How much does that cost?
Examining the economic costs of crime in North America attributable to people with psychopathic personality disorder

by
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Abstract

Psychopathic personality disorder (PPD) is associated with serious dysfunction (e.g., crime, violence), and as a result, scholars believe it inflicts a massive social burden. Yet, very few works have quantified the severity of this burden. The purpose of this dissertation was to examine the economic cost of crime attributable to PPD. To achieve this goal, a three-pronged approach was implemented. In Study 1, a conceptual analysis of PPD and violence risk case formulation was conducted, which revealed a host of potential causal links to violence. In Study 2, a top-down societal study considered prevalence rates, offending rates, and national costs of crime to produce national estimates of PPD-related crime costs for the US, UK, and Canada. The results suggested that PPD had staggering high crime costs in the US (simulated $678 to $1,276 billion) and Canada (simulated $33 to $42 billion), whereas the UK produced relatively modest costs (simulated £4.77 billion). In Study 3, a sample-driven empirical study of Canadian federal offenders was conducted. Using the Psychopathy Checklist—Revised, higher PPD traits were predictive of prospective crime costs. The results of all three studies suggest that people suffering from PPD produce disproportionately high crime costs. The discussion covered topics such as the causal role of PPD on violence, treatment of PPD, and policy implications for funding treatment and research.

Keywords: psychopathy; recidivism; violence; economic analysis; cost of illness; case formulation or case conceptualization
Study hard what interests you the most in the most undisciplined, irreverent and original manner possible.

(Richard Feynman)
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# Table of Contents

Approval .......................................................................................................................... ii  
Ethics Statement ............................................................................................................. iii  
Abstract .......................................................................................................................... iv  
Quotation ........................................................................................................................ v  
Acknowledgements .......................................................................................................... vi  
Table of Contents ............................................................................................................. vii  
List of Tables .................................................................................................................... xi  
List of Figures ................................................................................................................... xiii  
Preface .............................................................................................................................. xiv

Chapter 1. Central Issues Regarding Psychopathic Personality Disorder .......... 1  
1.1. Definition ...................................................................................................................... 1  
1.2. Models of Psychopathy .............................................................................................. 2  
1.3. Measuring and Assessing Psychopathy .................................................................... 3  
1.4. Conceptual and Definitional Issues .......................................................................... 5  
   1.4.1. Psychopathy: A Mental Disorder ................................................................. 5  
       Personality Disorder ......................................................................................... 7  
   1.4.2. Psychopathy: Kind or Continuum? ............................................................. 8  
   1.4.3. Developmental Stability of Psychopathy .................................................. 11  
1.5. Psychopathy and Dysfunction .............................................................................. 13  
1.6. Concluding Remarks ............................................................................................... 15

Chapter 2. Violence Risk Formulation and PPD ......................................................... 17  
2.1. Introduction ............................................................................................................... 17  
   2.1.1. A Comment on Crime and Violence ....................................................... 17  
   2.1.2. Personality Disorder, Violence, and Crime ........................................ 18  
   2.1.3. Psychopathy, Violence, and Crime ......................................................... 19  
   2.1.4. Functional Nexus between PPD and Violence ..................................... 21  
   2.1.5. Purpose ......................................................................................................... 24  
       Research Questions ......................................................................................... 25  
2.2. Conceptual Method and Assumptions .................................................................. 26  
   2.2.1. Conceptual and Theoretical Analysis .................................................... 26  
   2.2.2. Theories, Models, and Concepts .............................................................. 26  
       CAPP ................................................................................................................... 26  
       Formulation ..................................................................................................... 28  
       Forensic Case Formulation ........................................................................... 29  
       Structured Professional Judgment VRCF .................................................... 29  
       SPJ Decision Theory ...................................................................................... 31  
       Violence ........................................................................................................... 32  
   2.2.3. Procedure ....................................................................................................... 32  
2.3. Conceptual Analysis Results .................................................................................. 33  
   2.3.1. Motivators ..................................................................................................... 33
Chapter 3. Top-Down and Bottom-Up Costs of Crime Associated with Psychopathy

3.1. Introduction ............................................................................................................. 53
    3.1.1. Cost of Illness Studies: An Overview ............................................................... 53
        Definitions .............................................................................................................. 54
    3.1.2. COI Studies of Mental Disorders ................................................................. 55
    3.1.3. Cost of Crime ................................................................................................. 59
        National Costs of Crime ...................................................................................... 60
    3.1.4. Psychopathy and the Cost of Crime .............................................................. 61
    3.1.5. Purpose .......................................................................................................... 63
        Research Questions and Hypotheses .................................................................. 64
        Supplementary Research Questions ................................................................. 64

3.2. Study 1 Method ...................................................................................................... 65
    3.2.1. Procedure ........................................................................................................ 65
    3.2.2. Assumed Model Parameters ......................................................................... 65
Chapter 4. General Discussion: Conclusions & Implications .................. 120
4.1. Implications ................................................................................. 122
    Policy .............................................................................................. 122
    Clinical Practice ............................................................................... 126
    Researchers .................................................................................. 128
4.2. Future Research ............................................................................. 129
References .......................................................................................... 131

Appendix A. Proportion of PPD Crime Estimates ..................................... 167
Appendix B. Calculations for Per Unit Costs for Specific Crimes .............. 179
List of Tables

Table 1  CAPP Domain Direct Quotations from Cooke and Colleagues (2012, pp. 245–246) ......................................................................................................................... 28
Table 2  Empirical Estimates of the Prevalence of Psychopathic Personality Disorder in Forensic Settings ................................................................. 67
Table 3  Meta-Analytic Associations Between Psychopathy and Violence and Recidivism .................................................................................................................. 70
Table 4  Total Cost of Crime in the US Associated with Psychopathic Personality Disorder ........................................................................................................ 76
Table 5  Total Cost of Crime in Canada Associated with Psychopathic Personality Disorder ........................................................................................................ 76
Table 6  Total Cost of Crime in the UK Associated with Psychopathic Personality Disorder ........................................................................................................ 77
Table 7  Monte Carlo Simulation of the Proportion of Crime Attributable to Psychopathic Personality Disorder ................................................................. 77
Table 8  Descriptive Statistics of Previous Offenses and Index Offenses .......... 85
Table 9  Descriptive Statistics of the PCL-R and HCR-20 ................................ 87
Table 10  Unit Costs for Specific Violent and Non-Violent Crimes in 2018 Canadian Dollars .............................................................................................................. 89
Table 11  Descriptive Statistics of Prospective Criminal Charges and Convictions 96
Table 12  Mean and Standard Deviation of Cost Estimates for Prospective Criminal Charges and Convictions ................................................................. 97
Table 13  Mean and Standard Deviation of Prospective Total Cost Estimates ...... 98
Table 14  Mean and Standard Deviation of Prospective Total Cost Estimates Per Year in the Community ................................................................. 98
Table 15  Mann-Whitney U Test Results for Absolute Cost Differences Between High and Low PPD Groups (PCL-R Cut-Off of 30) ........................................ 99
Table 16  Mann-Whitney U Test Results for Absolute Cost Differences Between High and Low PPD Groups (PCL-R Cut-Off of 25) ........................................ 100
Table 17  Mann-Whitney U Test Results for Absolute Cost Differences Between High and Low PPD Groups (3-Facet PCL-R Cut-Off of 17) ...................... 100
Table 18  Mann-Whitney U Test Results for Cost Differences Per Year Living in the Community Between High and Low PPD Groups (PCL-R Cut-Off of 30) ......................................................................................................................... 101
Table 19  Mann-Whitney U Test Results for Cost Differences Per Year Living in the Community Between High and Low PPD Groups (PCL-R Cut-Off of 25) ......................................................................................................................... 102
Table 20  Mann-Whitney U Test Results for Cost Differences Per Year Living in the Community Between High and Low PPD Groups (3-Facet PCL-R Cut-Off of 17) ......................................................................................................................... 102
Table 21  Differences of Low Estimated Absolute Costs Between HCR-20 Summary Risk Judgment Groups ............................................................................ 103
Table 22  Differences of High Estimated Absolute Costs Between HCR-20 Summary Risk Judgment Groups ................................................................. 104
Table 23  Differences of Low Estimated Costs Per Year in the Community Between HCR-20 Summary Risk Judgment Groups ................................................. 105
Table 24  Differences of High Estimated Costs Per Year in the Community Between HCR-20 Summary Risk Judgment Groups ................................................. 105
Table 25  Steiger’s Test of Differences Between the HCR-20 and PCL-R (Cut-Off of 30) Correlation Coefficients for Total Costs ................................................................. 106
Table 26  Steiger’s Test of Differences Between the HCR-20 and PCL-R (Cut-Off of 25) Correlation Coefficients for Total Costs ................................................................. 107
Table 27  Steiger’s Test of Differences Between the HCR-20 and PCL-R (Cut-Off of 17) Correlation Coefficients for Total Costs ................................................................. 107
Table 28  Tobit Regression Results for PCL-R and HCR-20 (Without H7) Total Scores Predicting Absolute Costs of Crime ................................................................. 109
Table 29  Tobit Regression Results for PCL-R and HCR-20 (Without H7) Total Scores Predicting Total Costs of Crime Per Year in the Community .... 110
# List of Figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1</td>
<td>Comprehensive Assessment of Psychopathic Personality (CAPP; Cooke et al., 2012)</td>
<td>27</td>
</tr>
<tr>
<td>Figure 2</td>
<td>CAPP Traits that Motivate Violent Decisions</td>
<td>34</td>
</tr>
<tr>
<td>Figure 3</td>
<td>CAPP Traits that Disinhibit Violent Decisions</td>
<td>36</td>
</tr>
<tr>
<td>Figure 4</td>
<td>CAPP Traits that Destabilize Violent Decisions</td>
<td>39</td>
</tr>
<tr>
<td>Figure 5</td>
<td>Influence of Motivators, Destabilizers, and Disinhibitors on Violence</td>
<td>43</td>
</tr>
<tr>
<td>Figure 6</td>
<td>Frequency Distribution of Monte Carlo Simulation for North American PPD-Related Crime Costs</td>
<td>78</td>
</tr>
<tr>
<td>Figure 7</td>
<td>Frequency Distribution of Monte Carlo Simulation for UK PPD-Related Crime Costs</td>
<td>78</td>
</tr>
</tbody>
</table>
Preface

Psychopathic personality disorder (PPD; psychopathy) burdens people, both those with the disorder and those who come across its path. Its burden is direct and indirect. To a large degree, this burden is inherent and intuitive from the concept: Psychopathy is a personality disorder, and with it comes dysfunction. Researchers commonly acknowledge that psychopathy has stark impacts at a societal-ecological level. Hare poignantly commented:

One of the interesting findings to emerge from the research is that in spite of their small numbers—perhaps 1% of the general population—psychopaths make up a significant proportion of our prison populations and are responsible for a markedly disproportionate amount of serious crime and social distress. (1999, p. 186)

Hare does not stand alone on this issue. Others have argued that psychopathy imposes a major social burden (e.g., Beaver et al., 2014; Kiehl & Hoffman, 2011; Reidy et al., 2015; Reidy, Kearns, & DeGue, 2013). Researchers and clinicians may perceive the burden of PPD as intuitive. But how severe is this burden? And why precisely does psychopathy burden us? Upon contextualizing psychopathy research and theory, I addressed these questions by conducting the following studies:

1. A conceptual framework for why psychopathy contributes to crime and violence.

2. An estimation of the Canadian, UK, and US economic burden of PPD in the criminal justice system (CJS) at a population level (i.e., top-down).

3. A sample-level or bottom-up estimation of the Canadian economic cost of crime attributable to PPD among federal offenders.

