1-2017

It's Time: A Meta-Analysis on the Self-Control-Deviance Link

Alexander T. Vazsonyi
University of Kentucky, vazsonyi@uky.edu

Jakub Mikuška
University of Kentucky, jakub.mikuska@uky.edu

Erin L. Kelley
University of Kentucky, erin.kelley@uky.edu

It's Time: A Meta-Analysis on the Self-Control-Deviance Link

Digital Object Identifier (DOI)
https://doi.org/10.1016/j.jcrimjus.2016.10.001

Notes/Citation Information
Published in *Journal of Criminal Justice,* v. 48.

Journal of Criminal Justice 48 (2017) 48–63

Contents lists available at ScienceDirect

Journal of Criminal Justice

It's time: A meta-analysis on the self-control-deviance link

Alexander T. Vazsonyi *, Jakub Mikuška, Erin L. Kelley

University of Kentucky, Department of Family Sciences, 316 Funkhouser Building, Lexington, KY 40506, United States

ARTICLE INFO

Article history:
Received 14 October 2016
Accepted 18 October 2016
Available online 9 January 2017

Keywords:
Crime
Delinquency
Self-control theory
General theory of crime
Self-regulation

ABSTRACT

Purpose: The current meta-analysis examines the link between self-control and measures of crime and deviance, taking stock of the empirical status of self-control theory and focusing on work published between 2000 and 2010.

Methods: A total of 796 studies were reviewed for inclusion/exclusion criteria and yielded a final study sample of 99 studies (88 cross-sectional and 19 longitudinal effect sizes, analyzed separately). Random effects mean correlations between self-control and deviance were analyzed for cross-sectional and longitudinal studies, respectively. Publication bias was assessed using multiple methods.

Results: A random effects mean correlation between self-control and deviance was $M_r = 0.415$ for cross-sectional studies and $M_r = 0.345$ for longitudinal ones; this effect did not significantly differ by study design. Studies with more male participants, studies based on older or US-based populations, and self-report studies found weaker effects.

Conclusions: Substantial empirical support was found for the main argument of self-control theory and on the transdisciplinary link between self-control and measures of crime and deviance. In contrast to Pratt and Cullen, but consistent with theory, the effect from cross-sectional versus longitudinal studies did not significantly differ. There was no evidence of publication bias.

1. Introduction

Cited over 500 times in the past 15 years (Web of Science), Pratt and Cullen's (2000) meta-analysis tested empirical work based on Gottfredson and Hirschi's (1990) theory; it included 21 studies or 17 independent data sets, based on 49,727 individuals, published between 1993 and 1999. Findings provided substantial support for the low self-control-crime/deviance link; effect size exceeded 0.20, a finding which indicated that "this effect size would rank self-control as one of the strongest known correlates of crime" (Pratt & Cullen, 2000, p. 952). Other findings from the work showed how different operationalizations of self-control did not affect the strength of this relationship, nor did the relationship vary by sample composition (age, sex, or race). Many findings supported Gottfredson and Hirschi's theoretical predictions, some did not. For instance, the study found that the effect of low self-control was weaker in longitudinal studies and that social learning constructs continued to play a role, above and beyond measures of low self-control, in explaining the variability in crime and deviance. Few criminological theories have been tested through a meta-analysis prior to Pratt and Cullen's work; instead, efforts relied on narrative literature reviews to assess the empirical support for theories of crime. Thus, Pratt and Cullen argued that meta-analyses were an underused tool.

There is no question on how both the theoretical work and the meta-analysis has impacted criminology, and a number of allied disciplines; however, over 15 years have passed, and thus, the time seems right for further systematic review of the empirical evidence. The current study seeks to build on and expand this work, broadening the scope by examining a larger universe of samples and studies during the subsequent decade, from 2000 to 2010. The current study included a total of 99 empirical studies, with 88 cross-sectional and 19 longitudinal effects, covering 514,291 individuals from 95 independent data sets.

1.1. Literature review

1.1.1. The impact of self-control theory

Since its publication, Gottfredson and Hirschi's *A General Theory of Crime* has had a profound impact in criminology, inspiring a wealth of empirical studies that test the link between low self-control and measures of crime or deviance (Engel, 2012; DeLisi & Piquero, 2011; Pratt & Cullen, 2000). Arguably one of the most prominent theories in criminology, Tittle (2011, p. 91–92) argued that "Self-control theory (1990) would have to be regarded as one of the most popular of current theories, judging by the degree of research interest and the extent to which its theoretical premises have been integrated into other contemporary explanatory schemes." In addition, DeLisi (2013) and others

* Corresponding author.
E-mail addresses: vazsonyi@uky.edu (A.T. Vazsonyi), jakub.mikuska@uky.edu (J. Mikuška), erin.kelley@uky.edu (E.L. Kelley).

http://dx.doi.org/10.1016/j.jcrimjus.2016.10.001

have argued that theoretical premises and the self-control-deviance link appears to be "transdisciplinary" in nature; elements from and predictions based on self-control theory have influenced and appeared in work from a number of social and behavioral sciences, including psychology, developmental sciences, educational sciences, and health-risk behavior research, among others (Duckworth & Seligman, 2005; Eisenberg et al., 2005; Miller, Barnes, & Beaver, 2011; Tangney, Baumeister, & Boone, 2004).

Empirical support for the theory exists not only for data collected in the United States, but also outside of North America, in fact one of the original theoretical predictions made by Gottfredson and Hirschi, which positioned the theory to be not bound to a particular culture or developmental context, thus in effect culture free (e.g., Rebellon, Straus, & Medeiros, 2008; Smith & Crichlow, 2012; Vazsonyi & Belliston, 2007; Vazsonyi, Pickering, Junger, & Hessing, 2001). While some studies have demonstrated no relationship between self-control and deviance in cross-cultural samples (e.g., Cheung & Cheung, 2008; Hwang & Akers, 2003; Meneses & Akers, 2010), a number of other studies have.

1.1.2. Critiques of self-control theory

Since the publication of the theory, there have been a number of critiques of the work. For instance, Akers (1991) argued that the theory was tautological. Other critics have indicated that theory failed to operationalize self-control, and importantly, how it is different from criminal or deviant behaviors (Akers & Sellers, 2004). In part addressing this criticism, Grasmick, Tittle, Bursik, and Arneklev (1993) developed the most widely used attitudinal scale to measure low self-control; at the same time, Gottfredson and Hirschi (1990) have argued that behavioral measures of self-control were the preferred method for assessing self-control.

Over the past two decades, hundreds of empirical studies have been conducted to test self-control theory, using both attitudinal and behavioral measures. Again, Pratt and Cullen (2000) found that the effect size of the link between self-control and crime was largely unchanged based on how self-control was operationalized, either with attitudinal or behavioral measures. Hirschi (2004) also recast the measurement of self-control, slightly departing from several original theoretical propositions by linking self-control to social control, to indicators of social bonds. Despite some apparent differences, Hirschi maintained that behavioral measures of self-control were the most salient measures in operationalizing self-control. Controversy continues to surround the discussion on how to operationalize self-control, where some research finds contradictory evidence regarding different attitudinal and behavioral measures (Gunter & Bakken, 2012; Morris, Gerber, & Menard, 2011; Piquero & Bouffard, 2007; Rocque, Posick, & Zimmerman, 2013; Vazsonyi, Roberts, & Huang, 2015).

1.1.3. The development of self-control: Biology and socialization

An additional area of controversy about self-control theory involves how self-control develops (Wright & Beaver, 2005). Despite overwhelming evidence supporting self-control theory, much research has focused on the stability of self-control over time to test tenets of the theory, in part overlooking the question of actual processes behind the development. Gottfredson and Hirschi identify parental socialization practices within the first ten years of a child's life as one of the main developmental precursors of self-control (Vazsonyi & Huang, 2010). This focus has lead critics to argue that Gottfredson and Hirschi minimize, or even ignore, the effects of biology or genes on the development of self-control and the understanding of crime and deviance (Wright & Beaver, 2005). Vazsonyi et al. (2015) have recently argued that their original work in fact both recognized and acknowledged individual differences, presumably present at birth, but that their work focused on socialization processes in the development of self-control, in part related to its policy implications. Seminal work by Piquero, Jennings, Diamond, Farrington, and Reingle Gonzalez (2016) has substantiated that, in fact, this focus has paid off, that self-control is malleable and can be addressed in prevention and intervention work, both during childhood and adolescence. In turn, this has profound implications for criminal justice policy.

In addition to secondary socialization contexts of self-control, such as schools (Hay, 2001; Turner, Piquero, & Pratt, 2005), biology has an important role in self-control and in its development (Beaver, Connolly, Schwartz, Al-Ghamdi, & Kobeisy, 2013; Beaver, Wright, & DeLisi, 2007; Wright & Beaver, 2005). Wright and Beaver (2005) found that between 55% - 66% of the variability in self-control was attributable to heredity. Similarly, Beaver et al. (2013) found that between 78% and 89% of the observed stability in self-control over time and between 74% and 92% of the changes in self-control were related to genetic factors. Thus, biology and socialization play a complex and dynamic role in self-control and its developmental course.

1.1.4. The stability postulate

As mentioned, much work has focused on the stability of self-control theory over time because Gottfredson and Hirschi (1990) argue that once established by ages 8 to 10, self-control remains relatively stable over the life-course, not in absolute terms, but as rank ordering. Some studies have found support for this (Arneklev, Cochran, & Gainey, 1998; Mitchell & MacKenzie, 2006; Turner & Piquero, 2002; Vazsonyi & Huang, 2010). Vazsonyi and Huang (2010) showed, based on a sample of over 1000 children followed over a 6-year period from preschool to fifth grade, that self-control was stable (rank order stability); self-control also positively increased over the same time period, in part explained by socialization influences in the home. Other studies have found evidence to the contrary (Burt, Simons, & Simons, 2006; Burt, Sweeten, & Simons, 2014; Hay & Forrest, 2006; Ray, Jones, Thomas, & Jennings, 2013). For example, Burt et al. (2014) tested the stability of self-control over five assessments in the *Family and Community Health Study*, from ages 10 to 25. Their findings provided evidence of instability over time. Finally, other recent research on personality development has provided evidence that part of the "Big Five" overlap with self-control (Aslan & Cheung-Blunden, 2012; Fein & Klein, 2011; McCrae, 2010; Miller & Lynam, 2001; van Gelder & de Vries, 2013), and that personality traits change over the lifecourse (Caspi & Roberts, 2001; Helson, Jones, & Kwan, 2002; McCrae et al., 1999; Morizot & LeBlanc, 2005).

1.1.5. The current study

The influence by Pratt and Cullen's meta-analysis cannot be overstated. Nevertheless, the time seems ripe to conduct another, more comprehensive meta-analysis, one that also takes a broader transdisciplinary approach. A meta-analysis is, in essence, a "snapshot in time" and the current study seeks to explore the relationship between self-control and criminal and deviant behaviors in empirical research published during the decade immediately following Pratt and Cullen's work. Since Pratt and Cullen's meta-analysis, there has been a dramatic increase in the amount of scholarship and empirical tests focused on self-control theory, and more generally, on the link between self-control and measures of crime, deviance, and norm violations.

One more recent meta-analysis has partially addressed this gap in the literature. A study by de Ridder, Lensvelt-Mulders, Finkenauer, Stok, and Baumeister (2012) analyzed the results of 102 studies focusing on the relationships between self-control and a variety of behavioral outcomes, including school and work achievement, interpersonal functioning, well-being, addictive behaviors, and deviance. Based on aggregated samples ranging from 666 to 12,870 participants, and including 6 to 22 studies, they found that self-control (measured either by the Barratt Impulsiveness Scale, or the Grasmick et al. (1993), low self-control scale) was consistently associated with deviance (r range: 0.15–0.25) and addictive behavior ($r = 0.25$). This work which took a broader view, leaves room for a more narrow and more in depth meta-analysis focused on the link between self-control and deviance. Their sample of studies omits important work conducted which was not explicitly focused on self-control theory, and thus does not accurately reflect the

total amount of scholarship conducted in social and behavioral sciences. Thus, the current meta-analysis slightly refines the broader focus of de Ridder et al. (2012) work, including a larger number of studies, and it also addresses a number of limitations of Pratt and Cullen's (2000) work.

The current study examines a substantially larger collection of peer reviewed articles, and it includes a broader sampling of longitudinal studies. Gottfredson and Hirschi argue that the effects of self-control should not vary across research designs, stating that cross-sectional studies are adequate. Pratt and Cullen's findings did not support this, finding slightly smaller effect sizes in longitudinal studies than in cross-sectional studies. The study also analyzes a broader range of samples. While Pratt and Cullen compared studies including "younger versus older" participants, "racially homogeneous versus heterogeneous" or "male versus female" samples, the current meta-analysis provides additional depth, including a continuous age measure, proportion of "non-white" sample participants, and proportion of males in samples. The study also includes a larger number of adolescent and cross-cultural samples, which is simply related to the fact that few studies had been published in the first decade following the publication of the theory.

The current study also avails itself of more advanced quantitative techniques. To test for potential moderation effects, Pratt and Cullen used *t*-test to compare effect sizes from different groups. In the current study, we employed regression analyses to control for the effects of other potential moderators and to estimate unique effects. The current study also adjusted estimates for unreliability of measurement and provides a more detailed comparison whether the effects by self-control vary by measure of deviance (general deviance versus theft, assault, substance abuse, etc.). Finally, the current study also adds multiple methods of assessing for publication bias, namely funnel plot inspection, Begg and Mazumdar's Rank Correlation Test (1994), and Egger's test of the intercept (Egger, Smith, Schneider, and Minder, 1997), among others.

2. Methods

2.1. Study selection

2.1.1. Initial search

Multiple approaches were used to assemble a complete list of all potentially relevant studies. Initially, two trained graduate assistants searched for articles published in peer reviewed journals after 1990 using the EBSCO search engine (specifically within the PsycInfo database). The search was guided by a complex set of keywords[1] designed to yield high recall (find the relevant articles) and simultaneously high precision (filter out the irrelevant ones). This resulted in 54,281 hits (peer reviewed papers). These publications were pre-screened for eligibility by reading over their title and abstract. Articles which identified self-control or any related construct, along with deviance or any related construct as variables used in their analyses were retained. This phase of search was terminated once no additional articles were found. One final confirmation search was completed in both EBSCO and Scholar Google by a different graduate assistant to finalize list of articles and to uncover any potentially missed articles.

