N avail	267	273	262	259	253	243	240	
Mod theft	Prev	6.7	12.1	14.5	15.8	13.8	11.9	6.7	
	Freq	2.1	5.7	33.7	14.4	24.7	8.3	11.2	0.275
Serious theft	Prev	3.0	4.4	3.4	6.9	5.1	4.5	2.5	
	Freq	3.4	3.6	6.0	14.4	4.2	1.7	6.5	0.253
Total theft	Prev	8.2	13.6	14.9	17.0	13.8	13.2	7.5	
	Freq	3.0	6.2	34.2	19.3	26.3	8.1	12.1	0.306
Mod viol	Prev	8.6	11.0	13.4	12.0	8.7	7.4	2.5	
	Freq	2.5	4.5	4.1	6.0	17.6	10.1	3.0	0.313
Serious viol	Prev	6.7	5.5	6.1	5.8	7.1	7.8	2.5	
	Freq	1.7	3.3	3.6	5.2	6.4	8.4	10.0	0.301
Total vol	Prev	13.1	13.9	16.4	14.3	12.3	11.5	4.6	
	Freq	2.5	4.8	4.6	7.2	16.2	12.2	7.1	0.369
Total offending	Prev	18.4	20.9	24.8	25.1	19.4	20.6	11.3	
	Freq	3.1	7.2	23.6	17.2	29.1	12.0	10.9	0.383
Depression	M	3.0	2.5	2.3	2.1	2.2	2.2	1.9	0.449
	sd	4.1	3.5	3.3	2.9	3.1	3.6	2.9	
Anxiety	M	3.5	3.1	2.9	2.8	2.6	2.5	2.2	0.399
	sd	2.1	2.0	2.1	2.0	1.9	2.2	2.0	
Caucasian	Age	11	12	13	14	15	16	17	M stability Cor. (ρ)
	N avail	200	199	200	198	192	191	190	
Mod theft	Prev	6.5	12.1	13.5	13.1	16.7	13.6	11.1	
	Freq	2.2	4.1	7.8	23.1	37.7	4.0	16.3	0.321
Serious theft	Prev	1.0	3.0	3.5	4.5	4.2	4.2	6.3	
	Freq	4.5	1.3	6.9	6.0	12.8	4.4	7.5	0.253
Total theft	Prev	6.5	13.1	13.5	13.1	16.7	14.1	12.1	
	Freq	2.8	4.1	9.6	25.2	40.9	5.2	18.8	0.363
Mod viol	Prev	5.0	1.0	3.0	3.0	2.6	1.6	0.0	
	Freq	1.7	1.5	1.3	7.0	1.4	4.0	0.0	0.146
Serious viol	Prev	1.5	0.5	4.5	4.5	3.6	3.1	2.6	
	Freq	2.3	12.0	2.0	8.9	1.9	1.5	1.4	0.170
Total vol	Prev	5.0	1.5	7.0	7.1	5.7	4.2	2.6	
	Freq	2.4	5.0	1.9	8.7	1.8	2.6	1.4	0.182
Total offending	Prev	10.0	13.6	15.5	15.7	18.8	16.2	12.1	
	Freq	3.1	4.5	9.2	25.0	36.9	5.2	19.1	0.371
Depression	M	3.1	2.2	2.0	2.2	2.2	2.2	1.6	0.455
	sd	4.3	3.1	2.9	3.3	3.4	3.3	3.0	
Anxiety	M	3.4	3.2	2.8	2.6	2.4	2.2	2.1	0.442
	sd	2.0	2.1	2.0	1.9	1.9	1.8	1.6	

4. Discussion

The evidence from this study suggested that the measures of depression, and to a lesser extent anxiety, were outcomes of the various types of offending as opposed to causes of offending. The findings with regards to depression have been identified in other within-individual analyses (e.g., Defoe et al., 2013; Farrington et al., 2002), strengthening confidence in the current results. Like all research, this study should be subject to replication to confirm the findings (e.g., Losel, 2018). However, if the findings are supported, the suggestion that depression and anxiety are outcomes instead of risk factors for later offending would require a significant shift in the conceptualization of these relationships.

For example, based on a Swedish population study, Fazel et al. (2015) suggested that those with depression were at a significantly elevated risk for later violence and proposed that violence risk assessment should be considered for those in certain subgroups of depression. Based on the results of the current study, however, it is possible that earlier unrecorded offending resulted in the observed increased depression, rather than depression causing violence. Similarly, in a sample of

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279 prisoners with antisocial personality disorder (APD), Hodgins, De Brito, Chhabra, and Côté (2010) found that two-thirds of APD offenders had anxiety disorders. In addition, when APD offenders with anxiety disorders were compared with APD offenders without anxiety disorders, those with disorders had started offending earlier, had more APD symptoms, and were more likely to have committed serious violence. The authors suggested that APD offenders with anxiety disorders may be a unique subgroup of APD offenders requiring specific interventions. Through the lens of the current study, these results could also be explained if anxiety was considered to be an outcome of more serious and persistent offending.