I hoped to integrate the findings from each topic to develop a concluding narrative demonstrating the serious magnitude of psychopathy. In an effort to not bury the lede, my concluding opinion is that crime committed by those with PPD produces disproportionate economic losses. At a microscopic or individual level, such losses are felt by those diagnosed with the disorder and the victims of their crimes. At a macroscopic level, different state, provincial, and national social systems (e.g., criminal justice, health, workforce) are left footing the bill. Understanding these costs is the first step to their mitigation.
Chapter 1. Central Issues Regarding Psychopathic Personality Disorder

Readers extensively familiar with the scientific and clinical psychopathy literature may jump directly to this chapter’s Concluding Remarks section to read my core assumptions regarding psychopathy. Otherwise, the following chapter details definitions, models, and measures of psychopathy as well as conceptual issues, including the level of dysfunction associated with psychopathy.

1.1. Definition

Psychopathy or PPD has longstanding clinical origins dating back to the 19th century (see Pinel, 1806), and it is now one of the most researched personality disorders and forms of psychopathology. Over time, the field’s definition of psychopathic personality features has come to include a host of persistent, pervasive, and pathological traits. These traits include, among others, callousness, empathy deficits, incongruous affect, a superficial interpersonal style, lying, manipulation, irresponsibility, impulsivity, poor behavioural controls, and a pattern social misconduct (Cleckley, 1941, 1976; Cooke, Hart, Logan, & Michie, 2012; Hare, 2003; McCord & McCord, 1964).

Putative features also include fearlessness and a lack of anxiety (Lykken, 1955, 1996).¹ The most prototypical of these psychopathic features are subsumed under two higher-order personality domains: antagonism (i.e., non-agreeable people who are deceitful, aggressive, and arrogant) and undependability (i.e., low conscientiousness people who are careless, negligent, and overly hedonistic). This broad conceptualization of psychopathy is supported by conceptual and prototypicality analyses (Lynam & Miller, 2015; Widiger & Lynam, 1998) of the Five Factor Model of personality (FFM; McCrae & Costa, 1997), the predominant contemporary psychological model of personality. With

¹ A lack of anxiety and fearlessness are often tied with the idea of successful psychopathic personality traits (for more details, see Hall & Benning, 2006; Lilienfeld, Watts, & Smith, 2015; Steinert, Lishner, Vitacco, & Hong, 2017). A discussion of this topic goes beyond the scope of this project, which instead, focuses on dysfunctional and moderate-to-high psychopathic expressions.
these defining features in mind, psychopathy measures and models are conceptually tied with dysfunction.

1.2. Models of Psychopathy

PPD, the phenomenon, differs from the assessment and measurement of psychopathy. Such a position aligns with epistemological realism—a contemporary scientific stance—that assumes mental disorders are not socially created by their measurement or diagnostic criteria (i.e., operationism, see Lovett & Hood, 2011). Rather, a disorder like psychopathy exists autonomously of our thought and measurement. Until recently, it was commonplace to confuse the phenomenon or concept of psychopathy with the constructed measurement of psychopathy² (see Cooke, Hart, Logan, & Michie, 2012; Skeem & Cooke, 2010a). That is, the Psychopathy Checklist—Revised (Hare, 1991, 2003) was accepted as both a model and measure of PPD.

Several contemporary models improved our conceptualization of the disorder and distanced the field from an overly PCL-centric definition. Cooke and Michie (2001) blended a theoretical and empirical examination of multiple psychopathy-related measures to derive a hierarchical model. This PPD model includes a superordinate psychopathy factor that encompasses three domains: Interpersonal, Affective, and Behavioural. Of note, this model does not include criminal and antisocial behaviour. These outcomes are viewed as products, correlates, or epiphenomena of psychopathy rather than core dispositional features of psychopathy. Such a position reflects a trend in the field to regard psychopathy as a personality disorder rather than as a concept designed for violent or criminal risk assessment (Cooke, Michie, Hart, & Clark, 2004; Skeem & Cooke, 2010a, 2010b; cf. Hare & Neumann, 2010).

Other models include the Comprehensive Assessment of Psychopathic Personality (CAPP; Cooke, Hart, & Logan, 2004; Cooke et al., 2012), a lexical concept map that defines PPD using simple symptom-based adjectives that are organized

² The concept or term construct can be semantically misleading. The field has commonly used the concept "construct" to mean the phenomenon of psychopathy that exists in the world. Slaney and Garcia (2015) assert that the term construct is poorly selected because, in fact, measurement tools and exact diagnostic criteria are literally constructed, not psychopathy itself.
rationally into six domains (i.e., empirical modelling was not originally conducted). The CAPP has growing support for its content validity via analysis of prototypicality (Kreis, Cooke, Michie, Hoff, & Logan, 2012), lexical similarity (Gatner, Douglas, & Hart, 2017), and domain–symptom structural congruency (Hoff, Rypdal, Hart, Cooke, & Mykletun, 2015).

The Triarchic model of psychopathy (Patrick, Fowles, & Krueger, 2009), an alternative contemporary model, includes three phenotypic domains of psychopathic personality: boldness, meanness, and disinhibition. Some evidence supports its content validity (e.g., Few, Miller, & Lynam, 2013; Sörman et al., 2016), and Triarchic-based measures have shown a promising pattern of intercorrelations with other measures of psychopathy (Lilienfeld et al., 2016; cf. Gatner, Douglas, & Hart, 2016, 2017; Miller & Lynam, 2012). Additionally, the FFM of psychopathy conceptualizes psychopathy using dysfunctional extremes of universal personality domains and their underlying facets (Widiger & Lynam, 1998; Miller, Lynam, Widiger, & Leukefeld, 2001). This FFM includes core psychopathic features (see Lynam et al., 2011) such as antagonism, dominance, broad impulse control, outward expressions of negative affect (e.g., anger), and poorly experienced negative affect (e.g., anxiety). Overall, despite being researched extensively, psychopathy models still differ in their content and theoretical assumptions.

1.3. Measuring and Assessing Psychopathy

For most psychological concepts, the phenomenon definition interacts with its assessment tools. This is no truer than for the Psychopathy Checklist—Revised (PCL-R; Hare, 1991, 2003), the most commonly used tool to guide the assessment of PPD. It includes 20 clinician-rated items that are scored from collateral information and clinical interview. Although the PCL-R was not intended to be a comprehensive risk assessment tool and psychopathy remains only one of many criminal and violence risk factors (Hart, 1998), a consistent moderate correlation has emerged between PCL-R and antisocial outcomes such as violence and crime (Douglas, Nikolova, Kelley, & Edens, 2015; for more details see Chapter 2).

The PCL-R has nonetheless been subject to criticism, including its predictive validity (e.g., Gendreau, Goggin, & Smith, 2002; cf. Hemphill & Hare, 2004). For instance, a systematic meta-regression of commonly cited risk assessment tools
revealed that the PCL-R had the second weakest predictive validity of offending (Singh, Grann, & Fazel, 2011). The PCL-R field reliability has also been criticized for having weaker reliability in applied and adversarial settings than in research applications (e.g., Miller, Kimonis, Otto, Kline, & Wasserman, 2012; Sturup et al., 2014; cf. Hare, 2016). Thus, despite its frequent use and extensive research support, some issues have emerged regarding the PCL-R.

These criticisms notwithstanding, the PCL-R has strong psychometric properties (i.e., reliability, as well as factor, convergent, and discriminant validity) in comparison to different psychopathy measures and other psychological tests (Acheson & Olmi, 2005; Hare 1991, 2003; Hart, Cox, & Hare, 1995). It has reached the highest standards of reliability for psychological tests; its structural reliability (e.g., Cronbach’s alpha, corrected item-total correlations) has been reported in the high range (Hare, 2003; Storey, Hart, Cooke, & Michie, 2016). Further, the PCL-R meets legal admissibility standards in many contexts (DeMatteo, Hodges, & Fairfax-Columbo, 2016). In sum, researchers should criticize the PCL-R, and such criticism should help improve forensic psychological evaluations; however, the PCL-R remains the eminent assessment tool for psychopathy, and it stands as a relatively sound psychological measure.

The PCL-R has rightfully taken a central focus in the psychopathy literature, but other assessment instruments exist. The Comprehensive Assessment of Psychopathic Personality—Institutional Rating Scale (CAPP-IRS; Cooke et al., 2004) is a 33-item tool of psychopathy that relies on rater judgment using interview, observation, and other collateral information. Assessment timeframes can vary between lifetime prevalence (like the PCL-R) and recent symptom presentation in the past six months. The CAPP-IRS has initial evidence supporting its structural, internal, and interrater reliability (Floréz et al., 2018; Sandvik et al., 2012; Sea, 2018) and convergent validity with other measures of psychopathy and relevant constructs (Sandvik et al., 2012) among forensically-involved individuals. Although the evidence-base for the CAPP-IRS has been initially promising, it remains underdeveloped.

A strong research focus on assessing psychopathy has also stimulated the development of many self-report measures. The most validated self-report tool has been the Psychopathic Personality Inventory (PPI; Lilienfeld & Andrews, 1996; Lilienfeld & Widows, 2005). Although self-report measures are efficient to administer and help
assess subjective experience (e.g., empathy, self-concept), they are susceptible to intentional and non-intentional response distortion relevant to the psychopathic traits these tools attempt to assess (e.g., lying, manipulation, grandiosity, incongruent emotional experiences, see Breuk, Clauser, Stams, Slot, & Doreleijers, 2007; Kelsey, Rogers, & Robinson, 2015; cf. Ray et al., 2013). It is possible for this reason that, in my review of the literature, self-report inventories strictly measuring psychopathy are not being used in clinical assessments of the disorder. Instead, broader self-report inventories of personality and psychopathology are incorporated as sources of information relevant to the assessment of psychopathy. Specifically, the Personality Assessment Inventory (PAI, Morey, 1991) and the Minnesota Multiphasic Personality Inventory-2 (MMPI-2-RF, Ben-Porath, & Tellegen, 2008, 2011) include clinical scales that tap into concepts that are relevant to psychopathic traits (Morey, 2003).

Many methods and measures can inform the assessment of the psychopathy, and this statement reflects that the PCL-R should not be conflated with or reified as the concept of psychopathy. Skeem and Cooke (2010a) summarized eloquently that “a PCL–R score is not psychopathy any more than an intelligence test score is intelligence itself. A PCL–R score represents a way, not the way, to assess psychopathy” (p. 437). Still, the PCL-R remains the most validated and commonly used psychopathy assessment tool.

1.4. Conceptual and Definitional Issues

1.4.1. Psychopathy: A Mental Disorder

Is psychopathy a mental disorder? Hart and Cook (2012) commented that some researchers and clinicians—incorrectly—believe PPD does not exist. Yet, the vast theoretical, conceptual, and empirical work states that PPD should be considered a mental disorder. Some confusion stems from cursory reads of the Diagnostic and Statistical Manual of Mental Disorders (DSM; e.g., American Psychiatric Association, 2013), the commonly used nosological system for psychiatric and psychological diagnosis. The fifth edition of the DSM (DSM-5; American Psychiatric Association, 2013) and previous iterations have not included psychopathy as an official diagnosis. Yet, the alternative model for personality disorders includes a psychopathic features specifier for antisocial personality disorder (APD). Under the DSM-5 diagnostic features of APD, the
pattern “has also been referred to as psychopathy, sociopathy, dissocial personality disorder (p. 659),” while the International Classification of Diseases and Related Health Problems (ICD-10) includes a diagnosis of dissocial personality disorder. Regardless that diagnostic systems do not exhaustively account for all disorders and psychological phenomenon, clearly, psychopathy is captured by current psychiatric nosological systems.