Forward/Backward Search and Screening.

Next, one of the two assistants was assigned to search for publications that cited seminal work relevant to the current project through Web of Science. The seminal work that was selected as sources for relevant articles were Gottfredson and Hirschi's General Theory of Crime (1990) and five of the most commonly used measures of self-control or impulsivity (Eysenck, Easting, & Pearson, 1984; Grasmick et al., 1993; Patton, Stanford, & Barratt, 1995; Piquero & Bouffard, 2007; Tangney et al., 2004). Search results were filtered by the use of the same keywords from the previous phase. The initial yield of articles found through this process (1438) was refined to 384 potentially relevant and non-redundant publications. During this phase, one assistant screened all articles identified as potentially relevant in this and the previous phase. The final number of studies that were left for further consideration and a more thorough evaluation was 796.

2.1.2. Unpublished study search

Three additional assistants searched for potentially relevant unpublished studies. We focused predominantly on conference presentations and dissertation theses. The American Society of Criminology, European Society of Criminology, and Society for Research in Child Development were identified as most relevant conferences for our project, with the highest likelihood of hosting the most of relevant study presentations. In total we examined 43 conference programs and identified 62 potentially relevant studies; in addition, 141 potentially relevant dissertations were found through the Proquest.

2.1.3. Inclusion and exclusion criteria

The set of criteria which defined the final sample of studies used in this paper was initially developed broadly and throughout the process of searching became more refined as well as informed by the results of the search. We were interested in all articles that focused on the link between self-control, impulsivity, self-regulation, self-discipline, or similar relevant constructs; with deviance, delinquency, crime, offending, misconduct, and similar relevant behaviors.

First, following Pratt and Cullen's (2000) idea, a decade's worth of research was selected as the study sample. Having already ample evidence from the first decade following the publication of the (General Theory) of Crime (Gottfredson & Hirschi, 1990), peer reviewed articles published within the second decade (2000 − 2010) were selected which yielded 427 potentially relevant papers. Fig. 1 illustrates the continued growth since 2000 in the number of potentially relevant publications that appear each year which contributed to the decision to limit it to the second decade.

Focusing solely on published literature of course introduced the risk of the file drawer bias (Rosenthal, 1979) under which our estimation of the general effect size may become inflated due to underrepresentation of smaller and statistically non-significant effects in the published literature. We mitigated this risk in two ways, namely by presenting the same argument that Pratt and Cullen (2000) made – that due to the somewhat controversial nature of the emergence of General Theory of Crime (Gottfredson & Hirschi, 1990), null findings can hold interest for reviewers and journals in the sense of falsifying the theory and should be equally likely to be published as statistically significant findings. Second, we evaluated the presence and magnitude of publication using multiple mechanisms discussed subsequently, principally focused on an evaluation of potential publication bias.

Due to our interest in estimating the relationship between these two constructs, only studies which reported some measure of association between the constructs were included (Pearson's r, Spearman's ρ, regression coefficients, etc.); thus, studies reporting only group differences (e.g. between criminal and non-criminal sub groups) were not included, despite the possibility to convert mean difference effect sizes to an r type metric. This led to exclusion of 31 studies. Secondly, to prevent biasing the results by including multiple studies which analyze the same data and focus on the same outcome variables, a decision was made to only include the study that was published earlier and to exclude later studies. However, if multiple studies used the same data, but analyzed different outcome variables, they were each included in the final sample but for the purposes of overall analysis aggregated into one effect size (described in more detail under the section about coding). A total of 68 studies were excluded from the final sample due to this criterion. Next, 5 additional papers were excluded as they were published in non-English languages. Finally, papers which focused on personality disorders or their symptoms (such as antisocial, borderline, or other related personality disorders) were not included. Personality disorders are often expressed, defined, and diagnosed via delinquent or deviant behavior, and thus, as Gottfredson and Hirschi (1990) note, are inherently

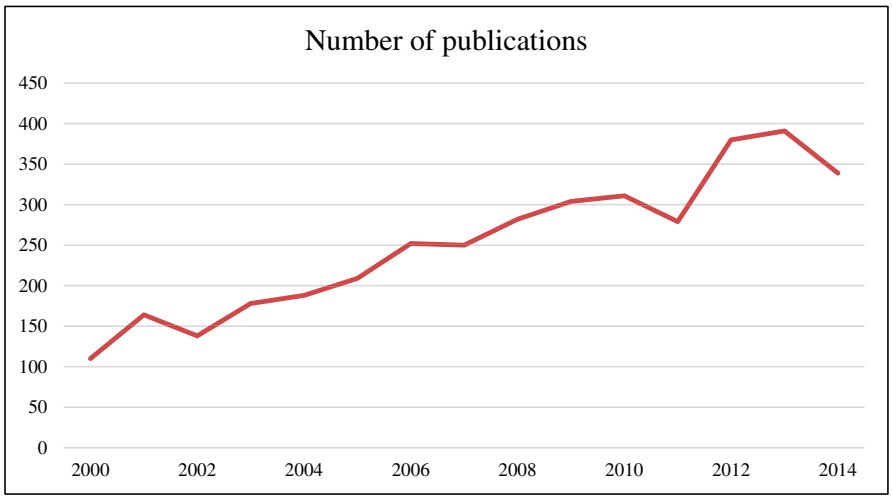

Fig. 1. Number of potentially relevant studies published annually.

deterministic as opposed to the concept of self-control which may express itself in delinquency or deviance, but is not defined by it.

Based on this initial screening of 427 articles, 102 mentioned self-control and deviance in their abstract, but lacked a focus on their relationship, and thus were excluded. Furthermore, 37 papers that were not empirical in nature, but rather only theoretical, literature reviews, or commentaries, were also dropped. Finally, 31 papers were excluded for a number of reasons, including a focus on disorders, ambiguous measurement or interpretation of either construct, a focus on the developmental change of constructs instead of their direct relationship. A number of studies (83) met inclusion criteria did not report the measures of association. A total of 70 authors of these studies were contacted multiple times with a request for additional study details. Less than half (29) replied and provided additional information about the study. Therefore, studies with no effect sizes were not included in the main analysis. The final number of studies included was 99, with a total of 319 unique effect sizes; 87[2] of the studies reported cross-sectional effects, with a combined sample of 178,464 participants, while 19 studies with a combined sample of 35,827 participants reported longitudinal effects. The entire selection and associated decision processes can be found in Fig. 2.

2.1.4. Data coding

Three graduate students were involved in coding study characteristics into a spreadsheet, extracting information about the study sample, study design, construct measurement, and results, and converting it all into analyzable form. A detailed coding manual, including instructions on how to code every specific variable in the database was developed, and each variable in the spreadsheet included a summarized instruction to ensure inter-coder reliability and consistency of the coding process. The coded study characteristics that were included in the final analyses can be found in Table 1. Other variables were coded as well, but ultimately not used either due to their nature (record keeping variables such as authors' information, date of publication, title), or due to the sparseness of the studies reporting them (socio-economic status of the respondents, specific proportion of minorities). Table 2 presents descriptive statistics of the sample.

To assess inter-coder reliability, we randomly selected 30 studies, 10 for each coder, that overlapped with other coders and computed Pearson's correlation coefficients on a number of most important continuous variables (namely sample size, mean age, proportion of male participants, proportion of white participants, Cronbach's alphas for measures of self-control and deviance, and the effect size of result) for each pair of coders. The correlations ranged from 0.81 to 1 with a median of 0.96.

The majority of studies (55) in the final sample reported more than one relevant effect size. In most cases, the multiplicity was caused by nuanced focus of the studies looking at more than one facet of deviance. In other cases (Alexander, Allen, Brooks, Cole, & Campbell, 2004; Botchkovar, Tittle, & Antonaccio, 2009; Kazemian, Farrington, & Le Blanc, 2009; Kobayashi, Vazsonyi, Chen, & Sharp, 2010; Marcus, Schuler, Quell, & Humpfner, 2002; Romero, Gomez-Fraguela, Ángeles Luengo, & Sobral, 2003; Vazsonyi & Belliston, 2007; Vazsonyi, Trejos-Castillo, & Huang, 2006; Wiebe, 2006; Wulfert, Block, Santa Ana, Rodrigues, & Colsman, 2002), it was caused due to reporting effect sizes separately for sub-groups in the sample. While all individual effect sizes were of interest, including a single study multiple times in an analysis would bias study findings due to the effects associated with particular methodologies and weight the outcomes toward studies with multiple entries. Therefore, two main approaches were selected to handle this issue. In cases of studies with multiple facets of deviance, when possible, a decision was made to focus on the most general one (i.e. in a study that reports correlations of self-control with theft, substance use, violence, and an aggregate measure including all of the above, we analyzed the latter one). In 47 instances when this was not possible (i.e. studies did not report the correlation of an aggregate measure), an average correlation was computed by applying a Fisher transformation to the correlation coefficients, computing a mean coefficient (weighted mean in cases with effect sizes based on different groups), and transforming it back. One exception to this approach was the study of Romero et al. (2003) which used two studies with different samples and two distinct methodologies, published in a same paper. These were treated as separate effect sizes in the main analyses.

As indicated previously, studies using overlapping data and focusing on the same outcomes as the other earlier published studies, were excluded. However, in two cases the sample overlap was not very clear, which did not permit a simple decision. First, in order to make the most of the available information available, two studies which focused on general delinquency, using two different time points from the Add Health project (Perrone, Sullivan, Pratt, & Margaryan, 2004, using data from the first wave, and Barnes & Beaver, 2010, using data from the second wave) were merged into a single case or entry for the main analyses, using the same approach as described above (weighted mean of Fisher transformed correlations). Second, studies by Vazsonyi and Belliston (2007) and Vazsonyi et al. (2006) used overlapping data from multiple countries. Despite being published later, because Vazsonyi and Belliston (2007) reported relationships of low self-control and general deviance, a decision was made to include these in the main analysis. However, the 2006 paper also reported results based on a country that was not included in the 2007 paper and this additional

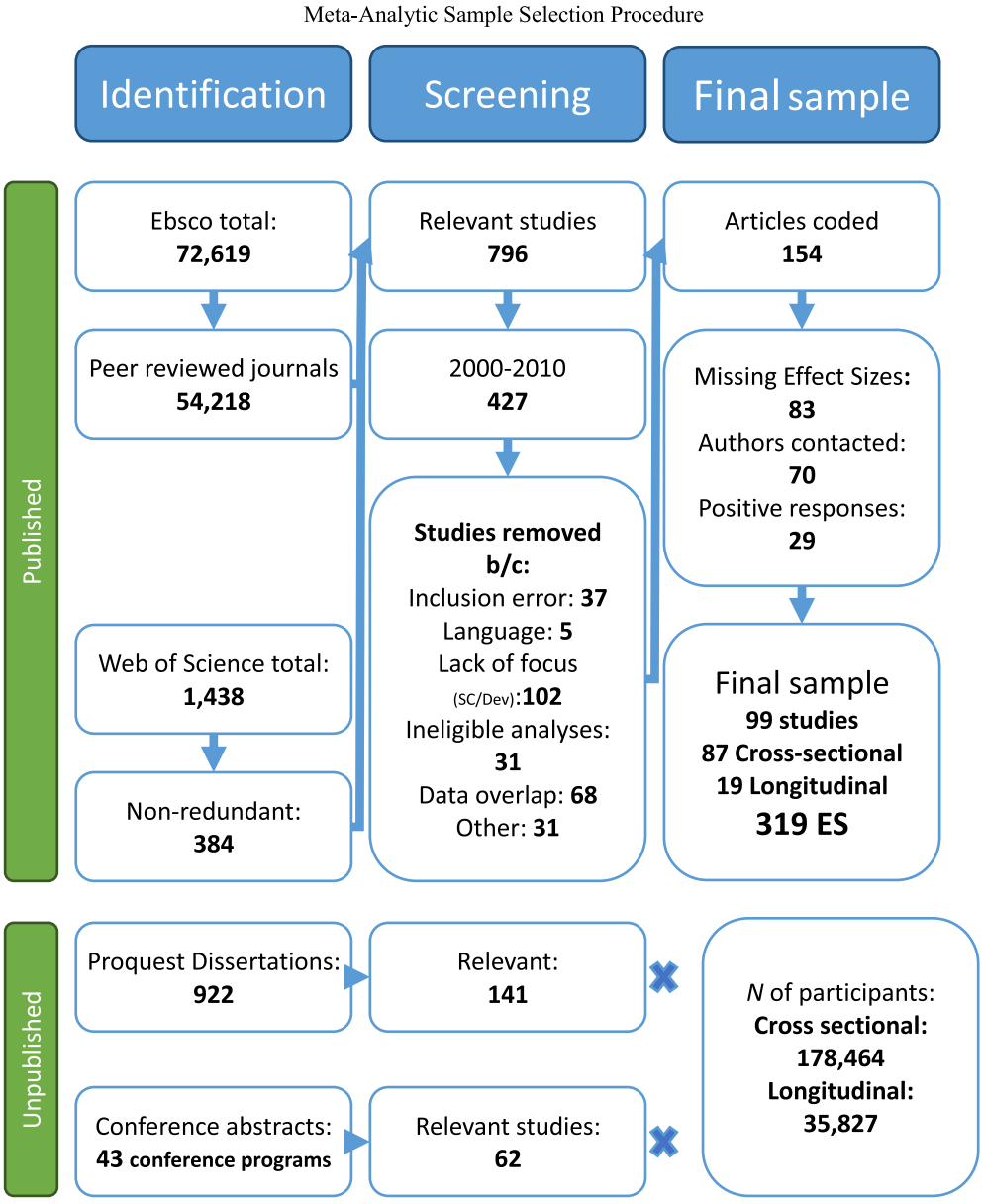

Fig. 2. Meta-analytic sample selection procedure.

information was included in the main analysis, while the overlapping information was omitted.