Identifying the true causal relationships between depression, anxiety and offending is important for furthering academic knowledge, but also has practical implications for interventions that are designed to prevent and reduce offending. The current study would suggest that interventions which address depression and anxiety, while potentially successful in reducing these two conditions, will have limited impact on later offending. In support of this, in their study of 232 mostly male court-referred youths, McCormick et al. (2017) found that youth with mental health needs (including depression and anxiety) in Canada were no more likely than youth without those needs to reoffend over approximately three years, regardless of whether those mental health needs were treated. The authors suggested that, within a correctional context, in which the primary goal of intervention is to prevent recidivism, treatment for mental health needs should be in addition to criminogenic needs treatment, not in replacement of it.

This is not to suggest that interventions which reduce depression and anxiety are not important for those who commit offenses, particularly for those who are incarcerated for these offenses. First, these disorders can be psychologically debilitating, and it is inherently correct that human services aim to reduce human suffering, regardless of the suffering that these individuals may have caused with their offending. Second, anxiety and depression may be barriers to offenders' engagement with interventions that would actually reduce their offending, as offenders may be too distressed to engage with the intervention, or because those delivering the interventions (e.g., probation staff) view these conditions as a barrier to delivery. Third, there is a very high prevalence of depression and anxiety amongst those in prison (e.g., Fazel & Danesh, 2002), and these disorders are associated with significant increases in the risk of self-harm and suicide in prison (Lonnqvist, 2002). In studies of those committing self-harm or taking their lives in prison in England and Wales, depression and anxiety disorders were some of the most common primary diagnoses (Marzano, Fazel, Rivlin, & Hawton, 2010; Shaw, Appleby, Humber, Moloney, & Baker, 2011).

Fourth, there is evidence that depression and anxiety can be reduced amongst adult (Leigh-Hunt & Perry, 2015) and younger offenders in prison (Townsend et al., 2010), which, could reduce the suffering associated with these disorders and could help to increase engagement with interventions to reduce reoffending. Fifth, the treatment of an offender's mental health needs, in addition to those criminogenic needs associated with later reoffending, fits well with the highly-successful risk-need-responsivity approach to offender treatment (Andrews & Bonta, 2006), in which those most likely to reoffend (risk), have their criminogenic needs addressed in evidence-based interventions (need), while considering the offender's personal context such as depression and anxiety (responsivity). In support of this, McCormick et al. (2017) found that the young offenders in their study who received mental health treatment also more frequently had their criminogenic needs met, suggesting compliance with the principles of RNR. Importantly, in the context of the current research, in the McCormick et al. (2017) study, mental health did not moderate the effect of criminogenic needs treatment: youth who had a greater proportion of criminogenic needs targeted through appropriate services were less likely to reoffend, regardless of their mental health status.

Given the importance of establishing causes in criminology, it is surprising that, with few exceptions, studies have rarely compared within-individual changes in potential causes of offending to changes in offending. This may be because this approach requires longitudinal data collection with repeated measures over time. However, Farrington's (2013) review of longitudinal and experimental studies in criminology identified 39 longitudinal studies which could potentially be used for this purpose. Not all 39 studies would be appropriate to examine within-individual changes (e.g., because of a limited number of repeated assessments), but certainly there is potential for this work to repeated with some of these studies.

Another important finding of the present research was that the relationship between depression, anxiety and later offending was stronger for African American boys than for Caucasian boys, and this was particularly the case with depression. The increased magnitude of the effect between offending and depression in African American boys should be acknowledged in culturally aware interventions designed to address future offending in African American boys (Glynn, 2014). This result provides further evidence of the importance of exploring the potential causes of offending for different racial groups (e.g., Farrington et al., 2003; Lynam et al., 1993) so that interventions can be relevant, appropriately targeted, and sufficiently tailored in order to have the greatest effect (Glynn, 2014)

Like all research, this study has limitations which should be considered when assessing the level of confidence that should be placed in the results. The measures of depression and anxiety, while reliable and valid (see Loeber et al., 2008) may not accurately reflect clinical levels of depression and anxiety. The causal relationship between depression, anxiety and offending may be different for more profound forms of these mental conditions. Linked to this, the present study covered childhood and adolescence, arguably the time period of greatest importance for understanding the development of offending, but perhaps the relationship between depression, anxiety and offending might be different in early adulthood. Only self-reported frequency of offending was included, which has both benefits, particularly when exploring the frequency of offending, but also limitations (Jolliffe & Hedderman, 2015). Future research should examine the link between depression, anxiety and both self-reported and official offending. It might be expected that official responses to offending (e.g., arrest or conviction), might have more profound impacts on mental health outcomes like depression and anxiety (Murray et al., 2014).

It is possible that other variables (e.g., victimization) could explain the observed results. However, this was an exploratory study, and the key finding, that changes in depression and anxiety are outcomes as opposed to causes of offending, and the implication, that interventions which address depression and anxiety will be unlikely to reduce offending, would be very unlikely to change as a result of the inclusion of other variables.

Notes

[1] It is important to note that Cronbach's alpha should be regarded as a lower bound estimate of internal consistency (Sijtsma, 2009).

[2] Statistically significant results to the $p < .10$ level are shown in all subsequent analyses because predictions were directional (i.e., either depression predicting delinquency or delinquency predicting depression).

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