Direct DSM and ICD references notwithstanding, some scholars also have put forth that psychopathy and APD are distinct constructs or phenomena (e.g., Ogloff, 2006; Steeler, Freeman, DiGiuseppe, & Mitchell, 2013). Much like the erroneous PCL-R–psychopathy confusion, which stems from conflating conceptual phenomena with measures, different diagnostic measures (DSM-based APD, ICD-based dissocial PD, PCL-R-based psychopathy) have created the incorrect notion that distinct phenomena exist. Granted, psychopathy, APD, and dissocial personality disorders all differ in their operational definitions; however, they are ultimately different terms for the same disorder (see Cooke & Michie, 2001; Hart & Cook, 2012). From a pragmatic perspective (i.e., comprehensive DSM reading, differentiating concepts and measures), psychopathy is recognized indirectly and directly as a mental disorder, although sometimes different terms are used.

Yet, conceptually or theoretically, what constitutes a (a) mental disorder and (b) personality disorder? And does psychopathy match onto these constituent elements? A disorder means that something is not working correctly in an organism (Spitzer, 1999). A mental disorder is a syndrome of disturbed cognition, emotion, or behaviour that is clinically significant and underpinned by dysfunction in mental functioning (e.g., biopsychological or developmental processes; see American Psychiatric Association, 2013). Additionally, mental disorders are typically associated with distress or disability (e.g., social, health, occupational dysfunction). This definition is quite broad, and concerns have been raised that the terms clinical significance and dysfunction are conceptually vague and lack of operational consensus (Kecmanovic, 2013; Spitzer, 1999).

Scholars have attempted to address these concerns. Spitzer (1999) noted that harmful dysfunction means (a) people wish whatever is not working was working, and (b) what is not working is dictated by our heritage or natural selection (Spitzer, 1999).
Wakefield (1992) discussed similar themes. Specifically, that a disorder is harmful and dysfunctional, and the latter is a product of facts and values. The dysfunction should objectively disrupt natural or evolutionary function and not simply be socially construed (i.e., facts), but the dysfunction should also cause harm as defined by cultural standards (i.e., values). With these definitional components in mind, how do they relate to psychopathy or PPD?

Psychopathy appears to meet these standards of a mental disorder. It includes many putative mental processes (e.g., biopsychological, developmental) that cause dysfunction (see below for details). From a sociocultural standard, people with psychopathy cause extreme harm, and they disrupt many social expectations. People with psychopathy cause violence, crime, interpersonal pain, difficulties at work, and stress on acquaintances and families. Although some scholars have argued that psychopathy is evolutionarily adaptive (see Glenn, Kurzban, & Raine, 2011), people with APD are more likely to die from non-natural causes (Repo-Tiihonen, Virkkunen, & Tiihonen, 2001), and people with psychopathy have deficient affective experiences (Hare, 2003)—emotions are meant to serve adaptive purposes such as motivating behaviour and communicating important information with oneself and others (see Linehan, 2015). Overall, psychopathy involves (a) mental functioning (biopsychological or developmental processes) that is (b) disordered (something that is not working based on social and natural standards).

**Personality Disorder.** A personality disorder is a specific form of mental disorder where the dysfunction becomes enduring, beginning in adolescence or early adulthood (Livesley & Jang, 2005). Livesley (1998) conceptualized personality disorder as a personality structure that causes dysfunction. This structure is a broad heuristic or system, which includes complex interactions between traits (i.e., enduring dispositional expression), systems of the self and interpersonal relations (i.e., consisting of beliefs or rules about oneself and others), environmental context, and output (i.e., behaviour which is influenced by cognition and emotional; Livesley, 2003).

Problems may occur at different structures and processes of the personality system (Livesley & Jang, 2005), which results in failing to achieve basic human adaptive functioning. This point is not trivial. Extreme trait expression is not a sufficient criterion for a personality disorder because traits are not outcomes; they are proclivities or
tendencies that increase the likelihood for problems or psychopathology (Livesley & Jang, 2005). For extreme traits to become symptomatic, they must be associated with dysfunction that often occurs in three primary areas: self-concept, familial relationships, and societal relationships (Livesley, 1998, 2003). For instance, someone might be extremely shy most of the time (i.e., extreme trait), but they adapt for critical life events (e.g., obtaining a job, meeting an intimate partner). This person has an extreme trait, but they are not experiencing significant dysfunction. PPD is no different. Its traits must—and often do (see the dysfunction section below)—result in dysfunction.

Just as psychopathy meets the criteria of a mental disorder, so too does it meet the conceptual criteria of a personality disorder. It fits within a personality structure, it is dysfunctional, and as noted below, it takes the form of a relatively enduring form of mental disorder. Most clinicians and academics consider psychopathy a personality disorder (Cooke & Logan, 2015) and others commented that it is possibly the “prototypic personality disorder” (Crego & Widiger, 2015, p. 665). Why is this important? The knowledge that psychopathy or PPD is broadly a mental disorder and specifically a personality disorder is fundamental to conducting an economic analysis of crime costs attributable to people with PPD. PPD is an illness that people suffer from; it is not simply a broad psychological concept (e.g., extraversion). As such, this dissertation need not take a nebulous variable-centric approach where all people are expected to be affected by psychopathy (i.e., the trait independent of dysfunction). Instead, its potential implications can be drawn from a person-centric approach where analysis is focused on people with PPD.

1.4.2. Psychopathy: Kind or Continuum?

If psychopathy reasonably meets all requisite criteria of a mental disorder, how should we measure, assess, and identify those with this personality disorder? Across all personality disorders, there is a trend toward conceptualizing and assessing personality disorders across a continuum of normal personality traits rather than focusing on categorical diagnoses based on symptom counts (Widiger & Costa, 2013). Some have criticized categorical approaches for causing disproportionate levels of comorbidity among personality disorders and for poor diagnostic utility with respect to treatment formulation (McCrae & Costa, 2013). Nonetheless, the DSM-5 (American Psychiatric Association, 2013) rejected the proposed personality disorder models that integrated
dimensional perspectives. Psychopathy, as a specific form of personality disorder, has not been exempt from this discussion.

The categorical conceptualization posits that people with PPD are qualitatively different than those without psychopathy (Walters, Duncan, & Mitchell-Perez, 2007). Conversely, the dimensional or continuum approach conceptualizes PPD as a set of extreme psychopathic traits, which are qualitatively the same but far less expressed in people without PPD. Originally, taxometric analyses of forensic psychiatric patients supported the categorical approach (Harris, Rice, & Quinsey, 1994; Skilling, Harris, Rice, & Quinsey, 2002). These initial findings were criticized for methodological limitations, including an unsuitable sample, dichotomizing PCL-R items, and file-based assessment (Edens, Marcus, Lilienfeld, & Poythress, 2006). More recently, PCL-R scores have demonstrated a better fit using a dimensional structure among North American inmates (Guay, Ruscio, Knight, & Hare, 2007; Walters et al., 2007) and court-ordered drug treatment patients (Edens et al., 2006). These findings suggest that the PCL-R identifies differences in the extremity of psychopathic traits rather than distinct classes (i.e., presence or absence of PPD).

A similar pattern emerged for other measures of psychopathy. A self-report inventory of psychopathy was reported as better fitting across a continuum than categorically (Marcus, John, & Edens, 2004), and similar findings have been reported for measures of psychopathic disturbance among delinquent youth (Edens, Marcus, & Vaughn, 2011; Murrie et al., 2007; Walters, 2014; cf. Vasey, Kotov, Frick, & Loney, 2005). Although the findings lack unanimity, on a balance, this body of evidence supports studying psychopathy from a dimensional approach. This implies that psychopathy can also be examined using statistical procedures that address continuous variables rather than only group comparisons.

Despite support for the dimensional nature of psychopathy, there are arguments against assessing and researching strictly from this perspective. First, Maraun and Hart (2016) argue that researchers have erred regarding the logic, specification, and methods used to test distributions of PPD and whether it is a naturally occurring category. Through conceptual and empirical analysis, the authors asserted that the categorical vs. dimensional debate remains unanswered because the relevant questions are not presently empirically testable.
Second, applied and pragmatic issues also need to be considered. The relevance of PPD is greatest in criminal justice contexts, but the dimensional conceptualization is at odds with North American legal systems, where decisions are often binary (Marcus, Poythress, Edens, & Lilienfeld, 2010). In the U.S., sexual offender legislation highlights psychopathy as central to clinical opinions, with some statutes including the concept of sexual psychopathy (DeMatteo, Edens, Galloway, Cox, Smith, & Formon, 2014). And although clinicians are unlikely (i.e., approximately 20%) to report a definite PPD diagnosis in legal cases, they are likely to describe their PCL-R assessments as scoring qualitatively low or high (DeMatteo, Edens, Galloway, Cox, Smith, Koller, & Bersoff, 2014). In these contexts, categorical opinions appear germane to legal decisions.

Categorical conceptualization and assessment of PPD is also relevant in violence risk assessment. Qualitative statements regarding psychopathy have strong positive associations with risk statements, such that individuals who were described as highly psychopathic were also frequently (88% of the time) assessed as high risk to reoffend (DeMatteo, Edens, Galloway, Cox, Smith, Koller, & Bersoff, 2014). The opposite was true for those described with low PCL-R scores (i.e., they were assessed as low risk to reoffend). In practice, when conducting a violence risk assessment guided by the Historical-Clinical-Risk Management-20, Version 3 (HCR-20V3; Douglas, Hart, Webster, & Belfrage, 2013), the presence of PPD is considered in qualitative terms (absent, partially present, or diagnostically present). Across multiple contexts, psychopathy is considered categorically rather than as a continuous dimension.

In sum, although empirical support exists for the dimensional perspective where psychopathy differs by degree rather than by kind, fundamental logical concerns underpin the empirical support for defining and assessing PPD from this perspective (Maraun & Hart, 2016). Further, diagnostic classification and qualitative labels are still relevant to legal and violence risk decision-making. Because of discrepancies between empirical findings, logic, and practice, researchers should consider the context and purpose of their PPD research and whether it addresses primarily theoretical or applied issues (see Mook, 1983) before selecting a categorical or dimensional approach. Indeed, such a consideration was central for this dissertation because the findings may resonate strongly with policy members who often think about personality disorders in a categorically all-or-nothing fashion.
1.4.3. Developmental Stability of Psychopathy

Personality crystalizes in early adulthood—or so the common personality assumption goes. The DSM-5 (American Psychiatric Association, 2013) and the ICD-10 (World Health Organization, 1992) note that personality disorder diagnoses are eligible only for those at or above the age of 18 and 25, respectively. Personality has been described as a stable psychological phenomenon—second only to cognitive ability (Caspi, Shiner, & Roberts, 2005). Such an enduring pattern has also been a core assumption of personality disorders (Clark, 2007). Yet, across empirical studies of personality, nuance exists. Personality has been reported as relatively stable across the lifespan but also has the potential for meaningful change (Anusic & Schimmack, 2016; Caspi & Roberts, 2001). Such stability does not reach its strongest point until after 50 years old (Roberts & DelVechchio, 2000). A similar pattern holds for personality disorders where moderate mean-level change has occurred across early and middle adulthood (Clark, 2007). For instance, among inpatients with borderline personality disorder, there was substantial symptom-level change over time and remission was relatively common (Zanarini, Frankenburg, Hennen, Reich, & Silk, 2005). Despite assumptions of rigid stability, a review of personality disorder research suggested that the degree of stability varied based on conceptual and methodological considerations (Morey & Hopwood, 2013). Empirical evidence suggests that personality traits and disorders can change—to some degree—over the lifespan, and that assuming stability from late adolescence is a misrepresentation of the evidence (Morey & Hopwood, 2013). If psychopathy is a personality disorder, should it be excused from the broader personality literature?

Not only do personality traits change, but context influences the severity of their dysfunction. A contextualist view of personality (see Lewis, 2001) posits that situations—where traits are expressed—will dictate the severity of dysfunction. For example, being overly dominant might produce fewer problems for the professional football coach than for the elderly care worker. Contextualist views of personality are in keeping with the Alternative DSM-5 Model of Personality Disorders (American Psychiatric Association, 2013) where clinicians assess life impairment associated with personality traits.