Other studies based on the same data but focusing on different outcomes were considered in our project. In these cases, only the studies analyzing the most general concept of deviance or delinquency were included in the main analysis and other studies were included only in analyses of specific types of deviance (such as violence, theft, or substance use). In seven cases (de Kemp et al., 2009; Higgins, 2007; Kazemian et al., 2009; Langton, 2006; Lynam et al., 2000; Meldrum, Jacob, Young, & Weerman, 2009; Schreck, Stewart, & Fisher, 2006), a study reported effect sizes based on both cross-sectional and longitudinal (time delayed) assessments of variables. Focusing on these effects separately allowed us to include relevant results of these analyses in appropriate analyses.

A study by Meier, Slutske, Arndt, and Cadoret (2008) was based on a sample of 85,301 adolescents and therefore was an outlier in terms of sample size. While there is no reason to remove the study from our analyses, it is likely that it had a strong effect on the results due to the sample-based weighting. Thus, a decision was made to repeat the main study analyses omitting this study from the sample. These findings are reported in Appendix A.

Finally, to aid interpretation of study results, the direction of all effect sizes was equalized (multiplied by −1 as needed) to reflect a relationship of *low* self-control and deviance. This means that higher positive values are interpreted as a stronger relationship or as an increase in the strength of the relationship (in the case of moderator analyses) between low self-control and deviance.

3. Results

Prior to all analyses, the study reports correlation coefficients and their associated standard errors; these were corrected for scale unreliability using the following formulas (a procedure described by Baugh, 2002 and Hunter & Schmidt, 2004, and suggested by Card, 2011):

$$r_{corrected} = \frac{r_{observed}}{\sqrt{\alpha_{SC}\,\alpha_{Dev}}} \qquad SE_{corrected} = \frac{SE_{observed}}{\sqrt{\alpha_{SC}\,\alpha_{Dev.}}}$$

Table 1
Coded study characteristics used in analysis.

Characteristic	Coded as	Used to
Sample size (n)	[C] Number of participants included in the analysis	Weight each study findings
Sex (male)	[C] Proportion of male respondents	Test and control for moderating effects of sex, age, ethnicity, and culture on the relationship of self-control and deviance
Age	[C] Mean age of the sample	
Race (non-white)	[C] Proportion of non-white respondents	
Country (non-US)	[D] Country of origin of the data. Due to a small number of alternative categories coded as United States (0) vs other (1)	
Target population (non-deviant)	[D] Study population of focus. General population (0) vs offenders (1; offenders, substance abusers, homeless, etc.)	Due to sparsity of studies based on non-self-report data, and collinearity issues associated with the target population variable, these characteristics were excluded from moderator analyses
Mode of assessment (non-self-report)	[D] The perspective from which participants' self-control and deviance were assessed. Due to a small number of alternative categories coded as self-report (0) vs other (1)	
Measurement reliability	[C] Cronbach's α of self-control and deviance scales (if applicable)	Correcting the effect sizes for unreliability (see. Card, 2011, chapter 6)
Time delay in assessment	[C] Number of years separating the self-control assessment from deviance assessment (if applicable)	Test and control for attenuation of the association between self-control and deviance due to delay in assessment
Type of outcome variable	[D] Specific type of deviance such as: general deviance, physical violence, verbal/interpersonal violence, substance use, academic/organizational dishonesty, crime, theft, online deviance (predominantly media piracy)	Test universality of the relationship of self-control across specific deviant behaviors
Study design	[D] Cross-sectional or longitudinal	Analyze cross-sectional and longitudinal studies separately
Effect size	[C] Correlation of self-control and deviance	Main outcome variable of the study

Note: CS = Cross-sectional, LT = Longitudinal studies, [C] = continuous, [D] = dichotomous variables.

In the current study, $r_{observed}$ is the reported correlation coefficient, $SE_{observed}$ is its associated standard error, and α_{SC}/α_{Dev} are Cronbach's alpha coefficients of the self-control. In cases that a study did not report these values, sample averages were substituted ($\alpha = 0.654$ for self-control, and $\alpha = 0.761$ for deviance measures). Afterwards all correlation coefficients were Fisher transformed in order to reduce bias when using them in statistical analyses. Results of the analyses were then back-transformed into the more readily interpretable metric of Pearson's r.

As an initial step, weighted mean correlations between low self-control and deviance were computed and the variance around these means were assessed. The fixed effect weighted mean based on cross-sectional studies was $M_r = 0.530$, $p < 0.001$, 95% CI = [0.525, 0.535]. For longitudinal studies, the effect size was expectedly smaller (due to the attenuation caused by the delay in assessments), $M_r = 0.292$, $p < 0.001$, 95% CI = [0.279, 0.306]. There was, however, considerable variability among the studies, as seen in Figs. 3, 4, and 5, and supported by a statistical test of heterogeneity, $Q(87) = 2839.949$, $p < 0.001$, Tau = 0.194, $I^2 = 96.937$ for cross-sectional studies, and $Q(18) = 631.384$, $p < 0.001$, Tau = 0.204, $I^2 = 97.149$ for longitudinal studies. This suggests two important things. First, the differences among the study results are not likely only due to sampling errors, but reflect variability in the magnitude of the relationship between low self-control and deviance across studies and within the population, or possibly different populations. Secondly, due to this variability, a simple point estimate of the mean correlation is not sufficient in describing the relationship and its variations.

The random effects model acknowledges that a population has a mean that can be represented as a point estimate, but also has a distribution of values around its mean. This underlies the difference of results in studies that draw samples from varying areas of the distribution. Estimating a random effects model allows us not only to model this variability, but also fill in potential gaps that individual studies do not cover in their sampling. For instance, using only a fixed effects model on a sample of studies that collectively include only participants of ages 8, 10, and 12, allows us to make conclusions only about 8, 10, and 12 year olds. Using the random effects model permits interpolation and estimates about a population of ranging in age from 8 to 12 years (Card, 2011). The random effects mean for cross sectional studies was $M_r = 0.415$, $p < 0.001$, 95% CI = [0.378, 0.451] and $M_r = 0.345$, $p < 0.001$, 95% CI = [0.258, 0.426] for longitudinal studies. Individual study effects, along with their confidence intervals, in relation to their appropriate random effects average, can be seen in Figs. 3–5.

One of the goals of the study was to address the differences between cross-sectional and longitudinal studies. Under the fixed-effects framework, the difference is evident by comparing the confidence intervals as well as confirmed by a significant t-test result, $t(105) = -6.232$, $p < 0.001$. Under the random-effects framework, which is more appropriate for our data, the difference however, was not statistically significant, $t(105) = -1.124$, $p = 0.263$.

3.1.1. Moderator analyses

The statistical significance of the variance around the mean indicates that results of the studies varied considerably and a simple point estimate was not enough to characterize the sample. Potential factors explaining these differences among the results, include different methodologies, focus on different populations, or other varying study characteristics. To test whether these variables have an effect on the results of primary studies, the study characteristics can be treated as predictors of the study's effect size in a linear regression – essentially testing whether study characteristics moderate the relationship of self-control and deviance.

Due to the relatively low number of studies included in this analysis and the resulting low power to detect effects within a mixed effect framework, the potential moderating effects were investigated as fixed effects through a weighted multiple linear regression. The mode of report of deviance variables, as well as focus on non-normal populations, were omitted from the final analyses due to issues with multicollinearity.[3] In almost 50% of studies, information about race/ethnicity composition of participants was missing, therefore this variable was not included in the main analysis, however it was tested (along with other predictors) in a subset of studies which did report it. The remainder of missing data was treated with multiple imputation (100 imputed data sets). The correlation matrix of the analyzed variables (weighted) can be seen in Table 3, and results of the moderator analyses in Tables 4 and 5.

The results of cross-sectional moderator analyses show that after controlling for effects of other variables included in the model, studies with a larger proportions of males had weaker correlations between low self-control and deviance; studies based on younger populations tended to find stronger associations; studies based on samples from outside the US tended to find slightly weaker

Table 2
Descriptive statistics of the sample.

Characteristic	Cross sectional studies				Longitudinal studies			
	Mean			Missing	Mean			Missing
	UNW	FE	RE		UNW	FE	RE	
Sample size (n)	2027.99 (9219.55)	43,526.52 (40,165.51)	2481.77 (10,257.11)	0%	1885.63 (3363.43)	7578.34 (6608.45)	2019.88 (3395.68)	0%
$Sex_{(male)}$	0.55 (0.21)	0.51 (0.10)	0.53 (0.20)	10%	0.68 (0.25)	0.67 (0.25)	0.68 (0.24)	11%
Age	21.80 (8.56)	15.40 (4.53)	20.96 (8.26)	27%	15.12 (5.64)	14.43 (3.93)	15.00 (5.49)	16%
$Race_{(non\text{-}white)}$	0.35 (0.24)	0.21 (0.18)	0.36 (0.24)	51%	0.56 (0.26)	0.44 (0.25)	0.55 (0.24)	37%
Target $population_{(deviant)}$	18%	4%	16%	0%	21%	15%	21%	0%
$Country_{(non\text{-}US)}$	40%	25%	40%	0%	26%	12%	26%	0%
Mode of assessment								
$Self\text{-}control_{(non\text{-}self\text{-}report)}$	5%	8%	5%	0%	21%	9%	20%	0%
$Deviance_{(non\text{-}self\text{-}report)}$	10%	8%	9%	0%	11%	11%	11%	0%
Measurement reliability								
$Self\text{-}control_{(Cronbach's\ alpha)}$	0.77 (0.11)	0.65 (0.13)	0.76 (0.11)	24%	0.74 (0.13)	0.70 (0.10)	0.74 (0.13)	21%
$Deviance_{(Cronbach's\ alpha)}$	0.76 (0.17)	0.71 (0.21)	0.75 (0.18)	52%	0.73 (0.14)	0.71 (0.14)	0.73 (0.14)	37%
Time delay in assessment	0	0	0	0%	6.21 (8.00)	4.48 (6.35)	6.12 (7.74)	11%
Effect size	0.42	0.53	0.42	0%	0.35	0.29	0.35	0%

Note. UNW = Unweighted, FE = Fixed effect weights, RE = Random effect weights. Standard deviations in parentheses.

associations; and finally, studies using self-report measures of self-control had weaker associations than studies based on other modes of reporting. Overall, the model was statistically significant $F(4,83) = 8.18$, $p < 0.001$, and explained almost 25% of variance among the study findings. Due to missing data, this analysis was conducted based on 100 data sets from multiple imputations. The estimates were then pooled or averaged using a combination of pooling algorithms of SPSS and ones suggested by van Ginkel and Kroonenberg (2014). The omitted variables were tested in separate variants of the analysis.[4] Subsequently all models were reanalyzed on a sample which excluded Meier et al. (2008) study, to investigate the effects of this large sample size. These results can be seen Appendix A (Table 7).

The longitudinal moderator analysis was not statistically significant $F(5,13) = 2.23$, $p = 0.074$, $R^2 = 0.18$, likely due to low power (sample size of studies = 19). None of the predictors reached significance, as seen in Table 4. As with the previous analysis, to be conservative, predictors were also tested separately to address issues of collinearity: still, none reached significance.

Finally, to compare the effects of low self-control on specific measures of deviant behaviors, a fixed and random effect means model was tested for each separate measure. As seen in Table 6, the strongest association was found between low self-control and general deviance, or physical violence, with the weakest ones including substance use or academic and organizational dishonesty. The non-independency of effects included in these estimates makes it difficult to test these differences statistically, but comparing the confidence intervals allows for a rudimentary comparison.

3.1.2. Publication bias

The decision to only focus on published studies is likely to introduce a degree of bias in the estimation of the results. To address this threat, a number of tools available were used. Presented below are funnel plots, results of Begg and Mazumdar's rank correlation test (1994), and the test by Egger et al. (1997) of the intercept (1997), Duval and Tweedie's trim and fill (2000), and Rosenthal's (1979) and Orwin's (1983) fail-safe *N*s.

Table 3
Correlations among study variables.

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Zrc		−0.012	-0.321^{**}	-0.496^{***}	-0.346^{***}	-0.213^{*}	0.174^{*}	0.094
(2) Male	−0.085		−0.061	−0.141	0.487^{***}	0.214^{*}	0.566^{***}	0.575^{***}
(3) Age	−0.295	0.390		−0.188	0.203^{*}	0.408^{***}	0.294^{*}	0.335^{*}
(4) Non-white	−0.246	0.256	0.142		0.158	0.174	−0.251	−0.194
(5) Deviant	−0.153	0.572	a	0.149		−0.046	−0.021	0.122
(6) NonUS	0.069	−0.133	−0.137	−0.162	−0.140		0.432^{***}	0.421^{***}
(7) SCr	0.224	0.113	−0.238	0.228	−0.141	−0.117		0.924^{***}
(8) DEVr	−0.213	0.335	0.236	−0.109	0.631^{**}	0.046	−0.108	
(9) Delay	−0.376	0.278	0.151	0.167	0.555^{*}	0.233	−0.145	0.612^{**}

Note: Values above the diagonal are for Cross-Sectional studies and below the diagonal for Longitudinal studies; Zrc = Fisher transformed correlation of (Low) Self-Control and Deviance corrected for unreliability attenuation; Male = Proportion of males in study sample; Age = Mean age of study sample; Non-white = Proportion of Non-white participants in study sample; Deviant = study focus on non-deviant (0) or deviant populations (1); Non-US = Study sample originally from US (0) or elsewhere (1); SCr and DEVr = Mode of report of the Self-Control and Deviance variables: Self-report (0) or other (1); Delay = time delay between assessments of Self-Control and Deviance (in years); All correlations based on weighted and pairwise deleted data; a = no valid race composition data present for studies from outside of US; $^{*} = p < 0.05$, $^{**} = p < 0.01$, $^{***} = p < 0.001$.

Table 4
Moderator analyses: Cross-sectional studies.

Moderator	*b*	*SE*	β	*p*	95% CI for b	
Intercept	0.816	0.094		<0.001	0.632	1.000
Sex (male)	−0.483	0.187	−0.487	0.010	−0.850	−0.115
Age (18)	−0.015	0.004	−0.596	<0.001	−0.022	−0.007
Non-US	−0.085	0.042	−0.204	0.046	−0.168	−0.002
SC report	0.350	0.088	0.358	<0.001	0.178	0.522

Note. $R^2 = 0.25$, $F(4,83) = 8.18$, Sex = Continuous: proportion of males in the sample; Age centered at 18 years, Non-Us: Dichotomous variable, (0) = Study based on a US sample, 1 = Study based on a non-US sample; SC Report: Dichotomous variable, (0) = self-report of the self-control measure 1 = other than self-report.

Funnel plots are useful tools to visualize the distribution of studies in regards to their reported sample and effect sizes. Currently, the effect sizes of studies are plotted against their standard error and are represented by circles of size that corresponds to the sample size. Studies are expected to fall within the diagonal lines representing the bounds of a 95% confidence intrerval at any given standard error, centered around fixed or random effect mean.

Visual inspection of the funnel plots (see Figs. 6 and 7) suggests variability among the studies, indicated by a large number of studies outside of the triangle. It is obvious that in case of cross-sectional studies, the random effects mean captures the variability of studies better, and the fixed effects mean is shifted toward Meier et al. (2008) study with a large sample. The presence of a publication bias would be indicated by plot asymmetry with an overrepresentation of smaller studies that found strong effects (lower right corner) than equally sized studies with weak effects (lower left corner). If less precise studies are more prone to sampling error than studies with smaller standard errors (direct consequence of a large sample size), it is likely that only those that find larger (or statistically significant) effects would be published. This asymmetry can be quantified and tested by Begg and Mazumdar's rank correlation test (1994) and Egger et al.'s test of the intercept (1997), and potentially corrected by Duval and Tweedie's trim and fill method (2000).

The rank correlation test for cross-sectional studies indicates a negative association between effect size and standard error, Kendall's $\tau_b = -0.282$, $p < 0.001$ (1-tailed), suggesting that studies with larger sample size actually found larger effects, which contradicts a publication bias. Egger et al.'s (1997) test of the intercept also suggests funnel plot assymetry, a similarly a negative one: intercept = −4.297, 95% CI [−5.670, −2.9233], $t(86) = 6.220$, $p < 0.001$. The directions of both Begg and Mazumdar (1994) and Egger et al. (1997) test seem to indicate an overrepresentation of high power-large effect size studies in the published literature, which is the opposite of how a publication bias would manifest itself.

Slightly different results were found among longitudinal studies, where Kendall's τ_b did not reach statistical significance, $\tau_b = -0.175$, $p = 0.147$, and Egger et al.'s (1997) intercept was positive and not significant, 2.519, 95% CI [−2.606, 7.644], $t(17) = 1.037$, $p = 0.157$ (1-tailed). Non-significance of both of these tests indicates an absence of publication bias; however, it may also be a result of modest statistical power, which is an often reported criticism of both methods (Sterne, Gavaghan, & Egger, 2000).

Finally, Duval and Tweedie's trim and fill technique (2000) allows an examination of an asymmetrical funnel plot, then locating studies "causing" the asymmetry, and subsequently imputing hypothetically missing studies of the same size that should in effect even out the funnel plot and adjust for the imbalance. In the current study, no evidence for asymmetry under the random effects model was found, although we did find one in the under fixed effect framework. For longitudinal studies, the adjusted fixed effect mean changed to 0.284, 95%CI [0.270, 0.297], $Q(19) = 720.589$, after imputing 2 studies. For cross-sectional studies however, the "missing studies" were imputed on the right side of the funnel plot, inflating the mean estimates to 0.561, 95%CI [0.562, 0.570], $Q(133) = 4961.245$ after imputing 36 studies under the fixed effect framework, and 0.448, 95%CI [0.414, 0.481], $Q(97) = 3034.870$ after imputing 10 studies under the random effect framework.

The 88 cross-sectional effects yielded a fixed effect mean[5] of $r = 0.530$, and a combined z-value of 96.520, $p < 0.001$. The estimated Rosenthal's (1979) fail-safe *N* for these values is 3325. This means that there would have to be 3325 similarly sized studies with null results located and included in the analysis in order for the estimated effect size to become non-significant at alpha level of 0.05 (2-tailed). This is well above Rosenthal's (1979) suggested tolerance level of 5*(number of studies) + 10. Due to the excessive reliance of this approach on significance testing, we also utilized Orwin's (1983) approach which allows us to estimate the number of studies with a specified average effect size that would be needed to bring the current average effect size to a specified 'trivial' value. With the current mean of $r = 0.530$, there would have to be 430 similarly sized studies with an average correlation of $r = 0.000$ included in the analysis to bring the estimated mean to $r = 0.100$. It is plausible that studies have been conducted, which would have met the inclusion/exclusion criteria, and found non-significant correlations between low self-control and deviance, that have not been published, however even the less conservative fail-safe number is nearly five times the available studies.

The Rosenthal's (1979) fail-safe *N* for longitudinal studies with a fixed effect mean of $r = 0.296$, combined z-value of 37.462, $p < 0.001$, was estimated to be 6923. Orwin's (1983) approach with a target criterion of $r = 0.100$ as a trivial correlation and a mean correlation of $r = 0.000$ among the hypothetical unpublished studies brings the estimated fail-safe *N* to 39, which is still twice the amount of studies included in this study. The ratio of analyzed studies to the hypothetical unpublished studies is however lower for longitudinal studies (1:4.886) than for cross-sectional studies (1:2.85).

Studies that do not primarily focus on the relationship between low self-control and deviance, but report these relationships among other results should also more resistant to editorial rejections based on the statistical significance of these findings and therefore publication bias. Results of 17 such studies in our sample did not differ from the results of studies in which this relationship was of focal interest $t(86) = 0.303$, $p = 0.762$ for cross-sectional studies, $t(17) = 0.935$, $p = 0.636$ for longitudinal studies, making the likelihood of finding 430 and 39 unpublished studies with a null result even smaller.

Table 5
Moderator Analyses: Longitudinal Studies.

Moderator	*b*	*SE*	β	*p*	95% CI for b		R^2	*F*
Intercept	0.12	0.28		0.670	−0.43	0.67		
Sex (male)	0.26	0.40	0.26	0.516	−0.53	1.05		
Age (18)	−0.01	0.02	−0.33	0.411	−0.05	0.02		
Non-US	0.10	0.15	0.19	0.511	−0.20	0.40		
SC report	0.01	0.18	0.02	0.939	−0.35	0.37		
Time delay	−0.01	0.01	−0.43	0.175	−0.03	0.01	0.182	2.23

Note. Sex = Continuous: proportion of males in the sample; Age centered at 18 years, Non-Us: Dichotomous variable, (0) = Study based on a US sample, 1 = Study based on a non-US sample; SC Report: Dichotomous variable, (0) = self-report of the self-control measure 1 = other than self-report; Time Delay - number of years between assessments, centered at 1.

Table 6
Comparison of different manifestations of deviance.

Outcome	*N* (effects)	M_r (Fix)	95% CI		Q	I^2	Tau^2	M_r (Ran)	95% CI	
General deviance	37	0.563	[0.558,	0.568]	2078.449***	98.268	0.038	0.436	[0.382,	0.488]
Physical violence	25	0.463	[0.451,	0.474]	469.939***	94.893	0.032	0.425	[0.359,	0.486]
Verbal/interpersonal violence	2	0.375	[0.298,	0.447]	0.085	Not applicable		0.375	[0.298,	0.447]
Substance use	28	0.326	[0.316,	0.337]	518.982***	94.798	0.022	0.367	[0.313,	0.420]
Academic/organ. dishonesty	10	0.298	[0.267,	0.327]	182.245***	95.062	0.072	0.406	[0.249,	0.542]
Crime	17	0.393	[0.378,	0.408]	409.076***	96.089	0.037	0.378	[0.290,	0.459]
Theft	11	0.337	[0.315,	0.359]	54.777***	81.744	0.010	0.306	[0.241,	0.368]
Online deviance	7	0.385	[0.339,	0.429]	24.489***	75.499	0.016	0.380	[0.285,	0.468]
Other	16	0.331	[0.312,	0.349]	445.433***	96.632	0.061	0.390	[0.276,	0.492]

Note: *** = $p < 0.001$.

4. Discussion

Building upon and extending Pratt and Cullen's (2000) meta-analysis, but also the one by de Ridder et al. (2012), the current study analyzed results of 99 peer reviewed publications which appeared between 2000 and 2010 that reported an estimate of an association between self-control and deviance (or other synonymous constructs). The evidence provides substantial support for the main argument of Gottfredson and Hirschi's (1990) self-control theory, namely that low self-control is a consistent predictor of criminal and deviant behaviors. Examining the relationship between self-control and deviance, an attenuation-corrected and weighted random effects mean correlation coefficient based on an aggregated sample of 178,464 respondents in cross-sectional studies was estimated to be $r = 0.415$, $p < 0.001$, 95% CI = [0.378, 0.451], which did not significantly differ from cross-sectional studies. For longitudinal studies, this estimate based on an aggregated sample of 35,827 participants, was $M_r = 0.345$, $p < 0.001$, 95% CI = [0.258, 0.426]. There was a significant amount of variance around these means (roughly 18–25%), some of which is explained by the characteristics of the samples of the primary studies (e.g., sex, age, culture) as well as reporting mode. In general, cross-sectional studies with higher proportion of males, older participants, higher proportions of non-white participants, focusing on deviant populations, and/or using self-report measurement of either self-control or deviance reported weaker correlations. Publication bias assessments suggest that studies with larger sample sizes tended to find stronger correlations as compared to smaller ones. This fact seems to contradict data patterns consistent with publication bias, which would expect an overrepresentation of smaller studies with larger effect sizes.

The current study further analyzed the relationship between low self-control and deviance by comparing the effects of low self-control on specific manifestations of deviant behaviors. As indicated in Table 6, the strongest associations were found between low self-control and general deviance ($r = 0.56$) and physical violence ($r = 0.46$). The weakest ones were found between low self-control and substance abuse ($r = 0.33$) and academic and organizational dishonesty ($r = 0.30$). These findings are slightly inconsistent with theoretical predictions which suggest that these links should be similar in magnitude. However, a body of existing research has found differences between the strengths of these associations between low self-control and different manifestations of deviance, with delinquent and violent acts having stronger associations with low self-control than other analogous behaviors (Baron, 2003; Engel, 2012; Piquero, MacDonald, Dorbin, Daigle, & Cullen, 2005). Study findings appear consistent with this work.

In addition to extending Pratt and Cullen's (2000) findings by a decade, the current study also sought to address some limitations in previous work. One such limitation centers on greater coverage and inclusion of longitudinal studies. Gottfredson and Hirschi (1990) argue that the effects of self-control should not vary across research designs and the use of cross-sectional studies is adequate. Pratt and Cullen's findings were contrary to this expectation; they found smaller effect sizes for self-control in longitudinal studies as compared to for cross-sectional ones. The current study included a greater number of longitudinal studies to further address this issue, finding partial support for Pratt and Cullen's results. Using the same weighting approach as Pratt and Cullen, we also found that longitudinal studies has significantly smaller relationships between self-control and measures of deviance than in cross-sectional studies. Explanations for these differences include methodological issues, such as attenuation of the associations due to temporal delay between the measurement of variables, or conceptual ones, including whether the link between self-control declines in magnitude and importance over time, as people age – an idea that would also be supported by the finding that cross-sectional studies with older participants generally find weaker associations. Using random effects weighting, however, which might be a both more appropriate and rigorous test, indicated that the observed differences were in fact not significantly different; this indicated that what appeared as observed differences can be largely attributed to other factors, including differences in study populations or study constructs.

The current study also examined a broader range of samples than the previous meta-analysis, seeking to include a larger number of adolescent and cross-cultural samples in an attempt to expand results. In regards to age, for cross-sectional studies, the mean age of the sample was 21.80 years and 15.12 years for longitudinal studies, demonstrating the inclusion of a larger proportion of youth. The study also included more cross-cultural samples, simply also related to the fact that few had been published during the first few years following the publication of the theory. In cross-sectional studies, 40% reported their country of origin to be outside of the United States, while 26% reported the same in longitudinal studies. Likewise, no restriction was specified in the current meta-analysis for the racial composition of the primary studies. On average, the proportion of non-white participants in the primary samples was 35% across cross-sectional studies and 56% across longitudinal studies, thus providing a much more inclusive test of diverse study samples.