For PPD, its developmental and temporal stability may best be understood by blending this contextualist approach with biological etiological mechanisms (e.g., Beauchaine, Klein, Crowell, Derbidge, & Gatzke-Kopp, 2009; Ribeiro da Silva, Rijo, &
Salekin, 2012). The contextual perspective may account for why impulsive and antisocial aspects of psychopathy have declined over the lifespan (Harpur & Hare, 1994); the context for this dysfunction (e.g., crime, reckless behaviour) may present itself less often as one ages. The biological perspective suggests that the development and stability of psychopathy may have strong genetic heritability (Beaver, Rowland, Schwartz, & Nedelec, 2011; Viding & Larsson, 2010). Regardless of developmental stance, evidence suggests that psychopathy can fluctuate over people’s life courses.

Using a longitudinal approach for community members and serious offenders, the temporal correlation of self-reported psychopathic traits between late adolescence and young adulthood (i.e., 17 to 23 years old) was low-to-moderate ($r = .16$ to $.39$; $t = .25$ to $.33$; intraclass coefficients $= .40$ to $.41$; Hawes, Mulvey, Schubert, & Pardini, 2014; Loney, Taylor, Butler, & Iacono, 2007). These correlations weakened as the time interval increased from the baseline assessment. For young adult offenders (ages 26 to 29), PCL-R Total scores were quite stable ($r = .71$) at a 2-year follow-up (Cauffman, Skeem, Dmitrieva, & Cavanagh, 2016), but diagnostic stability was less stable; only 53% of these adult offenders classified as psychopathic met the same criteria two years later. Likewise, the PCL-R scores of older methadone patients had moderate-to-high mean-level and rank-order stability (i.e., $.43$ to $.65$; see Rutherford, Cacciola, Alterman, McKay, & Cook, 1999). These findings suggest that although psychopathic traits have moderate stability over time and developmental periods, plenty of variability in psychopathy exists intra- and inter-individually, including diagnostic stability. Similar to personality and personality disorders, the empirical evidence specific to PPD suggest it becomes more stable as people grow older.

Developmental research on PPD has often been conducted using Psychopathy Checklist derivatives (i.e., measures of life prevalence; see Hare, 2003). Thus, these measures may not necessarily be adequately sensitive to accurately detect the full degree to which psychopathy can change. Much like personality disorders generally, the development of psychopathy can be summarized such that before “the age of 50 that character may set like plaster; before then, it’s more like being set in clay—change can occur” (Clark, 2007, p. 242). This claim has major implications for the management and treatment of psychopathy because forensic rehabilitation focuses relies heavily on the Risk-Needs-Responsivity model (RNR; Andrews, Bonta, & Hoge, 1990), which posits that interventions should target dynamic or criminogenic risk factors—targets that can
change. Specific to the current dissertation, if the cost of crime attributable to PPD is substantial, then this body of evidence suggests that PPD and its dysfunction has some potential to be influenced or changed.

1.5. Psychopathy and Dysfunction

Most measures and models of PPD assess and describe only trait extremity. However, personality disorders include (a) extreme traits (e.g., callousness) that (b) must also lead to dysfunction (Livesley & Jang, 2005). The association between PPD and recidivism or violence is likely the most harmful outcome (for more details see Chapter 2). However, PPD is associated with many other harmful and dysfunctional sequelae. A brief overview of such dysfunction will situate psychopathy as a personality disorder and will promote a discussion—beyond the cost analyses of this dissertation—of improving the treatment of the disorder.

Behavioural features of PPD (e.g., impulsivity, poor behavioural controls, antisocial history) have been associated with suicidality, whereas the interpersonal and affective traits have been uncorrelated with suicidality among undergraduates, civil psychiatric patients, and federal offenders (Douglas, Herbozo, Poythress, Belfrage, & Edens, 2006; Swogger, Conner, Meldrum, & Caine, 2009; Verona, Sprague, & Javdani, 2012). Although interpersonal and affective psychopathic traits may protect against suicide on their own, for undergraduate women, the interaction between these traits and behavioural traits was associated with suicidal behaviour above their main effects (Verona et al., 2012). Thus, despite initial views (e.g., Cleckley, 1941), PPD does not necessarily protect against suicide, and some of its features may be associated with increased incidence.

Psychopathy is also correlated with illicit substance misuse, particularly drug abuse disorders (see Ellingson, Littlefield, Vergés, & Sher, 2018; Taylor & Lang, 2006, for reviews). PCL-R scores for offenders and forensic psychiatric inpatients are moderately associated with drug use, drug abuse/dependence, and the number of tried substances, with Factor 2 scores frequently showing a significantly larger association than Factor 1 scores (Hemphill, Hart, & Hare, 1994; Walsh, Allen, & Kosson, 2007). Among undergraduates, prison inmates, and other forensically-involved people, self-reported psychopathy traits were moderately associated with different forms of drug
abuse and drug-related problems (Sellbom, Donnelly, Rock, Phillips, & Ben-Porath, 2017), and this pattern was generally consistent between men and women.

Psychopathic dysfunction also presents itself by disrupting healthy intimate relationships (Mooney, Ireland, & Lewis, 2019). In community dyads, self-reported psychopathy was negatively associated ($r \approx -.20$ to $-.37$) with relationship satisfaction perceived by the other intimate partner (Savard, Sabourin, & Lussier, 2011), and psychopathy was associated with attachment difficulties within these intimate relationships (Savard, Brassard, Lussier, & Sabourin, 2015). Among undergraduates, self-reported psychopathy was moderately correlated with attachment deficits, including commitment, romance, and trust (Love & Holder, 2016), as well as a manipulative loving style with infidelity (Miller et al., 2011). Although relatively little work has examined the impact of PCL-R-indexed psychopathy and relationship dysfunction, several PCL-R items tap directly into problems with underdeveloped and brief intimate relationships as well as promiscuous sexual behaviour (Hare, 2003). Empirically and conceptually, people with psychopathic features likely cause emotional or psychological harm to intimate or sexual partners.

This interpersonal conflict extends to the workplace. Self-reported and informant-based psychopathy has been associated with dysfunction at work. Employees’ ratings of their direct supervisors using the B-SCAN 360 (Babiak & Hare, 2014)—an informant-report measure of psychopathy in corporate settings—were positively associated with job dissatisfaction, family conflict, and psychological distress for these employees (Mathieu, Neumann, Hare, & Babiak, 2014), as well as poor leadership skills by the supervisors (Mathieu, Neumann, Babiak, & Hare, 2015). Structural equation modelling indicated that psychopathic traits influenced supervisory abuse, which resulted in job turnover and decreased job satisfaction (Mathieu & Babiak, 2016). And although they made up only a small fraction of Australian corporate managers (1%), those who were highly psychopathic—as measured by a behavioural proxy—disproportionately bullied their employees (Boddy, 2011). This is all to say, psychopathic traits can emerge in workplace environments to cause interpersonal harm and diminished productivity.

Even before exploring the criminal difficulties that so commonly plague people with PPD, this literature overview demonstrates that psychopathic dysfunction emerges in many other forms—a useful consideration when criminality is often a diagnostic
criterion of PPD. Psychopathic individuals are at increased risk for suicidal behaviours, drug-related use, work problems, and intimate relationship problems. In light of these diverse and unhealthy behaviours, it is unsurprising that Finnish offenders with antisocial personality disorder were six to seventeen times more likely to die from non-natural causes (Repo-Tiihonen et al., 2001). This finding is a suitable capstone for understanding the serious dysfunction associated with psychopathic features. Not only does psychopathy cause problems for others, it likely drastically impacts those afflicted by the disorder.

1.6. Concluding Remarks

Counterfactual thinking can improve understanding of complicated topics (Pearl & Mackenzie, 2018). For instance, brainstorming with clients on how to be more miserable can be an effective way to protect against the reoccurrence of depression (see Patterson, 2016). To understand the lay of the proverbial psychopathy land, core issues regarding psychopathy are summarized—somewhat irreverently—by thinking about what psychopathy is not.

1. Psychopathy is not a measure like the PCL-R. Instead, it is a phenomenon that exists independently of measurement, which has been defined differently across conceptual models. Specific measures try to capture the phenomenon as accurately as possible, and the PCL-R is currently the best available tool to inform the assessment of psychopathy.

2. Psychopathy is neither violence nor crime. Most violent people are not psychopathic. Instead, violence and crime are commonly occurring forms of dysfunction for those with the disorder, and antisocial conduct may help infer psychopathic traits. And beyond crime and violence, other forms of dysfunction also exist (e.g., interpersonal conflict, suicidality, substance abuse, work problems).

3. Psychopathy is not simply a broad psychological concept. It meets criteria for a mental disorder and specifically for a personality disorder. It may not exist in the DSM as a primary diagnosis, but “psychopathy” is referenced as a synonym for
antisocial personality disorder (see American Psychiatric Association, 2013, p. 659), and it has existed in clinical contexts for over a century.

4. Psychopathy is not unchangeable. Certainly, it is less dynamic than a person’s daily emotional fluctuations, but it is likely a misnomer that personality disorders are fully fixed across time.

5. Psychopathy is not definitively understood as a taxon or a continuum of normal personality traits. Instead, thought must be given to the theory, evidence base, and purpose of researching and assessing psychopathy to determine the most appropriate conceptualization.

Describing these fundamental tenets was not (only) my attempt at demonstrating my knowledge of the field of PPD. It also highlighted central themes that underpin the nature and purpose of this dissertation. Psychopathy is distinct from crime, it is a mental disorder, and it likely can change to some unknown degree. If PPD causes serious economic hardship for Western nations because of crime, then with these aforementioned themes in mind, there is hope for reducing this impact and helping those who suffer from the disorder—difficult as this endeavor might be. These empirical and conceptual issues were considered paramount for anchoring discussions of my dissertation findings. Readers are invited to explore Chapter 2, which analyzes why PPD symptoms lead to crime and violence.
Chapter 2. Violence Risk Formulation and PPD

Chapter 2 addresses the why. Why do people with PPD commit violence and crime, and why are they more likely than others to commit such acts in the future? As detailed below, it is scientifically reasonable to assume that violence and crime co-occur with personality disorders, including PPD. But why do they co-occur? Using conceptual and theoretical analysis from a violence risk formulation framework, I argue that PPD influences people to make violent and criminal decisions.

One of the goals of this chapter was to develop a rationale for the subsequent empirical costing studies (see Chapter 3), but I also aimed for it to stand alone as a useful resource. For mental health and threat assessment professionals, this chapter may help inform violence risk formulation when psychopathic personality symptoms are present and relevant. It may aid in bridging the gap between violence risk assessment and management. For researchers, this chapter presents testable mechanisms of how PPD and its symptoms might influence violent and criminal decisions.

2.1. Introduction

2.1.1. A Comment on Crime and Violence

If psychopathic dysfunction includes crime and violence, then we should understand their definitions, differences, and similarities. Using the HCR-20V3 definition (Douglas et al. 2013, p. 2), violence is "actual, attempted, or threatened infliction of bodily harm of another person" where harm is either physical or serious psychological harm (e.g., serious distress, depression, anxiety, or fear). This definition warrants some distinctions. First, HCR-20V3 violence includes reckless behaviour causing harm, whereas others would not classify recklessness (e.g., intoxicated driving causing harm) as violent (see Felson, 2013). Within the HCR-20V3 definition, a drunk driver acts willfully and ought to have known that such behaviour reasonably could have caused harm. Second, the current definition of violence is different than aggression (i.e., intentional harm-doing to another person; see Berkowitz, 1989). For violence to occur, harm must be non-trivial or fear inducing. These distinct components of violence make it a broad and multi-faceted concept that is highly specific to the violent players and their context.
Such broadness makes the interplay between violence and crime nuanced. Crime is a violation of sanctioned rules (e.g., laws), which are most often set by one’s government (Felson, 2009). Violence is often deviant or criminal in nature (i.e., rule breaking), but sometimes violence is socially sanctioned such as self-defense, or it is legal and reasonable corporal punishment (Felson, 2009). Thus, violence and crime are related but distinct; they are two concepts of a partially overlapping Venn diagram. In comparison with non-violent crime, violence is theoretically tied much more strongly with interpersonal conflict, revenge, and compliance (Felson, 2009). Given these distinctions, when estimating the cost of crime associated with psychopathy, one must consider general recidivism but also the costs specific to violent crime. Indeed, violent crime results in the highest estimated costs per crime (e.g., McCollister, French, & Fang, 2010).