An additional limitation of Pratt and Cullen's study (2000) relates to the complexity of analytical approaches in moderator analyses. While they compared effect sizes on different groups by using t-tests, the current study utilized regression analyses in order to control for the effects of other potential moderators and to estimate unique effects. Furthermore, Pratt and Cullen (2000) included only published studies in their sample and subsequently used the fail-safe N to test for potential publication bias. In our current study, despite the original plans to include unpublished research as well, due to the scale of the project, some difficult

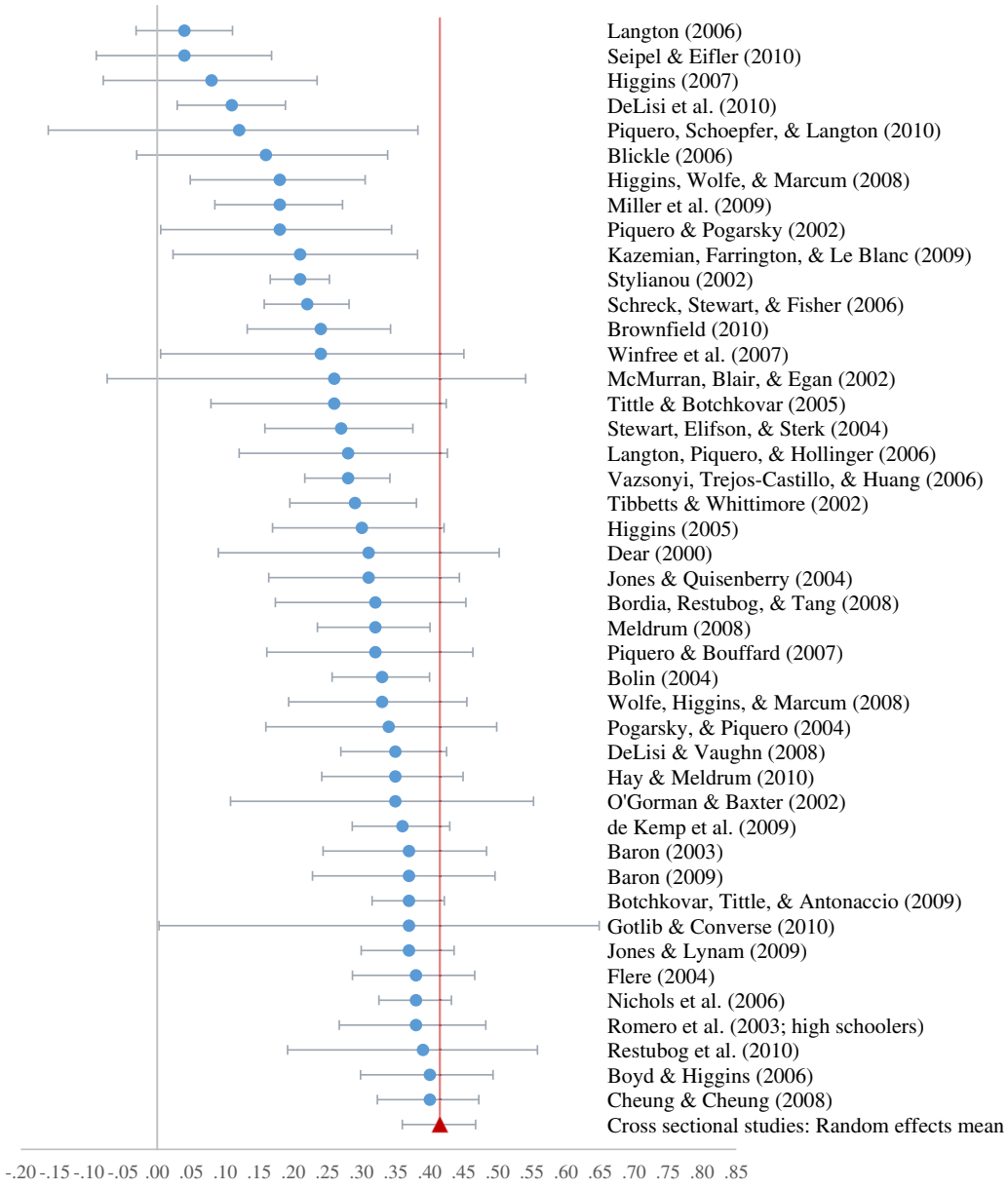

Fig. 3. Forest plot: Cross-sectional studies.

decisions had to be made that impacted the breadth and scope of the study. Limiting the sample of studies to only published manuscripts is not an optimal choice for any meta-analysis, due to potential biases introduced by publishing practices that favor significant effects. To assess and address this issue, we utilized additional methods including funnel plot inspection, Begg and Mazumdar's rank correlation test (1994), Egger's test of the intercept (Egger et al., 1997), and Duval and Tweedie's trim and fill (2000). All the evidence indicated the opposite of a publication bias. Larger studies in terms of sample size tended to find at stronger correlations than smaller ones, leading to the conclusion that publication bias was not a major threat to the validity of the current findings.

5. Limitations

An important decision was to correct the correlation coefficients reported in primary studies (and their associated standard errors) for the unreliability of the measures as this creates a discrepancy between the primary study findings and ones included in the current forest plots. Low reliability of measures leads to larger measurement errors that in turn attenuate the estimates of the strength of a relationship. Thus, unreliable measurement leads to the conclusion that a relationship is in fact weaker than it actually is, in part because a portion of the variance in the observed scores is due to unrelated error. To approximate a better representation of the true relationship between self-control and deviance, a correction approach was used, pioneered by Baugh (2002) as well as Hunter and Schmidt (2004), also described by Card (2011) in greater detail. This means that most correlation coefficients became larger in magnitude, however their associated standard errors became larger as well, leading into wider confidence intervals, reducing the likelihood type I error. Thus, due to this correction, the obtained estimates (M_{random} = 0.415 for cross-sectional and, M_{random} = 0.345 for longitudinal) represent the upper limits of these relationships.

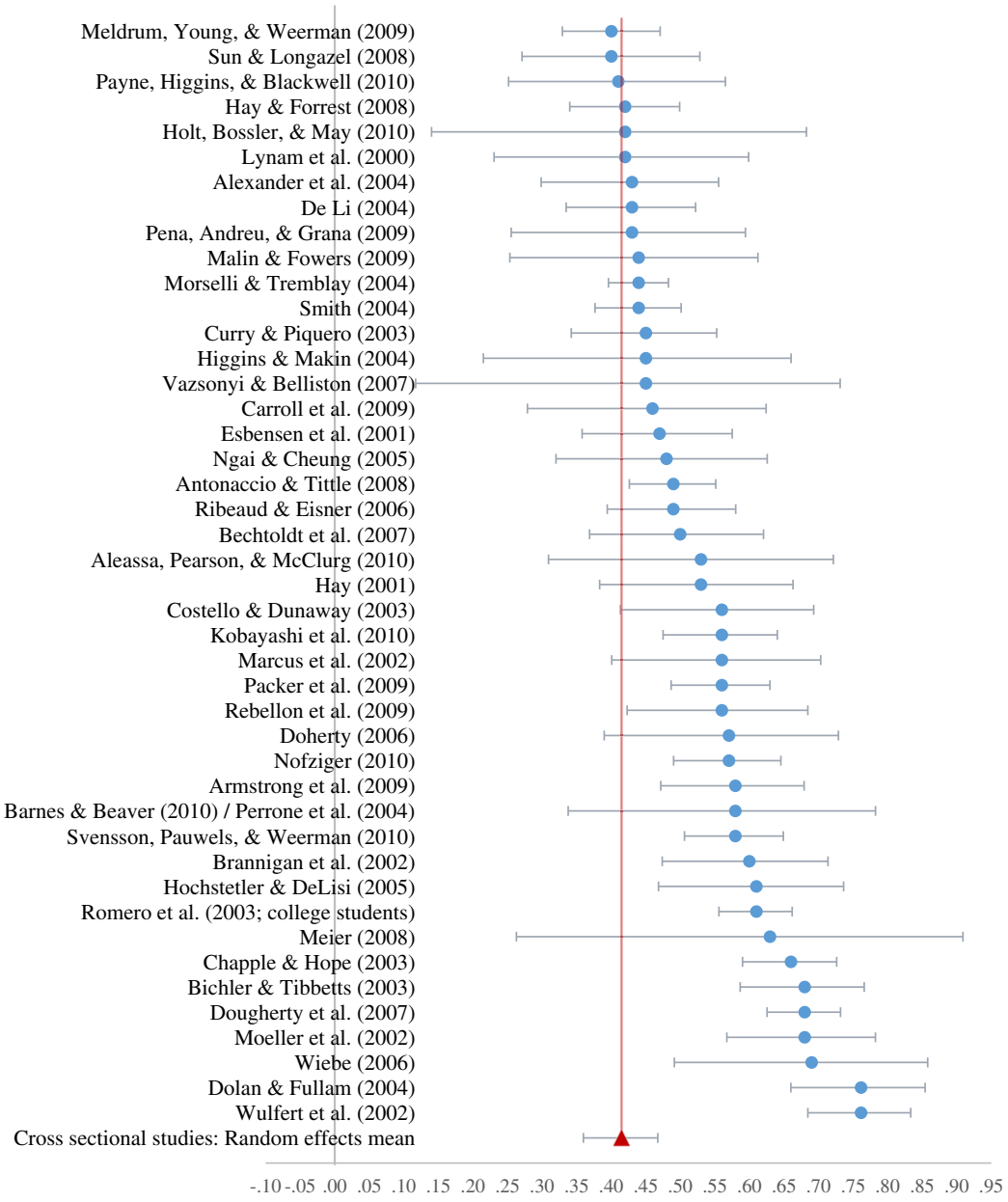

Fig. 4. Forest plot: Cross-sectional studies (continued).

Additionally, despite the obvious and designed variability in the study sample which makes it better suited for random effects modeling and testing, the relatively small number of studies and associated lower second-level power necessitated the use of fixed effect regressions to test for moderation effects. This approach in effect disregards a portion of the variability inherent in our sample as well as biases the results in favor of studies with larger samples (by the design of the weighting variable). Despite this imperfection, the approach brings us one step closer to understanding the differences among the studies and their results. To offset the sample size bias, we present results of moderator analyses based on a sample without one important outlier study in Appendix A.

One additional source of variability unaccounted for in our analyses relates to the breadth of constructs and psychometric approaches included in the current sample. Rather than restricting our search criteria to only a handful of specific scales (see e.g., de Ridder et al., 2012), or a specific facet of self-control (e.g., impulsivity), we focused on all constructs and measurement approaches related that capture the essence of self-control or self-regulation, but also tested for potential moderating effects by different conceptualizations of or differences in measurement. This approach has yielded limited insights as the vast majority of identified studies relied on the Grasmick et al. (1993) measure (45.5% of cross-sectional effects, 26.3% of longitudinal effects). The conceptual and psychometric differences in representation of self-regulation among the studies are likely at least in part an explanation to account for some of the observed residual variance in our model.

And finally, an unavoidable problem arose when the published studies failed to report basic descriptive statistics for their samples

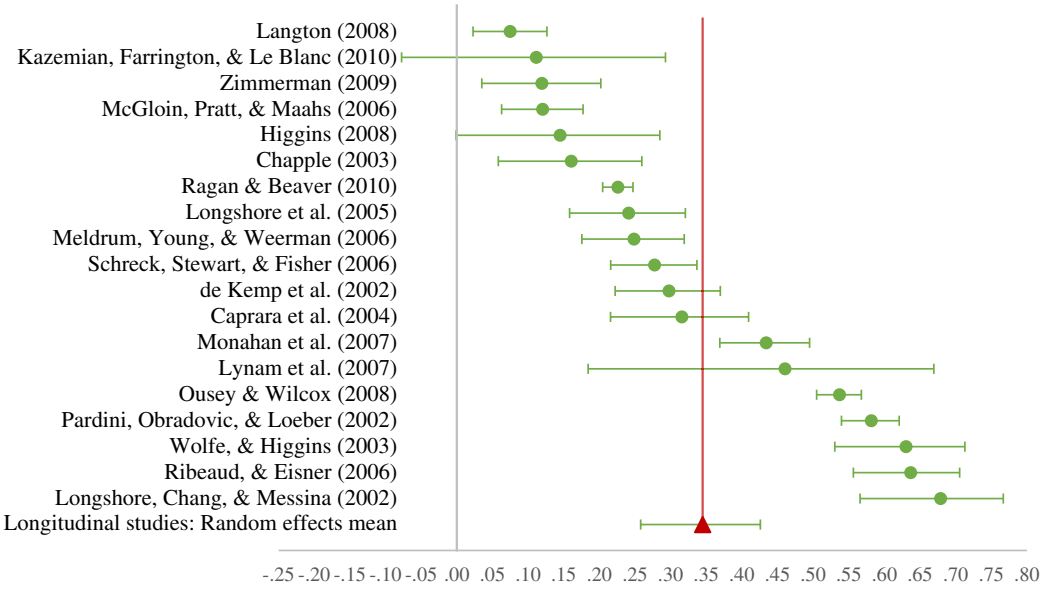

Fig. 5. Forest plot: Longitudinal studies.

needed for the moderator analyses, or reliability estimates of their measures needed for the correction. Only 36 out of the 88 cross-sectional studies, and 11 out of the 19 longitudinal studies, reported all relevant demographic or psychometric information that we sought to test in moderation analyses. Racial/ethnic composition of the sample, as well as reliability estimates of deviance measurement, were missing in half of all cross-sectional studies and 37% of longitudinal ones. This is likely due to the fact that a part of the studies was based in countries with a small amount of diversity in study populations or that studies used in some cases only a single item to measure deviance. Additionally, 27% of cross-sectional studies and 16% of longitudinal studies did not report mean age of the participants, and likewise about a quarter of the studies did not report reliability estimates for self-control measurement. This missingness of data had to be adjusted by multiple imputation which may not be optimal, despite being state of the art. Future work should include detailed descriptions of samples and methods to permit readers more thorough evaluation of the research and a more detailed synthesis of knowledge. Using more than one indicator of constructs of interest is also advisable to increase reliability of measurement which is a necessary prerequisite of valid results. In fact, 16 (18%) cross-sectional and 3 (16%) longitudinal studies did not report the number of items used to measure their construct of deviance. Of those that did, 14 (19%) cross-sectional and 2 (13%) longitudinal studies only used a single item or indicator to measure deviance. This oversight ignores the complexity of the phenomenon and greatly reduces the reliability of measuring psychological or behavioral constructs.

6. Conclusions

The focus on self-control and related constructs has had a large influence on a number of social and behavior science disciplines, including psychology, education, and health research. Gottfredson and Hirschi's (1990) profoundly changed criminological thinking – in theory, empirical work, but also prevention and intervention efforts. Taking stock once again of an additional decade of scholarship has provided strong and convincing evidence, based on about 100 cross-sectional and longitudinal studies, that a strong link between low self-control and deviance or crime exists and that it does not greatly vary across modes of assessment, across study designs (cross-sectional versus longitudinal), across measures of deviance, across different populations within the United States, but also across samples across cultures. In this sense, self-control theory has established itself as one of the most influential pieces of theoretical scholarship during the past century, as it continues to stand up to a plethora of rigorous empirical tests.

Beyond this, the theory and its basic tenets provides a clear road map on where we should spend our efforts, our resources as a society, to prevent crime and deviance from both psychological as well as economic standpoints, namely on primary prevention efforts, principally focused on the family context, on the socialization of self-control among children, understanding that a large portion of its variability is in fact genetic in origin based on behavior genetic evidence. The great potential of self-control malleability as shown in recent work (Piquero et al., 2016) and as recently also argued by Gottfredson (2015), and as documented in decades-long longitudinal work by Moffitt and colleagues (Moffitt et al., 2011), provides a clear path with implications for human development more generally, but also the criminal justice system and processes associated with it more specifically (Gottfredson & Hirschi, 2016). In this sense, the overwhelming evidence is quite clear, where we need to focus our efforts, and the current study stands to provide yet another modest piece of evidence to the puzzle.

Acknowledgements

We are indebted to two graduate, Joshua Roberts and Guangyi Cui, as well as to two undergraduate students in the Adolescent Development Lab, Lauren Ishmael and Demetra Canion, for assisting with searching, compiling, and coding of the large amounts of information. Thank you also to two expert methodologists, namely Noel Card for his insights into interpreting some of our findings, as well as Michael Borenstein, for his assistance with the application of his software for some of our plots. This work was supported, in part, by the John I. and Patricia J. Buster Endowment to the first author.