2.1.2. Personality Disorder, Violence, and Crime

Personality disorders, particularly those classified as Cluster B (e.g., borderline, narcissistic, antisocial, see American Psychiatric Association, 2013), are associated with increased rates of violence (e.g., Cooke, 2010; Nestor, 2002) and crime (e.g., Bonta, Blais, & Wilson, 2014; Walter, Wiesbeck, Dittmann, & Graf, 2011). A meta-analysis comparing healthy controls and people with standardized personality disorder diagnoses reported that personality disorders were a risk factor for violent and non-violent antisocial behaviour (Yu, Geddes, & Fazel, 2012). People diagnosed with personality disorders had an increased association with violence (OR = 3.0) and general antisocial behaviour that included violence (OR = 6.2). Similar effect sizes were observed between personality disorders and recidivism; participants with personality disorders had increased odds for repeated offending (OR = 2.4). Of note, one personality disorder, APD, had a very large—albeit heterogeneous—association with antisociality (OR = 12.8) when compared to those without any personality disorder diagnosis.

To contextualize personality disorders in the broader violence risk assessment literature, I will compare it with another important risk factor for violence: psychotic symptoms (see Douglas et al., 2013; Witt, van Dorn, & Fazel, 2013). Psychotic symptoms were meta-analytically associated with increased odds of violence (median Odds Ratio [OR] = 1.53 to 1.69), particularly positive psychotic symptoms such as hallucinations or delusions (median OR = 2.32; Douglas, Hart, & Guy, 2009). Yet, in
studies of people with personality disorders, those experiencing psychotic symptoms were less likely to be violent (median OR = 0.59; Douglas et al., 2009). If personality disorder has been a stronger risk factor than psychosis, where does it fit within the violence risk literature? Yu and colleagues (2012) note that the violence risk associated with personality disorders—as a broad category—are similar to bipolar disorders and head injury, whereas the specific risk for APD is even greater and is similar to substance abuse, which has been meta-analytically reported as a central risk factor (e.g., Bonta et al., 2014).

2.1.3. Psychopathy, Violence, and Crime

How does psychopathy, a specific and serious personality disorder, relate to antisocial conduct? In brief, a moderate association exists between psychopathy and violence or crime (Douglas et al., 2015; Douglas, Vincent, & Edens, 2006). DeLisi (2009) extended beyond this association and argued that psychopathy is a unified theory of crime because of its strong theoretical and empirical ties with a wide range of recidivism. Across numerous meta-analytic reviews, PCL-R Total scores have moderately predicted future violence and general recidivism among adult offender and psychiatric populations (Guy, Douglas, & Hendry, 2010; Leistico, Salekin, DeCoster, & Rogers, 2008; Salekin, Rogers, & Sewell, 1996; Walters, 2003a). The PCL-R has also predicted institutional misconduct (Guy, Edens, Anthony, & Douglas, 2005), sexual recidivism (Hawes, Boccaccini, & Murrie, 2013), as well as reactive and instrumental violence (Blais, Solodukhin, & Forth, 2014). In line with the adult literature, the meta-analytic pattern holds for juvenile offenders with psychopathic features. The Psychopathy Checklist: Youth Version (PCL:YV; Forth, Kosson, Hare, 2003) has moderately predicted institutional misconduct ($r_w = .24$; Edens & Campbell, 2007) as well as general and violent recidivism ($r_w = .24, .25$, respectively), but it did not predict sexual recidivism (Edens, Campbell, & Weir, 2007). Although PPD does not equate to violent and criminal recidivism, it appears to be a frequent consequence of the disorder.

Although the overall bivariate association between psychopathy and violence is robust, it has been heterogeneous (Douglas et al., 2006; Douglas et al., 2015). The most

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3 Salekin and colleagues (1996) included both prospective and postdictive studies in their meta-analysis.
reliable nuance emerges at the domain- or facet-level: PCL-R Factor 2 or the impulsive lifestyle and antisocial facets have better predicted antisocial behaviour than PCL-R Factor 1 or the interpersonal and affective facets (e.g., Hawes et al., 2013; Leistico et al., 2008; Walters, 2003b). For instance, among clinical samples (32 effect sizes; \( N = 10,555 \)), Factor 2 was a moderate predictor of violence, whereas Factor 1 was only a small predictor (Kennealy, Skeem, Walters, & Camp, 2010). Further, the authors observed that Factor 1 did not interact with Factor 2 to add incremental value above the factors’ individual additive effects (Kennealy et al., 2010). From a strict predictive accuracy perspective, these findings have led researchers to promote shifting emphasis away from the broad concept of psychopathy and toward its domains and symptoms.

Psychopathy factor differences notwithstanding, the association with violence has also varied across operationalizations of the disorder. In comparison with the APD operationalization, the assessment of psychopathy has provided more clinical and predictive utility in forensic settings. Offenders with a comorbid diagnosis of psychopathy and APD (vs. APD-only) had more violence in their criminal histories (Coid & Ullrich, 2010; Kosson, Lorenz, & Newman, 2006; Riser & Kosson, 2013). Such a difference does not only emerge because PCL-R-based psychopathy is a more selective diagnosis. Even when increasing the cut-off scores for SCID-based APD (i.e., an increased number of symptoms required for an APD diagnosis, which lowers its prevalence), offenders with PPD had greater criminal versatility and committed more violent crimes than those with only an elevated-APD diagnosis (Riser & Kosson, 2013). If APD and substance abuse are comparably strong violence risk factors (e.g., Yu et al., 2012), it stands to reason that psychopathy is an important consideration in violence risk assessment. This claim is not novel. Hart (1998) recommended that psychopathy must be considered—among many other risk factors—when conducting a threat assessment.

Of course, in social science research, broad claims are subject to nuanced empirical criticism. Despite psychopathy’s association with criminal and violent recidivism, comprehensive violence risk assessments may not be hindered when omitting psychopathy. Across seven raw datasets of correctional offenders as well as forensic and civil psychiatric patients, the HCR-20 (Webster, Douglas, Eaves, & Hart, 1997) added incrementally above the PCL-R when excluding its psychopathy factor (i.e., \( H^7 \); Guy et al., 2010). In multivariate models, the HCR-20 (without \( H^7 \)—but not the PCL-R—also uniquely accounted for violence (Guy et al., 2010). These results suggest
that a comprehensive violence risk assessment guided by the HCR-20 may not be invalidated when excluding the PCL-R.

This finding has serious implications for the role of psychopathy in risk assessment, particularly when espousing that criminality should be excluded from the definition and assessment of the disorder (see Cooke & Skeem, 2010a, 2010b; cf. Hare & Neumann, 2010). Nevertheless, from a pragmatic perspective, psychopathy remains an important violence risk factor among popular risk-assessment tools (e.g., HCR-20^3; Douglas et al., 2013; Violence Risk Appraisal Guide [Quinsey, Harris, Rice, & Cormier, 2006]). Beyond risk prediction, assessing psychopathy can inform case formulations and the intensity of risk management recommendations (Guy et al., 2010). Indeed, Cooke and Logan (2015) also posited that psychopathy can help explain violence at the idiographic level; it may be central to explaining how and why people are violent. This is to say, although it may hold less weight from a statistical risk prediction perspective, PPD is likely still relevant and important to risk management and forensic evaluation.

2.1.4. Functional Nexus between PPD and Violence.

Personality disorder is highly prevalent in forensic settings, which is likely attributable to its association with recidivism and violence. Yet, researchers have rarely extended beyond this bivariate association (Logan & Johnstone, 2010). A black box exists between how personality disorder and violence correlate because top-down theory explaining the mechanisms between the two factors has rarely been discussed. Duggan and Howard (2009) argued that the functional link between personality disorder and violence has not met the scientific criteria to attribute causality (see Haynes, 1992). Namely, covariation between violence and personality disorder has not been fully established, and extraneous third variables have not been adequately ruled out. These criteria have also not been adequately established to explain how other mental disorders might cause violence (Johnstone, 2013). Given that personality disorder is a higher-order concept that may mask nuanced levels of explanation, Duggan and Howard (2009) recommended specifying a variety of causal pathways between personality disorders and violence.

Despite Duggan and Howard’s concerns (2009), some scholars have attempted to specify how personality disorders cause violence and crime. Unfortunately, putative
personality disorder- or psychopathy-based mechanisms for antisocial conduct have been inconsistent and disjointed. What follows below is a review of these explanations.

Logan and Johnstone (2010) analyzed how violence is caused by higher-order personality disorder dimensions known as the dissocial (antagonism, callousness, stimulus seeking) and emotion dysregulation (anxiousness, insecure attachments) dimensions. For people with dissocial or psychopathic personality, which is conceptually and empirically related to narcissism (Blackburn, 2007), they may have threatened egotism. Violence can resolve these problems by elevating personal needs and reestablishing self-esteem (Logan & Johnstone, 2010; Nestor, 2002). Moreover, Baumeister (1996) noted that threats to someone’s narcissistic self-concept (i.e., threatened egotism) forces them to decide how to respond to this conflict. Violence can be the solution, as it expresses anger and avoids revising one’s self-concept (Baumeister, 1996).

Maladaptive cognitions also play a role between dissocial personality and violence. This personality disorder dimension is associated with the core belief that social rules are not personally applicable (Logan & Johnstone, 2010), which reduces the cost of violence. In contrast, the benefits of violence increase when someone develops the dissocial cognitive distortion that banal situations are threatening (Howard, 2015; Logan & Johnstone, 2010). Someone with dissocial personality may also exaggerate the severity of perceived injustices. Such misinterpretations may lead to extreme retribution, including violence. These paranoid cognitions, according to Nestor (2002), exist not only among psychotic disorders, but can be a central cognitive style embedded within personality disorders. That is, people with personality disorders view the world as hostile and threatening, and thus, they may defend themselves using violence (Nester, 2002). Overall, for dissocial personality a host of cognitive, attachment, and self-concept mechanisms (i.e., threatened egotism, social dominance, social misperception, paranoia) are likely to cause interpersonal conflict and emotional tension, which may result in violence.

4 Although the social avoidance (e.g., restricted relationships, intimacy problems) and compulsive dimensions (e.g., constraint, conscientiousness) were causally linked to violence (see Logan & Johnstone, 2010), the dissocial and emotional regulation dimensions are germane to PPD, and as such, their hypothesized mechanisms are discussed in more detail.
For the second personality dimension, emotional dysregulation, the potential for violence can be activated when perceiving an injury through fears of abandonment (Logan & Johnstone, 2010). That is, violence may serve to control others and to express intense emotions. People with emotional dysregulation may also act violently because of poor impulse control (Howard, 2015; Logan & Johnstone, 2010). Such a quality has also been remarked among those with antisocial or dissocial personality features (Nestor, 2002). Similarly, emotional dysregulation may limit down-regulating positive affect (i.e., excitement), which results in a positive feedback loop that reinforces excitement (Howard, 2011). Excitement-seeking may mediate the link between personality disorder and violence (Howard, 2011)—violence provides excitement. Finally, people with emotion regulation deficits may use drugs and alcohol to cope (e.g., gain excitement, numb emotions), which may exacerbate violence risk (Howard, 2011; Logan & Johnstone, 2010). Overall, like dissocial personality, the emotion dysregulation dimension presents behavioural, affective, and cognitive mechanisms that may contribute to violence.

Certain functional mechanisms for violence have also been specifically identified for PPD. With admittedly mixed evidence, three behavioural-emotional mechanisms were identified in a literature review (Berkout, Gross, & Kellum, 2013) of the PPD–deviance association: fearlessness, diminished empathy, and deficient learning from punishment. From a cognitive perspective, early maladaptive schemas may also influence the development of personality disorders (see Beck, Davis, & Freeman, 2015; Beck, Freeman, & Associates, 1990). For PPD specifically, these schemas concern insufficient self-control, mistrust, and low subjugation, which may spur the development of the psychopathic impulsive-lifestyle features, and in turn, contribute to future distorted thinking and antisocial behaviour (Chakhssi, Bernstein, & Ruiter, 2014).

Beyond these brief explanations, a more detailed analysis was conducted by McCuish, Corrado, Hart, and DeLisi (2015) who posited that CAPP-defined psychopathy contributes to persistent violent offending using situational action theory (see Wikström & Treiber, 2009). Specifically, a propensity for violence was influenced by CAPP Sense of Entitlement, Inflexibility, and certain Behavioural symptoms (Disruptive, Recklessness, Aggression). The situational context for violence was influenced by Dominance symptoms (Manipulative, Domineering, Antagonistic), Intolerance, Suspiciousness, and Lack of emotional stability. Finally, Attachment symptoms (Detached, Uncommitted,
Uncaring, Unempathic), Sense of invulnerability, Lack of planfulness, Lack of anxiety, and Lack of emotional depth all reduced the likelihood of deterring violence. The authors acknowledged that these links were conceptual and non-exhaustive. Overall, initial evidence suggests cognitive-behavioural and emotional deficits might contribute to violence among people with PPD, but the precise reasoning and logic remains fuzzy.

A host of putative mechanisms have been identified that link personality disorder to violence and crime. Some mechanisms are directly related to PPD, others are peripherally related through overlapping disordered personality dimensions (e.g., affect dysregulation). Still, these mechanisms remain inconsistent. In other words, the field has taken a shotgun approach where the mechanisms are scattered across theories, categorical systems, and personality conceptualizations.

2.1.5. Purpose

In the current analysis, I intended to identify and clarify how psychopathic personality disorder may cause violence. Despite calls for explaining how PPD and other personality disorders cause crime and violence (e.g., Duggan & Howard 2009), the field had a continued need for more clarity. To my knowledge, a comprehensive model of psychopathy has not been systematically analyzed through a theoretical lens of antisocial behaviour. Using theoretical and conceptual analysis, I identified how Comprehensive Assessment of Psychopathic Personality (CAPP; Cooke et al., 2012) symptoms may cause violence through a violence risk formulation approach: the structured professional judgment (SPJ) framework known as decision theory.

The CAPP was selected because Cooke and Logan (2015) suggested that explaining or formulating violence among psychopathic individuals may be most effective through a CAPP-lens. That is, the lexical development of the CAPP matches a narrative of a person’s past, present, and future violence (i.e., violence risk case formulation [VRCF]). SPJ decision theory includes elements that are central to many theories of crime and aggression, including the general theory of crime and its heavy emphasis on low self-control (Gottfredson & Hirschi, 1990; Hirschi, 2004) as well as the general aggression model, which includes a component of cognitive appraisal and deliberate or impulsive action (Anderson & Bushman, 2002; DeWall, Anderson, & Bushman, 2011). However, SPJ decision theory finds its roots most centrally in situational action theory.
(Wikström & Treiber, 2009) and bounded rationale choice (Felson, 2009; for more details see the Structured Professional Judgment VR CF section below). Decision theory was selected for the current analysis because Felson (2009) posited that general theories of crime (e.g., general strain theory [Agnew, 1992]) might not necessarily match onto theories of violent crime, but a rational choice approach, such as SPJ decision theory, can help explain both deviance (e.g., crime) and aggression (e.g., violence).

Research Questions. This study was exploratory, yet several broad research questions emerged. First, how many functional links will exist between the CAPP and violent crime? Because the CAPP is an over-inclusive model (i.e., fringe concepts were initially included in the model), I expected that certain CAPP traits would not hold a strong theoretical pathway to crime or violence, but that these traits would be exceptions to the general pattern of most traits holding causal pathways to violence. Second, of these causal links, which type of influencing mechanism will be the most commonly occurring? I hypothesized that disinhibitors (see below for details) would be the most commonly occurring mechanism because disinhibition has conceptual and empirical overlap with the behavioural features that predict antisocial conduct (Hawes et al., 2013; Kennealy et al., 2010; Leistico et al., 2008; McCuish et al., 2015; Walters, 2003b). As psychopathy has been described as an omnibus theory of crime (see DeLisi, 2009), I hypothesized that the CAPP traits would also motivate and destabilize decisions to act violently. Third, which CAPP traits will be most closely tied to violence? I hypothesized that CAPP traits previously identified as most prototypical of psychopathy (e.g., Unempathic, Lacks Remorse, Manipulative, Self-Centered; see Kreis et al., 2012) would be the primary causal agents of violence.

Johnstone (2013) called for more work clarifying the logical connection between mental disorders (e.g., PPD) and violence. Identifying causal links between psychopathic traits and violence can help improve the risk management and treatment of those suffering from PPD. The psychopathy–violence link is one of several ways that psychopathy can be symptomatic—if one is employing the trait + dysfunction conceptualization of personality disorder symptoms. By better understanding the link between trait and dysfunction, mental health professionals may have a new treatment target: not only psychopathic traits and the dysfunction, but the functional link that connects these two variables—a relevant topic across forensic evaluation and treatment referrals (see Cooke, 2010; Cutler & Zapf, 2015).
2.2. Conceptual Method and Assumptions

2.2.1. Conceptual and Theoretical Analysis

Conceptual analysis is reasoning with scientific theories, models, and concepts (Machado & Silva, 2007). In the current analysis, the theory was SPJ decision theory, which is underpinned by situational action theory (Wikström & Treiber, 2009) and the theory of bounded rational choice (Felson, 2009). The concepts were the traits and domains from the CAPP lexical model, as well as core mechanisms from SPJ decision theory. The analysis systematically integrated the CAPP traits with decision theory as it pertains to violent decision-making.

2.2.2. Theories, Models, and Concepts

**CAPP.** The CAPP (Cooke et al., 2012) is a conceptual model of psychopathic personality disorder developed to be independent of measurement (see Figure 1). That is, although CAPP-specific measures exist, the CAPP model attempts to define, explicate, clarify and/or describe the *phenomenon* of psychopathy. Its development rested upon the lexical hypothesis that personality is encoded in human language (e.g., Goldberg 1993), and so lexical markers were derived rationally by systematically reviewing clinical, empirical, and theoretical writings. Subject matter experts were interviewed about their opinions on these lexical markers as well as other concepts relevant to PPD.
Next, the concepts were synthesized and translated into non-technical trait adjectives or brief adjectival phrases (e.g., Lacks Remorse, Antagonistic). The authors identified 33 final symptoms organized between six thematic domains: Attachment, Behavioural, Cognitive, Dominance, Emotional, and Self domains (see Table 1 for operational definitions). The authors also created three synonyms for each symptom. For example, the symptom *Intolerant* was triangulated around the synonyms *Narrow-minded*, *Bigoted*, and *Hypercritical*.

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5 Readers might find that if they “remember their ABCDEs,” they will also remember the six CAPP domains (i.e., Attachment, Behavioural, Cognitive, Dominance, Emotional, Self).
### Table 1  
**CAPP Domain Direct Quotations from Cooke and Colleagues (2012, pp. 245–246)**

<table>
<thead>
<tr>
<th>Domain</th>
<th>Quotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attachment</td>
<td>The Attachment domain reflects difficulties with interpersonal affiliation, such as the failure to form close, stable emotional bonds with others. It focuses on the intimacy and acceptance by others that people attempt to achieve in interpersonal exchanges.</td>
</tr>
<tr>
<td>Behavioural</td>
<td>The Behavioral domain reflects problems with the organization of goal-directed activities, such as the tendency to be impulsive and sensation seeking. It focuses on behavior regulation including the failure to establish adaptive strategies to deal with life tasks in a systematic, consistent, or planned manner.</td>
</tr>
<tr>
<td>Cognitive</td>
<td>The Cognitive domain reflects problems with mental flexibility and adaptability, such as the tendency to be distractible, intolerant, and suspicious. It focuses on mental actions and processes, including how the person focuses and allocates attention, encodes and processes information, organizes thoughts, and makes attributions.</td>
</tr>
<tr>
<td>Dominance</td>
<td>The Dominance domain reflects difficulties with interpersonal agency, such as excessive status seeking and assertiveness. It focuses on the degree of power or control that people try to take in interpersonal exchanges.</td>
</tr>
<tr>
<td>Emotional</td>
<td>The Emotional domain reflects problems with mood regulation, such as the tendency to experience shallow, labile emotions. It focuses on the tone, depth, and appropriateness of people’s affective responses.</td>
</tr>
<tr>
<td>Self</td>
<td>The Self domain reflects problems with identity or individuality, such as being self-centered and self-aggrandizing. It is concerned with people’s accurate consciousness of their own identities including appreciation of their personality traits and schemas, and an appreciation of their salient abilities, qualities and desires. Additionally, the self influences social roles and relations with others.</td>
</tr>
</tbody>
</table>

The CAPP was developed with several explicit assumptions (Cooke et al., 2012) that were also pertinent to the current analysis. First, CAPP symptoms reflect a foundational level of personality disorder and these basic components can be organized into hierarchical clusters. Second, these symptoms can change over time. Third, the CAPP was developed to be over-inclusive so that debatable symptoms were included and the model could be refined over time. Fourth, the CAPP is a relatively pure measure of psychopathy personality (for a discussion, see Cooke et al., 2004) that does not heavily weight violent or socially deviant behaviour (e.g., criminality).

**Formulation.** Case formulation, or clinical conceptualization, is an expected competency for mental health professionals (e.g., Mutual Recognition Agreement of the Regulatory Bodies for Professional Psychologists in Canada, 2004). Many authorities have provided definitions of case formulation. Persons, Becker, and Tompkins (2013) defined formulation as a “hypothesis … about the factors that cause and maintain the patient’s presenting problems… to generate intervention strategies and guide clinical
decision-making” (p. 399). Eells (2007b) provided a working definition that “case formulation is a hypothesis about the causes, precipitants, and maintaining factors of a person’s psychological, interpersonal, and behavioural problems” (p. 4).

Although both the aforementioned definitions are relatively atheoretical, case formulation may take different forms (Eells 2007a; Persons, 1991) based on existing theoretical clinical orientations (e.g., cognitive-behavioural, interpersonal, psychodynamic). In addition to theoretical grounding, a case formulation should be a testable narrative regarding the lifespan of a specific person (i.e., past, present, future). This testable hypothesis often employs abductive inferences that extend beyond evidence or facts (Hart, Sturmey, Logan, & McMurran, 2011; Ryan, Gatner, Slaney, & Hart, 2019). The common thread across formulation components is a linkage between assessment and treatment. That is, a formulation identifies and explains a person’s past and present problems and connects them with future interventions to solve these problems.

**Forensic Case Formulation.** Case formulation specific to violence risk assessment is a budding clinical and research consideration (Hart et al., 2011). Much like general and forensic case formulation, many applied and theoretical approaches exist specifically for violence risk case formulation (VRCF; see Sturme & McMurran, 2011). Hart and Logan (2011) summarize four VRCF approaches, including Offence Paralleling Behaviour (see Daffern et al., 2007), Risk Needs Responsivity (see Andrews et al., 1990), the Good Lives Model (see Ward, 2002), and—most salient to the current project—the structured professional judgment (SPJ) approach to VRCF.