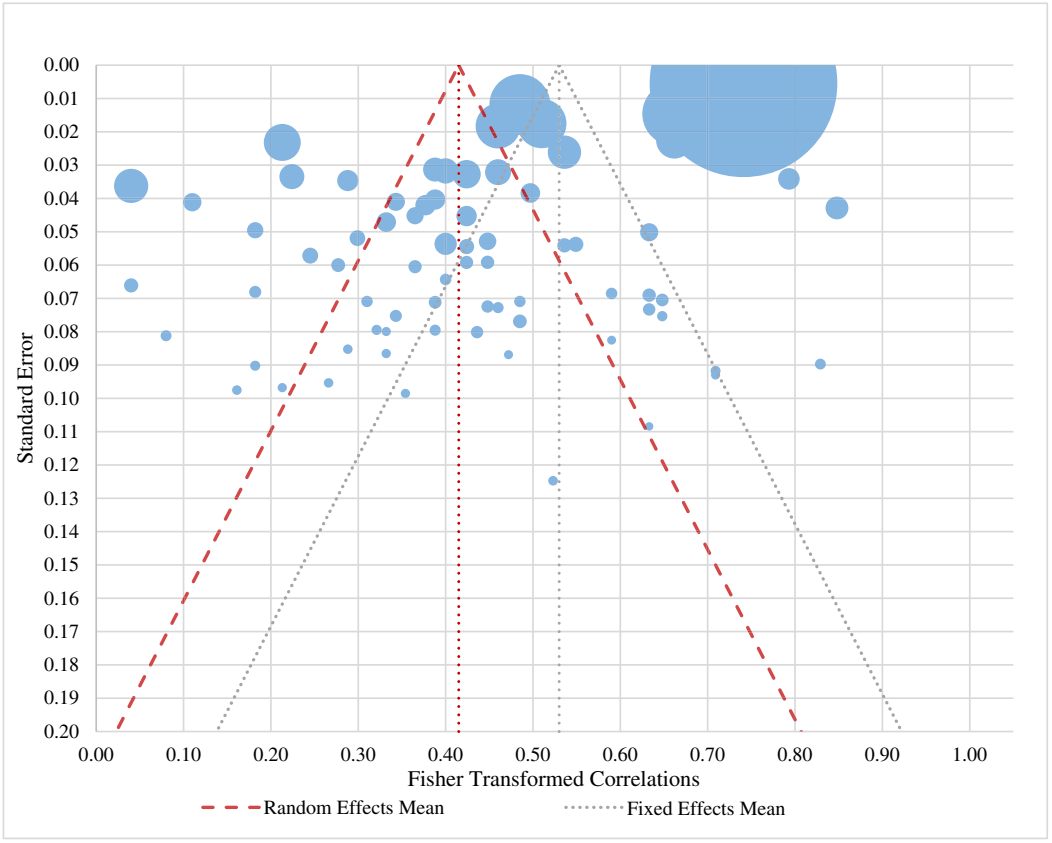

Fig. 6. Funnel Plot: Cross-sectional studies.

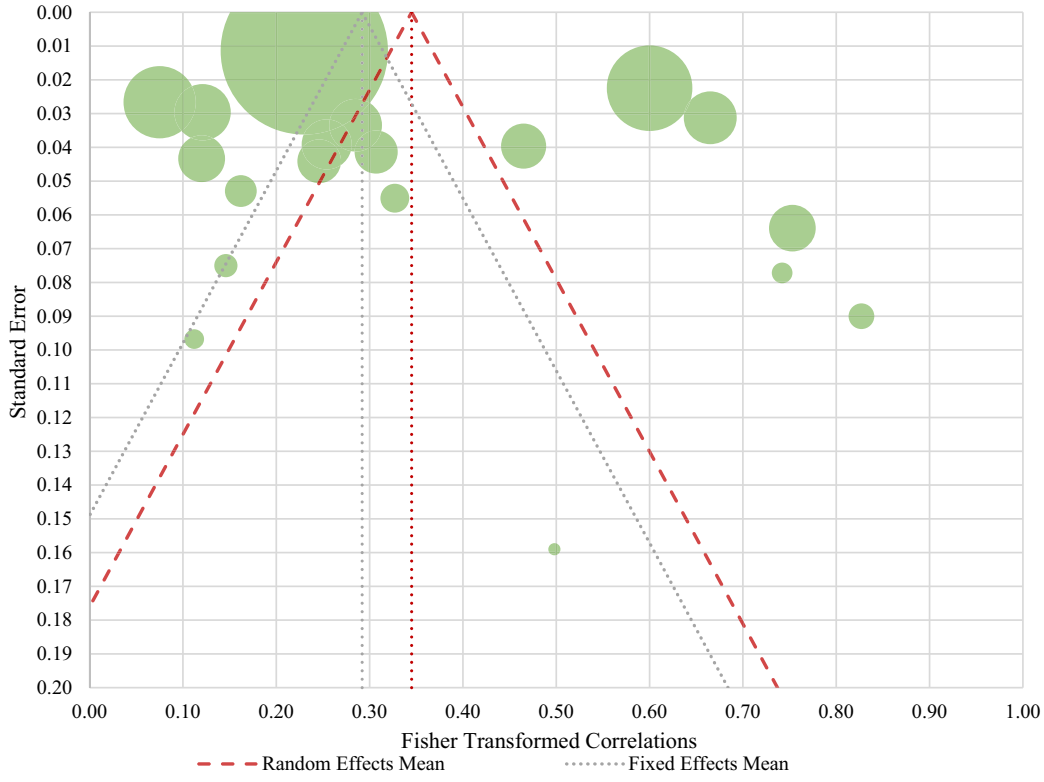

Fig. 7. Funnel plot: Longitdudinal studies.
Note: Size of circles represents sample sizes

Appendix A

Cross-sectional results based on a sample omitting the outlier study (Meier et al., 2008): Fixed effect mean $M_r = 0.459$, $p < 0.001$, 95% CI = [0.452, 0.465], $Q(86) = 1588.154$, $p < 0.001$, $I^2 = 94.585$, Tau = 0.172; Random effect mean $M_r = 0.411$, $p < 0.001$, 95% CI = [0.378, 0.444].

Table 7
Moderator analyses: Cross-sectional studies (without Meier et al., 2008).

Moderator	*b*	*SE*	β	*p*	95% CI for b	
Intercept	0.616	0.074		<0.001	0.472	0.761
Sex (male)	−0.339	0.140	−0.265	0.015	−0.613	−0.065
Age (18)	−0.007	0.003	−0.259	0.030	−0.012	−0.001
Non-US	0.033	0.035	0.119	0.341	−0.035	0.101
SC report	0.308	0.062	0.344	<0.001	0.186	0.431

Note. $R^2 = 0.27$, $F(4,82) = 8.81$, Sex = Continuous: proportion of males in the sample; Age centered at 18 years, Non-Us: Dichotomous variable, (0) = Study based on a US sample, 1 = Study based on a non-US sample; SC Report: Dichotomous variable, (0) = self-report of the self-control measure 1 = other than self-report; replacing sex in the model with a dichotomous variable of sample focus (0 = normal populations, 1 = deviant populations) the estimates for this variable were b = −0.203, 95%CI [−0.336, −0.070], β = −0.375, $p = 0.003$, $R^2 = 0.323$, $F(4,82) = 9.802$; replacing SC Report with its Deviance counterpart led to the following estimates for the new variable: $b = 0.231$, 95%CI [0.107, 0.355], β = 0.344, $p < 0.001$, $R^2 = 0.205$, $F(4,82) = 5.297$.

Notes

[1] First set of keywords: "low self control" or "impulsiveness" or "impulsivity" or "low self-control" or "self-control" or "self control" or "self-regulation" or "self-discipline" and "offender behavior" or "criminal behavior*" or "juvenile delinquency" or "antisocial behavior*" or "devian*" or "delinquency" or "crime*" or "offending" or "cheating" or "misconduct". Later refined into: (impulsive* or "self-control" or "self control" or "self-regulation" or "self-discipline") and (offend* or antisoci* or devian* or delinqu* or crim* or cheat* or misconduct*).

[2] Romero et al. (2003) however reported results of 2 distinct samples which are both included in the analyses, making the total analytic *n* for cross-sectional studies 88.

[3] Mode of deviance reporting (self vs other) was tested instead of the analogous variable for self-control and its effects were also statistically significant $b = 0.27$, 95%CI [0.10, 0.44], β = 0.40, $p = 0.002$, $F(4,83) = 5.80$, $R^2 = 0.181$.

Proportion of non-white participants was tested as an additional variable in the described model, however with the analytical sample constrained only to studies with valid information about sample composition (e.g. listwise deletion). Its effect based on 43 studies was statistically significant and negative $b = -0.48$, 95%CI [−0.69, −0.28], β = −0.57, $p < 0.001$, and the model explained a substantial amount of variability among the eligible studies $F(5,37) = 10.41$, $R^2 = 0.528$.

[4] Focus on deviant populations was tested instead of the proportion of males in the sample and its effects were statistically significant $b = -0.29$, 95%CI [−0.46, −0.11], β = −0.53, $p = 0.002$, $F(4,83) = 9.25$, $R^2 = 0.275$.

[5] The fail-safe N approach has not yet been expanded to random effects framework (Card, 2011).

[6] *Cross-sectional studies used in meta-analysis. **Longitudinal studies used in meta-analysis. Unmarked — not used in meta-analysis, but used in article.

References[6]

Akers, R. L. (1991). Self-control as a general theory of crime. *Journal of Quantitative Criminology*, *7*, 201–211.

Akers, R. L., & Sellers, C. S. (2004). *Criminological theories: Introduction, evaluation, and application* (4th ed.). Los Angeles: Roxbury.

*Aleassa, H., Pearson, J. M., & McClurg, S. (2010). Investigating software piracy in Jordan: An extension of the theory of reasoned action. *Journal of Business Ethics*, *98*, 663–676.

*Alexander, F., Allen, C., Brooks, J., Cole, C., & Campbell, A. (2004). Reason to believe: Representations of aggression as phenomenological read-out. *Sex Roles*, *51*, 647–659.

*Antonaccio, O., & Tittle, C. R. (2008). Morality, self-control, and crime. *Criminology*, *46*, 479–510.

*Armstrong, T. A., Keller, S., Franklin, T. W., & Macmillin, S. N. (2009). Low resting heart rate and antisocial behavior: A brief review of evidence and preliminary results from a new test. *Criminal Justice and Behavior*, *36*, 1125–1140.

Arneklev, B. J., Cochran, J., & Gainey, R. R. (1998). Testing Gottfredson and Hirschi's low self-control stability hypothesis: An exploratory study. *American Journal of Criminal Justice*, *23*, 107–127.

Aslan, S., & Cheung-Blunden, V. (2012). Where does self-control fit in the five-factor model? Examining personality structure in children and adults. *Personality and Individual Differences*, *53*, 670–674.

*Baker, J. O. (2010). The expression of low self-control as problematic drinking in adolescence: An integrated control perspective. *Journal of Criminal Justice*, *38*, 237–244 (Data overlap – specific deviance analysis only).

*Barnes, J. C., & Beaver, K. M. (2010). An empirical examination of adolescence-limited offending: A direct test of Moffitt's maturity gap thesis. *Aggressive behavior*, *36*, 437–451 (Merged with Perrone et al due to sample overlap for analyses).

*Baron, S. W. (2003). Self-control, social consequences, and criminal behavior: Street youth and the general theory of crime. *Journal of Research in Crime and Delinquency*, *40*, 403–425.

*Baron, S. W. (2009). Differential coercion, street youth, and violent crime. *Criminology*, *47*, 239–268.

Baugh, F. (2002). Correcting effect sizes for score reliability: A reminder that measurement and substantive issues are linked inextricably. *Educational and Psychological Measurement*, *62*, 254–263.

Beaver, K. M., Wright, J. P., & DeLisi, M. (2007). Self-control as an executive function: Reformulating Gottfredson and Hirschi's parental socialization thesis. *Criminal Justice and Behavior*, *34*, 1345–1361.

Beaver, K. M., Connolly, E. J., Schwartz, J. A., Al-Ghamdi, M. S., & Kobeisy, A. N. (2013). Genetic and environmental contributions to stability and change in levels of self-control. *Journal of Criminal Justice*, *31*, 300–308.

*Bechtoldt, M. N., Welk, C., Hartig, J., & Zapf, D. (2007). Main and moderating effects of self-control, organizational justice, and emotional labour on counterproductive behaviour at work. *European Journal of Work and Organizational Psychology*, *16*, 479–500.

Begg, C. B., & Mazumdar, M. (1994). Operating characteristics of a rank correlation test for publication bias. *Biometrics*, *15*, 1088–1101.

*Bichler, G., & Tibbetts, S. G. (2003). Conditional covariation of binge drinking with predictors of college students' cheating. *Psychological Reports*, *93*, 735–749.

*Blickle, G., Schlegel, A., Fassbender, P., & Klein, U. (2006). Some personality correlates of business white-collar crime. *Applied Psychology: An International Review*, *55*, 220–233.

*Bolin, A. U. (2004). Self-control, perceived opportunity, and attitudes as predictors of academic dishonesty. *The Journal of Psychology*, *138*, 101–114.

*Bordia, P., Lloyd, S., Restubog, D., & Tang, R. L. (2008). When employees strike back: Investigating mediating mechanisms between psychological contract breach and workplace deviance. *Journal of Applied Psychology*, *93*, 1104–1117.

*Botchkovar, E. V., Tittle, C. R., & Antonaccio, O. (2009). General strain theory: Additional evidence using cross cultural data. *Criminology*, *47*, 131–176.

*Boyd, R. J., & Higgins, G. E. (2006). Can parental support mediate the link between low self-control and deviance? *Criminal Justice Studies*, *19*, 257–273.

*Brannigan, A., Gemmell, W., Pevalin, D. J., & Wade, T. J. (2002). Self-control and social control in childhood misconduct and aggression: The role of family structure, hyperactivity, and hostile parenting. *Canadian Journal of Criminology*, *44*, 119–142.