**Structured Professional Judgment VRCF.** SPJ VRCF (Hart, Douglas, & Guy, 2016; Hart & Logan, 2011) is an explicit component of several SPJ guidelines (e.g., HCR-20V3; Douglas et al., 2013; Guidelines for Stalking Assessment and Management [SAM]; Kropp, Hart, & Lyon, 2008). The SPJ formulation approach includes (a) scenario planning about plausible future events and (b) decision theory to explain past and present events (Hart & Logan, 2011). Several case studies have applied an SPJ approach—with specific reference to decision theory—when formulating risk for general violence (Logan, 2014), stalking (Storey, Hart, & Lim, 2017), and intimate partner violence (Cook, Murray, Amat, & Hart, 2014). An empirical investigation of threat assessment professionals reported general consistency in SPJ VRCF for practice.
assessments of sexual violence (Wilson, 2013). In addition to its clinical application and initial empirical validation, decision theory is underpinned by two criminological theories of crime and violence: Situational action theory (Wikström & Treiber, 2009) and bounded rationale choice (Felson, 2009).

Situational action theory (SAT; Wikström, 2004, 2014; Wikström & Treiber, 2009) attempted to address causal explanations of moral behaviour— as opposed to correlates of moral behaviour. SAT views crime as one of many categories of moral behaviour. The causal mechanism is a perception and choice that a person makes regarding a specific situation. SAT assumes that (a) people make choices to act violently or criminally; (b) these choices can only be enacted when it is perceived as viable; and (c) these choices vary from deliberate to habitual. A person’s development and life circumstances are assumed to influence more proximal causes of violence. In other words, people’s actions— be they criminal, violent, or other— can be described as the interaction: “propensity x exposure = action” (Wikström & Treiber, 2009, p. 91). Propensity includes action-relevant moral rules (i.e., thinking about what is perceived as right and wrong), self-control, and emotions. Exposure includes a situation that stimulates a person to consider a moral act in a moral context. Overall, SAT explains violence combining individual and situational frameworks, which is in keeping with other psychological orientations such as contextual functionalism (Hayes, 1993) and cognitive-behavioural theory (Farmer & Chapman, 2016).

Bounded rational choice (BRC; Felson, 2009) is the second theory that underpins SPJ decision theory. BRC assumes that all violence is instrumental. That is, it serves a purpose to obtain something of value (e.g., influence others, possess something, communicate strong emotion). Because violence is instrumental, BRC assumes that people make rational choices. This form of rationality is not defined by accurate logic or reason, but rather, it is defined by the capacity to reason— irrespective of accuracy. The bounded component of BRC means that rational choices are capped by subjective views of incentives and costs—a premise empirically supported by offending patterns of serious adolescent offenders (Loughran, Paternoster, Chalfin, & Wilson, 2016). People may consider these benefits and costs quickly, carelessly, and impulsively, but they consider them nonetheless (BRC; Felson, 2009, 2013). Felson also argued that when violence and crime are both classified as instrumental choices, they can be explained
using a single theory, and that this single theory can be applied to an individual and groups.

**SPJ Decision Theory.** How does SPJ decision theory synthesize the many principles and assumptions put forth by SAT and BRC? It assumes that violence is a decision. These decisions are goal-directed (i.e., instrumental; see BRC, above) and involve planning, although the planning need not be long. The decision to act violently is rational—it involves basic human cognition—but it might not be conscious (i.e., it might be rapid and habitual; see SAT, above). These decisions do not need to be logical, reasonable, or grounded in reality (Hart et al., 2016). For instance, an involuntary violent tic or violence during sleepwalking would not include rational thought, but killing my friend because I believe he is a predatory alien would be considered rational—as outlined above.

According to SPJ decision theory, a violent decision is preceded by a 4-part stepwise process:

1. People enter a situation where a violent decision is consciously entertained.
2. People consider the benefits of violence.
3. People consider the costs of violence.
4. People consider the options and feasibility of acting violently (Hart & Logan, 2011).

Steps 2 and 3 are essential to decision theory and violent decisions. To explain violent decision-making, professionals need to evaluate how people weigh the perceived benefits and costs of violence. As noted above, these decisions are not necessarily economic, systematic, or accurate, and this is because humans are influenced by a host of social and psychological factors. Specifically, violence risk factors affect decisions by motivating, disinhibiting, or destabilizing thinking, which leads to violence.

Motivators increase a person’s perceived benefit of violence.\(^6\) Disinhibitors decrease a person’s perceived cost of violence. Destabilizers disturb our thinking and distort reality, causing difficulty in regulating decision-making. Consider a car metaphor where an accident is a violent or criminal decision. Motivators act as if the accelerator is

\(^6\) In addition to the cited works surrounding SPJ decision theory, credit for these ideas should also be provided to Dr. Stephen Hart and Dr. Kevin Douglas for information that they have provided informally in personal communications during lectures and trainings.
stuck to the floor, which causes the car to speed into an accident. Disinhibitors act as if the brake cables snapped, which stops the car from slowing and avoiding an accident. Destabilizers act as if the steering system has malfunctioned, which causes the car to swerve into an accident. Violence risk factors influence the different automotive system errors. For instance, psychotic symptoms could act as dirt and grime which influence the steering (i.e., destabilizers) and cause distorted thinking. Financial problems could act as a heavy foot on the accelerator (i.e. motivators) and increase the benefits of crime and violence. Substance use problems could act as an object obstructing the brake pedal (i.e., disinhibitors) and decrease the costs of violence. In the case of people at high risk for violence, often many risk factors are present and relevant, which cause them to speed recklessly into a violent crash without the ability to stop in time. That is, often multiple motivators, disinhibitors, and destabilizers are present and relevant.

**Violence.** In this conceptual analysis, violence was defined using the aforementioned HCR-20V3 definition of “actual, attempted, or threatened infliction of bodily harm of another person” (Douglas et al., 2013, p. 2). Violence was defined broadly, and therefore, it captured non-physical violent acts (e.g., stalking or harassing behaviour) and specific forms of violence (e.g., sexual violence, intimate partner threats, extremist violence).

### 2.2.3. Procedure

The 33 CAPP traits were analyzed to determine if each trait served as a motivator, disinhibitor, and/or destabilizer for violence. Specific mechanisms were considered for each broad influencer (i.e., motivator, disinhibitor, destabilizer), which were provided by a structured professional judgment formulation manual for violence risk assessment (Ryan, Hart, & Kropp, in preparation). This systematic approach was selected to create a comprehensive analysis while reducing bias, incompleteness, and idiosyncratic selection in the conceptual analysis. Further, definitions for domains and its adjectival traits were derived from the original CAPP development source (Cooke et al., 2012).
2.3. Conceptual Analysis Results

2.3.1. Motivators

To determine which CAPP traits were motivators of violence, I systematically considered each trait and its specific type of motivation. That is, I identified how CAPP traits may increase the perceived benefits or rewards of violence (see Figure 2).

**Attachment.** The Attachment traits include: Detached (Remote, Distant, Cold), Uncommitted (Unfaithful, Undevoted, Disloyal), Unempathic (Uncompassionate, Cruel, Callous), and Uncaring (Inconsiderate, Thoughtless, Neglectful). None of the Attachment traits were conceptually related to decisions motivating violence.

**Behavioural.** Reckless (Rash, Impetuous, Risk-taking) may cause violence as a means of gaining excitement and arousal. Restless (Overactive, Fidgety, Energetic) may cause violence as a means of expressing or releasing energy. Behavioural traits that were not identified as motivators of violence included: Lacks perseverance (Idle, Undisciplined, Unconscientious), Unreliable (Undependable, Untrustworthy, Irresponsible), Disruptive (Disobedient, Unruly, Unmanageable), and Aggressive (Threatening, Violent, Bullying). Disruptive and Aggressive were more closely aligned with PPD-related consequences or functional impairment rather than the PPD traits. These two traits were conceptualized as forms of crime and violence rather than motivators of these outcomes.

**Cognitive.** Suspicious (Distrustful, Guarded, Hypervigilant) may cause violence to provide protection and defense against perceived threats. Intolerant (Narrow-minded, Bigoted, Hypercritical) may cause violence to seek justice or retribution against someone who has not met a moral standard or expectation. Inflexible (Stubborn, Rigid, Uncompromising) may cause violence to achieve compliance from others. Lacks Concentration (Distractible, Inattentive, Unfocused) and Lacks Planfulness (Aimless, Unsystematic, Disorganized) were the two Cognitive traits that were not identified as motivators of violence.
Figure 2  CAPP Traits that Motivate Violent Decisions
**Dominance.** Antagonistic (Hostile, Disagreeable, Contemptuous) may cause violence to release emotions. Domineering (Arrogant, Overbearing, Controlling) may cause violence to (1) control and change others’ behaviour or (2) increase self-esteem or a feeling of status. Deceitful (Dishonest, Deceptive, Duplicitous) may cause violence to (1) enhance ego or self-esteem or (2) increase status or (3) provide excitement through threats. Manipulative (Devious, Exploitative, Calculating) may cause violence to control others. CAPP Dominance traits that were not identified as motivators of violence included: Insincere (Superficial, Slick, Evasive) and Garrulous (Glib, Verbose, Pretentious).

**Emotional.** Of the Emotional traits, only Lacks Emotional Stability (Temperamental, Moody, Irritable) was identified as a motivator, which may cause violence to express and release emotions. The remaining traits that were not identified as motivators of violence included: Lacks Anxiety (Unconcerned, Unworried, Fearless), Lacks Pleasure (Pessimistic, Gloomy, Unenthusiastic), Lacks Emotional Depth (Unemotional, Indifferent, Inexpressive), and Lacks Remorse (Unrepentant, Unapologetic, Unashamed).

**Self.** Self-Centered (Egocentric, Selfish, Self-Absorbed) may cause violence to (1) achieve material gain or profit, or (2) gain status/esteem/dominance. Both Self-Aggrandizing (Self-important, Conceited, Condescending) and Sense of Uniqueness (Sense of Being Extraordinary, Exceptional, Special) may cause violence to establish status, esteem, or dominance. Sense of Entitlement (Demanding, Insistent, Sense of Being Deserving) may cause violence to (1) gain or profit from others (e.g., robbery) or (2) maintain proximity to others or (3) control others. CAPP Self traits that were not identified as motivators of violence included: Sense of Invulnerability (Sense of Being Invincible, Indestructible, Unbeatable), Self-Justifying (Minimizing, Denying, Blaming), and Unstable Self-Concept (Labile, Incomplete, Chaotic Sense of Self).

### 2.3.2. Disinhibitors

To determine which CAPP traits were disinhibitors of violence, I systematically considered each trait and its specific type of disinhibition. That is, I identified how CAPP traits may decrease the perceived costs of violence (see Figure 3).
Figure 3   CAPP Traits that Disinhibit Violent Decisions
**Attachment.** All the CAPP Attachment traits were identified as disinhibitors. Both Detached (Remote, Distant, Cold) and Uncommitted (Unfaithful, Undevoted, Disloyal) may disinhibit violence by social alienation. Unempathic (Uncompassionate, Cruel, Callous) may disinhibit violence by not experiencing the associated emotional consequences surrounding harming others. Uncaring (Inconsiderate, Thoughtless, Neglectful) may disinhibit violence by lacking insight into or minimizing others’ perspectives.

**Behavioural.** Disruptive (Disobedient, Unruly, Unmanageable) may disinhibit violence as inferred from antisocial attitudes surrounding a disregard for rules and social norms. CAPP Behavioural traits that were not identified as disinhibitors included: Lacks perseverance (Idle, Undisciplined, Unconscientious), Unreliable (Undependable, Untrustworthy, Irresponsible), Reckless (Rash, Impetuous, Risk-taking), Restless (Overactive, Fidgety, Energetic), and Aggressive (Threatening, Violent, Bullying).