*Brownfield, D. (2010). Social control, self-control, and gang membership. *Journal of Gang Research*, *17*, 1–12.

Burt, C. H., Simons, R. L., & Simons, L. G. (2006). A longitudinal test of the effects of parenting and the stability of self-control: Negative evidence for the general theory of crime. *Criminology*, *44*, 353–396.

Burt, C. H., Sweeten, G., & Simons, R. L. (2014). Self-control through emerging adulthood: Instability, multidimensionality, and criminological significance. *Criminology: An Interdisciplinary Journal*, *52*, 450–487.

**Caprara, G. V., Gerbino, M., Paciello, M., Di Giunta, L., & Pastorelli, C. (2010). Counteracting depression and delinquency in late adolescence: The role of regulatory emotional and interpersonal self-efficacy beliefs. *European Psychologist*, *15*, 34–48.

Card, N. A. (2011). *Applied meta-analysis for social science research*. The Guilford Press.

*Carroll, A., Houghton, S., Wood, R., Unsworth, K., Hattie, J., Gordon, L., & Bower, J. (2009). Self-efficacy and academic achievement in Australian high school students: The mediating effects of academic aspirations and delinquency. *Journal of Adolescence*, *32*, 797–817.

Caspi, A., & Roberts, B. W. (2001). Personality development across the life course: The argument for change and continuity. *Psychological Inquiry*, *12*, 49–66.

**Chapple, C. L. (2005). Self-control, peer relations, and delinquency. *Justice Quarterly*, *22*, 89–106.

*Chapple, C. L., & Hope, T. L. (2003). An analysis of the self-control and criminal versatility of gang and dating violence offenders. *Violence and Victims*, *18*, 671–690.

*Chapple, C. L., Hope, T. L., & Whiteford, S. W. (2005). The direct and indirect effects of parental bonds, parental drug use, and self-control on adolescent substance use. *Journal of Child and Adolescent Substance Abuse*, *14*, 17–38 (Data overlap with Chapple 2005, using only for substance abuse).

*Cheung, N. W. T., & Cheung, Y. W. (2008). Self-control, social factors, and delinquency: A test of the general theory of crime among adolescents in Hong Kong. *Journal of Youth and Adolescence*, *37*, 412–430.

*Costello, B. J., & Dunaway, R. G. (2003). Egotism and delinquent behavior. *Journal of Interpersonal Violence*, *18*, 572–590.

*Curry, T. R., & Piquero, A. R. (2003). Control ratios and defiant acts of deviance: Assessing additive and conditional effects with constraints and impulsivity. *Sociological Perspectives*, *46*, 397–415.

*/**de Kemp, R. A. T., Vermulst, A. A., Finkenauer, C., Scholte, R. H. J., Overbeek, G., Rommes, W. M., & Rutger, C. M. (2009). Self-control and early adolescent antisocial behavior a longitudinal analysis. *Journal of Early Adolescence*, *29*, 497–517.

*De Li, S. (2004). The impacts of self-control and social bonds on juvenile delinquency in a national sample of midadolescents. *Deviant Behavior*, *25*, 351–373.

de Ridder, D. T., Lensvelt-Mulders, G., Finkenauer, C., Stok, F. M., & Baumeister, R. F. (2012). Taking stock of self-control a meta-analysis of how trait self-control relates to a wide range of behaviors. *Personality and Social Psychology Review*, *16*(1), 76–99.

*Dear, G. E. (2000). Functional and dysfunctional impulsivity, depression, and suicidal ideation in a prison population. *The Journal of Psychology*, *134*, 77–80.
DeLisi, M. (2013). Pandora's box: The consequences of low self-control into adulthood. In C. L. Gibson, & M. D. Krohn (Eds.), *Handbook of life-course criminology*. New York: Springer-Verlag.
DeLisi, M., & Piquero, A. R. (2011). New frontiers in criminal careers research, 2000-2011: A state-of-the-art review. *Journal of Criminal Justice*, *39*, 289–301.
*DeLisi, M., & Vaughn, M. G. (2008). The Gottfredson-Hirschi critiques revisited: Reconciling self-control theory, criminal careers, and career criminals. *International Journal of Offender Therapy and Comparative Criminology*, *52*, 520–537.
*DeLisi, M., Beaver, K. M., Vaughn, M. G., Trulson, C. R., Kosloski, A. E., Drury, A. J., & Wright, J. P. (2010). Personality, gender, and self-control theory revisited: Results from a sample of institutionalized juvenile delinquents. *Applied Psychology in Criminal Justice*, *6*, 31–46.
*Doherty, E. E. (2006). Self-control, social bonds, and desistance: A test of life-course interdependence. *Criminology*, *44*, 807–833.
*Dolan, M., & Fullam, R. (2004). Behavioural and psychometric measures of impulsivity in a personality disordered population. *The Journal of Forensic Psychiatry and Psychology*, *15* (426–250).
*Dougherty, D. M., Dew, R. E., Mathias, C. W., Marsh, D. M., Addicott, M. A., & Barratt, E. S. (2007). Impulsive and premeditated subtypes of aggression in conduct disorder: Differences in time estimation. *Aggressive Behavior*, *33*, 574–582.
Duckworth, A. L., & Seligman, M. E. P. (2005). Self-discipline outdoes IQ in predicting academic performance of adolescents. *Psychological Science*, *16*, 939–944.
Duval, S., & Tweedie, R. (2000). Trim and fill: A simple funnel-plot–based method of testing and adjusting for publication bias in meta-analysis. *Biometrics*, *56*, 455–463.
Egger, M., Smith, G. D., Schneider, M., & Minder, C. (1997). Bias in meta-analysis detected by a simple, graphical test. *British Medical Journal*, *315*, 629–634.
Eisenberg, N., Zhou, Q., Spinrad, T. L., Valiente, C., Fabes, R. A., & Liew, J. (2005). Relations among positive parenting, children's effortful control, and externalizing problems: A three-wave longitudinal study. *Child Development*, *76*, 1055–1071.
Engel, C. (2012). *Low self-control as a source of crime: A meta-study*. MPI Collective Goods Preprint (No. 2012/4).
*Esbensen, F., Winfree, L. T., He, N., & Taylor, T. J. (2001). Youth gangs and definitional issues: When is a gang a gang, and why does it matter? *Crime and Delinquency*, *47*, 105–130.
Eysenck, S. B., Easting, G. G., & Pearson, P. R. (1984). Age norms for impulsiveness, venturesomeness and empathy in children. *Personality and Individual Differences*, *5*, 315–321.
Fein, E. C., & Klein, H. J. (2011). Personality predictors of behavioral self-regulation: Linking behavioral self-regulation to five-factor model factors, facets, and a compound trait. *International Journal of Selection and Assessment*, *19*, 132–144.
*Flere, S. (2004). Religiosity and delinquency: Research results on the population of Maribor university undergraduates eastern European religion. *Pázmány Társadalomtudomány*, *5*, 95–103.
*Gotlib, T., & Converse, P. (2010). Dishonest behavior: The impact of prior self-regulatory exertion and personality. *Journal of Applied Social Psychology*, *40*, 3169–3191.
Gottfredson, M. R. (2015). Early childhood, problem behaviors and a focus on prevention: An emergent source for cross-disciplinary, cross-national criminology. *Presentation at the European Society of Criminology, Porto, Portugal, September 2–5*.
Gottfredson, M. R., & Hirschi, T. (1990). *A general theory of crime*. Stanford, CA: Stanford University Press.
Gottfredson, M. R., & Hirschi, T. (2016). The criminal career perspective as an explanation of crime and a guide to crime control policy: The view from general theories of crime. *Journal of Research in Crime and Delinquency*, *53*, 406–419.
Grasmick, H. G., Tittle, C. R., Bursik, R. J., & Arneklev, B. J. (1993). Testing the core empirical implications of Gottfredson and Hirschi's general theory of crime. *Journal of Research in Crime and Delinquency*, *30*, 5–29.
Gunter, W. D., & Bakken, N. W. (2012). The many measurements of self-control: How re-operationalized self-control compares. *European Journal of Criminology*, *9*, 309–322.
*Hay, C. (2001). Parenting, self-control, and delinquency: A test of self-control theory. *Criminology*, *39*, 707–736.
Hay, C., & Forrest, W. (2006). The development of self-control: Examining self-control theory's stability thesis. *Criminology*, *44*, 739–774.
*Hay, C., & Forrest, W. (2008). Self-control theory and the concept of opportunity: The case for a more systematic union. *Criminology*, *46*, 1039–1072.
*Hay, C., & Meldrum, R. (2010). Bullying victimization and adolescent self-harm: Testing hypotheses from general strain theory. *Journal of Youth and Adolescence*, *39*, 446–459.
Helson, R., Jones, C., & Kwan, V. (2002). Personality change over 40 years of adulthood: Hierarchical linear modeling analyses of two longitudinal samples. *Journal of Personality and Social Psychology*, *83*, 752–766.
*Higgins, G. E. (2005). Can low self-control help with the understanding of the software piracy problem? *Deviant Behavior*, *26*, 1–24.
*/**Higgins, G. E. (2007). Digital piracy: An examination of low self-control and motivation using short-term longitudinal data. *CyberPsychology and Behavior*, *10*, 523–529.
*Higgins, G. E., & Makin, D. A. (2004). Self-control, deviant peers, and software piracy. *Psychological Reports*, *95*, 921–931.
*Higgins, G. E., Wolfe, S. E., & Marcum, C. D. (2008). Digital piracy: An examination of three measurements of self-control. *Deviant Behavior*, *29*, 440–461.
Hirschi, T. (2004). Self-control and crime. In R. F. Baumeister, & K. D. Vohs (Eds.), *Handbook of self-regulation: Research, theory and applications*. New York: Guilford Press.
*Hochstetler, A., & DeLisi, M. (2005). Importation, deprivation, and varieties of serving time: An integrated-lifestyle-exposure model of prison offending. *Journal of Criminal Justice*, *33*, 257–266.
*Holt, T. J., Bossler, A. M., & May, D. C. (2010). Low self-control, deviant peer associations, and juvenile cyberdeviance. *American Journal of Criminal Justice*, *37*, 378–395.
Hunter, J. E., & Schmidt, F. L. (2004). *Methods of a meta-analysis* (2nd ed.). Thousand Oaks, CA: Sage.
Hwang, S., & Akers, R. L. (2003). Substance use by Korean adolescents: A cross-cultural test of social learning, social bonding, and self-control theories. In R. L. Akers, & G. F. Jensen (Eds.), *Social learning theory and the explanation of crime: A guide for the new century* (pp. 39–63). New Brunswick, NJ: Transaction.
*Jones, S., & Lynam, D. R. (2009). In the eye of the impulsive beholder: The interaction between impulsivity and perceived informal social control on offending. *Criminal Justice and Behavior*, *36*, 307–321.
*Jones, S., & Quisenberry, N. (2004). The general theory of crime: How general is it? *Deviant Behavior*, *25*, 401–426.
*/**Kazemian, L., Farrington, D. P., & Le Blanc, M. (2009). Can we make accurate long-term predictions about patterns of de-escalation in offending behavior? *Journal of Youth and Adolescence*, *38*, 384–400.
*Kobayashi, E., Vazsonyi, A. T., Chen, P., & Sharp, S. F. (2010). A culturally nuanced test of Gottfredson and Hirschi's "General Theory": Dimensionality and generalizability in Japan and the US. *International Criminal Justice Review*, *20*, 112–131.
*/**Langton, L. (2006). Low self-control and parole failure: An assessment of risk from a theoretical perspective. *Journal of Criminal Justice*, *34*, 469–478.
*Langton, L., Leeper, N., Piquero, A. R., & Hollinger, R. C. (2006). An empirical test of the relationship between employee theft and low self-control. *Deviant Behavior*, *27*, 537–565.
**Longshore, D., Chang, E., Hsieh, S., & Messina, N. (2004). Self-control and social bonds: A combined control perspective on deviance. *Crime and Delinquency*, *50*, 542–564.
**Longshore, D., Chang, E., & Messina, N. (2005). Self-control and social bonds: A combined control perspective on juvenile offending. *Journal of Quantitative Criminology*, *21*, 419–437.
*/**Lynam, D. R., Caspi, A., Moffitt, T. E., Wikström, P., Loeber, R., & Novak, S. (2000). The interaction between impulsivity and neighborhood context on offending: The effects of impulsivity are stronger in poorer neighborhoods. *Crime and Delinquency*, *109*, 563–574.
*Malin, J., & Fowers, B. J. (2009). Adolescent self-control and music and movie piracy. *Computers in Human Behavior*, *25*, 718–722.
*Marcus, B., Schuler, H., Quell, P., & Humpfner, G. (2002). Measuring counterproductivity: Development and initial validation of a German self-report questionnaire. *International Journal of Selection and Assessment*, *10*, 18–35.
McCrae, R. R. (2010). Self-regulation and the five-factor model of personality traits. In R. H. Hoyle (Ed.), *Handbook of personality and self-regulation* (pp. 145–168). Hoboken, NJ: Wiley-Blackwell.
McCrae, R. R., Costa, P. T., de Lima, M. P., Simoes, A., Ostendorf, F., & Angleitner, A. (1999). Age differences in personality across the adult life span: Parallels in five cultures. *Developmental Psychology*, *35*, 466–477.
**McGloin, J. M., Pratt, T. C., & Maahs, J. (2004). Rethinking the IQ-delinquency relationship: A longitudinal analysis of multiple theoretical models. *Justice Quarterly*, *21*, 603–634.
*McMurran, M., Blair, M., & Egan, V. (2002). An investigation of the correlations between aggression, impulsiveness, social problem-solving, and alcohol use. *Aggressive Behavior*, *28*, 439–445.
*Meier, M. H., Slutske, W. S., Arndt, S., & Cadoret, R. J. (2008). Impulsive and callous traits are more strongly associated with delinquent behavior in higher risk neighborhoods among boys and girls. *Journal of Abnormal Psychology*, *117*, 377–385.
*Meldrum, R. C. (2008). Beyond parenting: An examination of the etiology of self-control. *Journal of Criminal Justice*, *36*, 244–251.
*/**Meldrum, R. C., Jacob, T., Young, N., & Weerman, F. M. (2009). Reconsidering the effect of self-control and delinquent peers: Implications of measurement for theoretical significance. *Journal of Research in Crime and Delinquency*, *46*, 353–376.
Meneses, R. A., & Akers, R. L. (2010). A comparison of four general theories of crime and deviance: Marijuana use among American and Bolivian university students. *International Criminal Justice Review*, *21*, 333–352.
Miller, J. D., & Lynam, D. R. (2001). Structural models of personality and their relation to antisocial behavior: A meta-analytic review. *Criminology*, *38*, 199–232.
*Miller, B. L., Griffin, O. H., Gibson, C. L., & Khey, D. N. (2009). Trippin' on Sally D: Exploring predictors of *Salvia divinorum* experimentation. *Journal of Criminal Justice*, *37*, 396–403.
Miller, H. V., Barnes, J. C., & Beaver, K. M. (2011). Self-control and health outcomes in a nationally representative sample. *American Journal of Health and Behavior*, *35*, 15–27.
Mitchell, O., & Mackenzie, D. L. (2006). The stability and resiliency of self-control in a sample of incarcerated offenders. *Crime and Delinquency*, *52*, 432–449.
*Moeller, G. F., Dougherty, D. M., Barratt, E. S., Oderinde, V., Matthias, C. W., Harper, A., & Swann, A. C. (2002). Increased impulsivity in cocaine dependent subjects independent of antisocial personality disorder and aggression. *Drug and Alcohol Dependence*, *68*, 105–111.
Moffitt, T. E., Arseneault, L., Belsky, D., Dickson, N., Hancox, R. J., Harrington, H., ... Caspi, A. (2011). A gradient of childhood self-control predicts health, wealth, and public safety. *Proceedings of the National Academy of Sciences of the United States of America*, *108*, 2693–2698.
**Monahan, K. C., Steinberg, L., Cauffman, E., & Mulvey, E. P. (2009). Trajectories of antisocial behavior and psychosocial maturity from adolescence to young adulthood. *Developmental Psychology*, *45*, 1654–1668.
Morizot, J., & LeBlanc, M. (2005). Searching for a developmental typology of personality and its relations to antisocial behavior: A longitudinal study of a representative sample of men. *Journal of Personality*, *73*, 139–182.
Morris, R. G., Gerber, J., & Menard, S. (2011). Social bonds, self-control, and adult criminality: A nationally representative assessment of Hirschi's revised self-control theory. *Criminal Justice and Behavior*, *38*, 584–599.

*Morselli, C., & Tremblay, P. (2004). Criminal achievement, offender networks and the benefits of low self-control. *Criminology*, *42*, 773–804.
*Ngai, N., & Cheung, C. (2005). Predictors of the likelihood of delinquency: A study of marginal youth in Hong Kong, China. *Youth and Society*, *36*, 445–470.
*Nichols, T. R., Graber, J. A., Brooks-Gunn, J., & Botvin, G. J. (2006). Sex differences in overt aggression and delinquency among urban minority middle school students. *Applied Developmental Psychology*, *27*, 78–91.
*Nofziger, S. (2010). A gendered perspective on the relationship between self-control and deviance. *Feminist Criminology*, *5*, 29–50.
*O'Gorman, J. G., & Baxter, E. (2002). Self-control as a personality measure. *Personality and Individual Differences*, *32*, 533–539.
Orwin, R. G. (1983). A fail-safe N for effect size in meta-analysis. *Journal of Educational Statistics*, 157–159.
**Ousey, G. C., & Wilcox, P. (2007). The interaction of antisocial propensity and life-course varying predictors of delinquent behavior: Differences by method of estimation and implications for theory. *Criminology*, *45*, 313–354.
*Packer, G., Best, D., Day, E., & Wood, K. (2009). Criminal thinking and self-control among drug users in court mandated treatment. *Criminology and Criminal Justice*, *9*, 93–110.
**Pardini, D., Obradović, J., & Loeber, R. (2006). Interpersonal callousness, hyperactivity/impulsivity, inattention, and conduct problems as precursors to delinquency persistence in boys: A comparison of three grade-based cohorts. *Journal of Clinical Child and Adolescent Psychology*, *35*, 46–59.
Patton, J. H., Stanford, M. S., & Barratt, E. S. (1995). Factor structure of the Barratt impulsiveness scale. *Journal of Clinical Psychology*, *51*, 768–774.
*Pena, M., Andreu, J. M., & Grana, J. L. (2009). Multivariate model of antisocial behavior and substance use in Spanish adolescents. *Journal of Child and Adolescent Substance Abuse*, *18*, 207–220.
*Perrone, D., Sullivan, C. J., Pratt, T. C., & Margaryan, S. (2004). Parental efficacy, self-control, and delinquency: A test of a general theory of crime on a nationally representative sample of youth. *International Journal of Offender Therapy and Comparative Criminology*, *48*, 298–312.
*Piquero, A. R., & Bouffard, J. A. (2007). Something old, something new: A preliminary investigation of Hirschi's redefined self-control. *Justice Quarterly*, *24*, 1–27.
*Piquero, A. R., & Pogarsky, G. (2002). Beyond Stafford and Warr's reconceptualization of deterrence: Personal and vicarious experiences, impulsivity, and offending behavior. *Journal of Research in Crime and Delinquency*, *39*, 153–186.
Piquero, A. R., MacDonald, J., Dorbin, A., Daigle, L. E., & Cullen, F. T. (2005). Self-control, violent offending, and homicide victimization: Assessing the general theory of crime. *Journal of Quantitative Criminology*, *21*, 55–71.
*Piquero, A. R., Leeper, N., Schoepfer, A., & Langton, L. (2010). Completely out of control or the desire to be in complete control? How low self-control and the desire for control relate to corporate offending. *Crime and Delinquency*, *56*, 627–647.
Piquero, A. R., Jennings, W. R., Diamond, B., Farrington, D. P., & Reingle Gonzalez, J. M. (2016). A meta-analysis update on the effects of early family/parent training programs on antisocial behavior and delinquency. *Journal of Experimental Criminology*, *12*(2), 249–264.
*Pogarsky, G., & Piquero, A. R. (2004). Studying the reach of deterrence: Can deterrence theory help explain police misconduct? *Journal of Criminal Justice*, *32*, 371–386.
Pratt, T. C., & Cullen, F. T. (2000). The empirical status of Gottfredson and Hirschi's general theory of crime: A meta-analysis. *Criminology*, *38*, 931–964.
**Ragan, D. T., & Beaver, K. M. (2010). Chronic offenders: A life-course analysis of marijuana users. *Youth and Society*, *42*, 174–198.
Ray, J. V., Jones, S., Thomas, A., & Jennings, W. G. (2013). Testing the stability of self-control: Identifying unique developmental patterns and associated risk factors. *Criminal Justice and Behavior*, *40*, 588–607.
Rebellon, C. J., Straus, M. A., & Medeiros, R. (2008). Self-control in global perspective: An empirical assessment of Gottfredson and Hirschi's general theory within and across 32 national settings. *European Journal of Criminology*, *5*, 331–361.
*Rebellon, C. J., Leeper, N., Piquero, A., Piquero, R., & Thaxton, S. (2009). Do frustrated economic expectations and objective economic inequity promote crime? A randomized experiment testing Agnew's general strain theory. *European Journal of Criminology*, *6*, 47–71.
*Restubog, S., Patrick, L. D., Raymund, Garcia, J. M., Wang, L., & Cheng, D. (2010). It's all about control: The role of self-control in buffering the effects of negative reciprocity beliefs and trait anger on workplace deviance. *Journal of Research in Personality*, *44*, 655–660.
*Ribeaud, D., & Eisner, M. (2006). The 'drug-crime link' from a self -control perspective: An empirical test in a Swiss youth sample. *European Journal of Criminology*, *3*, 33–67.
*Ribeaud, D., & Eisner, M. (2010). Risk factors for aggression in pre-adolescence: Risk domains, cumulative risk and gender differences - results from a prospective longitudinal study in a multi-ethnic urban sample. *European Journal of Criminology*, *7*, 460–498.
Rocque, M., Posick, C., & Zimmerman, G. M. (2013). Measuring up: Assessing the measurement properties of two self-control scales. *Deviant Behavior*, *34*, 534–556.
*Romero, E., Gomez-Fraguela, J. A., Ángeles Luengo, M., & Sobral, J. (2003). The self-control construct in the general theory of crime: An investigation in terms of personality psychology. *Psychology, Crime and Law*, *9*, 61–86.
Rosenthal, R. (1979). The file drawer problem and tolerance for null results. *Psychological Bulletin*, *86*, 638.
*/**Schreck, C. J., Stewart, E. A., & Fisher, B. S. (2006). Self-control, victimization, and their influence on risky lifestyles: A longitudinal analysis using panel data. *Journal of Quantitative Criminology*, *22*, 319–340.
*Seipel, C., & Eifler, S. (2010). Opportunities, rational choice, and self-control: On the interaction of person and situation in a general theory of crime. *Crime and Delinquency*, *56*, 167–197.
*Smith, T. R. (2004). Low self-control, staged opportunity, and subsequent fraudulent behavior. *Criminal Justice and Behavior*, *31*, 542–563.
Smith, T. R., & Crichlow, V. J. (2012). A cross-cultural validation of self-control theory. *International Journal of Comparative and Applied Criminal Justice*, *1*, 1–19.
Sterne, J., Gavaghan, D., & Egger, M. (2000). Publication and related bias in meta-analysis: Power of statistical tests and prevalence in the literature. *Journal of Clinical Epidemiology*, *53*, 1119–1129.
*Stewart, E. A., Elifson, K. W., & Sterk, C. E. (2004). Integrating the general theory of crime into an explanation of violent victimization among female offenders. *Justice Quarterly*, *21*, 159–181.
*Stylianou, S. (2002). The relationship between elements and manifestations of low self-control in a general theory of crime: Two comments and a test. *Deviant Behavior: An Interdisciplinary Journal*, *23*, 531–557.
*Sun, I. Y., & Longazel, J. G. (2008). College students' alcohol-related problems: A test of competing theories. *Journal of Criminal Justice*, *36*, 554–562.
*Svensson, R., Pauwels, L., & Weerman, F. M. (2010). Does the effect of self-control on adolescent offending vary by level of morality? A test in three countries. *Criminal Justice and Behavior*, *37*, 732–743.
Tangney, J., Baumeister, R. F., & Boone, A. L. (2004). High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. *Journal of Personality*, *72*, 271–324.
*Tibbetts, S. G., & Whittimore, J. N. (2002). The interactive effects of low self-control and commitment to school on substance abuse among college students. *Psychological Reports*, *90*, 327–337.
Tittle, C. R. (2011). Self-control theory and the management of violence. In W. Heitmeyer, H. G. Haupt, A. Kirschner, & S. Malthaner (Eds.), *The control of violence*. New York, NY: Springer.
*Tittle, C. R., & Botchkovar, E. V. (2005). The generality and hegemony of self-control theory: A comparison of Russian and US adults. *Social Science Research*, *34*, 703–731.
Turner, M. G., & Piquero, A. R. (2002). The stability of self-control. *Journal of Criminal Justice*, *30*, 457–471.
Turner, M. G., Piquero, A. R., & Pratt, T. C. (2005). The school context as a source of self-control. *Journal of Criminal Justice*, *33*, 327–339.
van Gelder, J., & de Vries, R. E. (2013). Tales of two self-control scales: Relations with five-Facor and HEXACO traits. *Personality and Individual Differences*, *54*(6), 756–760.
van Ginkel, J. R., & Kroonenberg, P. M. (2014). Analysis of variance of multiply imputed data. *Multivariate Behavioral Research*, *49*, 78–91.
*Vazsonyi, A. T., & Belliston, L. M. (2007). The family → low self-control → deviance: A cross-cultural and cross-national test of self-control theory. *Criminal Justice and Behavior*, *34*, 505–530.
Vazsonyi, A. T., & Huang, L. (2010). Where self-control comes from: On the development of self-control and its relationship to deviance over time. *Developmental Psychology*, *46*, 245–257.
Vazsonyi, A. T., Pickering, L. E., Junger, M., & Hessing, D. (2001). An empirical test of a general theory of crime: A four-nation comparative study of self-control and the prediction of deviance. *Journal of Research in Crime and Delinquency*, *38*, 91–131.
*Vazsonyi, A. T., Trejos-Castillo, E., & Huang, L. (2006). Risky sexual behaviors, alcohol use, and drug use: A comparison of eastern and western European adolescents. *Journal of Adolescent Health*, *39*, 753–761.
Vazsonyi, A. T., Roberts, J., & Huang, L. (2015). Hirschi's reconceptualization of self-control: Is truth truly the daughter of time? Evidence from eleven cultures. *Journal of Criminal Justice*, *43*, 59–68.
*Wiebe, R. P. (2006). Using an expanded measure of self-control to predict delinquency. *Psychology Crime and Law*, *12*, 519–536.
*Winfree, L. T., Giever, D. M., Maupin, J. R., & Mays, G. L. (2007). Drunk driving and the prediction of analagous behavior: A longitudinal test of social learning and self-controlled theories. *Victims & Offenders*, *2*, 327–349.
**Wolfe, S. E., & Higgins, G. E. (2008). Self-control and perceived behavioral control: An examination of college student drinking. *Applied Psychology in Criminal Justice*, *4*, 108–134.
*Wolfe, S. E., Higgins, G. E., & Marcum, C. D. (2008). Deterrence and digital piracy a preliminary examination of the role of viruses. *Social Science Computer Review*, *26*, 317–333.
Wright, J. P., & Beaver, K. M. (2005). Do parents matter in creating self-control in their children? A genetically informed test of Gottfredson and Hirschi's theory of low self- control. *Criminology*, *43*, 1169–1202.
*Wulfert, E., Block, J. A., Santa Ana, E., Rodrigues, M. L., & Colsman, M. (2002). Delay of gratification: Impulsive choices and problem behaviors in early and late adolescence. *Journal of Personality*, *70*, 533–552.
**Zimmerman, G. M. (2010). Impulsivity, offending, and the neighborhood: Investigating the person–context nexus. *Journal of Quantitative Criminology*, *26*, 301–332.