**Cognitive.** Intolerant (Narrow-minded, Bigoted, Hypercritical) may disinhibit violence by holding negative and antisocial attitudes, which diminish the status of victims (e.g., misogyny, believing people should be taken advantage of). Cognitive traits that were not identified as disinhibitors of violence included: Suspicious (Distrustful, Guarded, Hypervigilant), Lacks Concentration (Distractible, Inattentive, Unfocused), Inflexible (Stubborn, Rigid, Uncompromising), and Lacks Planfulness (Aimless, Unsystematic, Disorganized).

**Dominance.** Insincere (Superficial, Slick, Evasive) may disinhibit violence by social alienation or lacking genuine connection with others. Dominance traits that were not identified as disinhibitors of violence included: Antagonistic (Hostile, Disagreeable, Contemptuous), Domineering (Arrogant, Overbearing, Controlling), Deceitful (Dishonest, Deceptive, Duplicitous), Manipulative (Devious, Exploitative, Calculating), and Garrulous (Glib, Verbose, Pretentious).

**Emotional.** Lacks Anxiety (Unconcerned, Unworried, Fearless) may disinhibit violence by failing to consider threatening outcomes or not experiencing an emotional reaction to these outcomes (i.e., lacking anxiety). Lacks Pleasure (Pessimistic, Gloomy, Unenthusiastic) may disinhibit violence by a sense of nihilism. Lacks Emotional Depth (Unemotional, Indifferent, Inexpressive) may disinhibit violence by reducing the intensity
and full expression of guilt or anxiety associated with violence. Lacks Remorse (Unrepentant, Unapologetic, Unashamed) may disinhibit violence by not experiencing guilt. The only Emotional trait that was not identified as a disinhibitor of violence was Lacks Emotional Stability (Temperamental, Moody, Irritable).

**Self.** Self-Centered (Egocentric, Selfish, Self-Absorbed), Self-Aggrandizing (Self-important, Conceited, Condescending), and Sense of Uniqueness (Sense of Being Extraordinary, Exceptional, Special) may all disinhibit violence by a negative self-concept that overvalues oneself while devaluing others' relative worth. Sense of Invulnerability (Sense of Being Invincible, Indestructible, Unbeatable) may disinhibit violence by having a self-concept and belief system that one will not receive or be harmed by negative outcomes (e.g., jail, retribution). Self-Justifying (Minimizing, Denying, Blaming) may disinhibit violence by ignoring or not appreciating the consequences of violence. Unstable Self-Concept (Labile, Incomplete, Chaotic Sense of Self) may disinhibit violence by a poor sense of self and a disconnect from one's morals. The only Self trait that was not identified as a disinhibitor of violence was Sense of Entitlement (Demanding, Insistent, Sense of Being Deserving).

### 2.3.3. Destabilizers

To determine which CAPP traits were destabilizers of violence, I systematically considered each trait and its specific destabilizing mechanism. That is, I identified how CAPP traits may distort or disrupt thinking around violence and its perceived costs and benefits (see Figure 4).
Figure 4  CAPP Traits that Destabilize Violent Decisions

Psychopathic Personality Disorder

- Disturbed Perception
- Obsessive/Perseverative Thoughts
- Impulsive/Intrusive Thoughts
- Antagonistic
- Dominance
- Manipulative
- Lacks Emotional Stability
- Emotional

Attachment
- Uncaring

Behavioural
- Reckless
- Impulsive/Intrusive Thoughts
- Impaired Reasoning
- Inflexible/Obsessive/Perseverative Thoughts
- Suspicious

Cognitive
- Lacks Concentration
- Disturbed Attention/Concentration
- Lacks Planfulness
- Impaired Reasoning
- Inflexible/Obsessive/Perseverative Thoughts
- Intolerant
- Impulsive/Intrusive Thoughts
**Attachment.** Uncaring (Inconsiderate, Thoughtless, Neglectful) may destabilize thinking and increase violent decisions by diminished or absent attention and concentration. Attachment traits that were not identified as destabilizers included: Detached (Remote, Distant, Cold), Uncommitted (Unfaithful, Undevoted, Disloyal), and Unempathic (Uncompassionate, Cruel, Callous).

**Behavioural.** Reckless (Rash, Impetuous, Risk-taking) may destabilize thinking and increase violent decisions by rapid thinking and impulsivity. Behavioural traits that were not identified as destabilizers of violence included: Lacks perseverance (Idle, Undisciplined, Unconscientious), Restless (Overactive, Fidgety, Energetic), Disruptive (Disobedient, Unruly, Unmanageable), Unreliable (Undependable, Untrustworthy, Irresponsible), and Aggressive (Threatening, Violent, Bullying).

**Cognitive.** All of the Cognitive traits were identified as destabilizers of violent decisions. Suspicious (Distrustful, Guarded, Hypervigilant) may destabilize thinking and increase violent decisions by (1) disturbed perception of others’ intentions (2), impaired reasoning regarding others’ intentions, and (3) perseverative thinking. Lacks Concentration (Distractible, Inattentive, Unfocused) may destabilize thinking and increase violent decisions by disturbed attention and concentration. Inflexible (Stubborn, Rigid, Uncompromising) may destabilize thinking and increase violent decisions by inflexible perseveration around identifying alternative, non-violent actions to achieve goals. Lacks Planfulness (Aimless, Unsystematic, Disorganized) may destabilize thinking and increase violent decisions by (1) impaired reasoning, and (2) impulsive thinking. Finally, Intolerant (Narrow-minded, Bigoted, Hypercritical) may destabilize thinking and increase violent decisions by (1) inflexible, perseverative thinking (2) impaired reasoning around members of outgroups.

**Dominance.** Antagonistic (Hostile, Disagreeable, Contemptuous) may destabilize thinking and increase violent decisions by disturbed perception of others’ intentions (e.g., hostile attribution). Manipulative (Devious, Exploitative, Calculating) may destabilize thinking and increase violent decisions by obsessing over using others to obtain personal means. Dominance traits that were not identified as destabilizers included: Domineering (Arrogant, Overbearing, Controlling), Deceitful (Dishonest,
Deceptive, Duplicitious), Insincere (Superficial, Slick, Evasive), and Garrulous (Glib, Verbose, Pretentious).

**Emotional.** Lacks Emotional Stability (Temperamental, Moody, Irritable) may destabilize thinking and increase violent decisions by activating impulsive thinking and behaviour. Emotional traits that were not identified as destabilizers of violence included: Lacks Anxiety (Unconcerned, Unworried, Fearless), Lacks Pleasure (Pessimistic, Gloomy, Unenthusiastic), Lacks Emotional Depth (Unemotional, Indifferent, Inexpressive), and Lacks Remorse (Unrepentant, Unapologetic, Unashamed).

**Self.** With the exception of Unstable Self-Concept (Labile, Incomplete, Chaotic Sense of Self), the remainder of the Self traits were identified as destabilizers of violent decisions: Sense of Invulnerability (Sense of Being Invincible, Indestructible, Unbeatable), Self-Centered (Egocentric, Selfish, Self-Absorbed), Self-Aggrandizing (Self-important, Conceited, Condescending), Sense of Uniqueness (Sense of Being Extraordinary, Exceptional, Special), Sense of Entitlement (Demanding, Insistent, Sense of Being Deserving), Self-Justifying (Minimizing, Denying, Blaming). All of these Self traits may destabilize thinking and increase violent decisions by impaired reasoning and cognitive distortions about the personal consequences (i.e., rewards or costs) of acting violently.

### 2.4. Conceptual Analysis Discussion

I analyzed how PPD may be conceptually related to violence. Stemming from the recommendations of other scholars (Cooke et al., 2004; Duggan & Howard, 2009), my primary aim was to specify potential causal mechanisms of violence through speculation that was grounded in theory. Specifically, I examined the conceptual relations between (a) CAPP-defined psychopathic traits and (b) violence using a case formulation framework known as SPJ decision theory. Broadly, I conceptualized that CAPP PPD had many and diverse pathways toward violence. The analysis suggests that different CAPP domains may cause violence, and the specific causal mechanisms vary—CAPP traits motivate, disinhibit, and destabilize decisions to act violently.

Of the 33 CAPP traits, 31 traits had a plausible causal link to violence, which was consistent with my hypothesis that most traits would be functionally linked with violence.
CAPP traits were equally motivating and disinhibiting (14 traits each), whereas CAPP traits were most frequently identified as destabilizing violent decisions (16 traits). Thus, my hypothesis that disinhibitors would be the most commonly occurring mechanism of violence was not supported. Despite the large number of destabilizing traits, these deficits seem less extreme than the destabilizing influence of prototypic destabilizers like positive psychotic symptoms (e.g., hallucinations, delusions). As noted in the CAPP development (Cooke et al., 2012), the Cognitive domain includes more subtle problems with mental processing and organization that result in impaired reasoning, instability, and inflexibility. Such cognitive deficits aggravate the already problematic perceptions of the rewards and costs of acting violently. Overall, motivators, disinhibitors, and destabilizers all appeared to have a relatively equal number of functional pathways toward violence.

CAPP traits serving as motivators of violence may have the most direct causal role on violent decisions. Motivators directly relate to a reason for violence or the function it serves (i.e., its perceived benefit), whereas destabilizers and disinhibitors might moderate violence. On their own they may not cause violence, but their presence in addition to a plausible motivator will likely substantially increase the likelihood of violence (see Figure 5). Using the aforementioned car metaphor, a violent car crash cannot occur if there is no motion or acceleration (i.e., motivator) even if there are serious problems with the car’s steering (i.e., destabilizers) and brakes (i.e., disinhibitors). This claim could have important implications for clinicians’ violence risk formulations (for more details see the Implications section below).
At the domain level, the greatest motivator of violence was CAPP Dominance. To a lesser degree, the Self domain also motivated violence through several traits. Such findings are congruent with the CAPP domain descriptions (Cooke et al., 2012). Both the Dominance and Self domains include explicit interpersonal exchanges—such exchanges have been identified as strongly contributing to violence (Felson, 2009)—where something can be won or obtained. In many cases during the analysis, this motivating reward was increased status, dominance, or esteem, which seems conceptually relevant to CAPP Dominance. The Self domain also emerged as a central contributor; it resulted in many functional links between its traits and violence. Indeed, the Self domain was also a central disinhibitor, along with the Attachment and Emotional domains. The latter two CAPP domains include diminished intimacy and emotionality, which in turn, are likely to decrease the costs or negative consequences of violence. Finally, the central destabilizer from this conceptual analysis was the CAPP Cognitive and Self domains. Although all the CAPP domains are relevant to violence, these findings suggest that the Self domain was the common thread between motivators, disinhibitors, and destabilizers of violence.

In the current study, emphasis was given to direct functional links where the trait had an ostensibly clear role in influencing violent decisions. However, there may be interaction or moderating effects between different types of influencers (i.e., motivators, disinhibitors, and destabilizers). For instance, CAPP Suspiciousness may motivate violent decisions through a need for protection, and this heightened motivation may create a secondary disinhibiting influence by supressing the perceived costs of acting violently. Additionally, distal links likely exist where certain CAPP traits create contexts...
for more direct functional links with violence. For example, CAPP Lacks Perseverance may cause economic and housing problems, which could prompt violence as a means to profit financially. These complex secondary and distal impacts are important, particularly for individualized case formulation; however, for length, clarity, and parsimony, these secondary effects were not explicitly analyzed in this study.

At a trait-level, the conceptual analysis revealed that individual CAPP traits influence violence decisions in various ways by motivating, disinhibiting, or destabilizing these decisions. In reviewing this analysis, relevant CAPP traits varied in their theoretical closeness to these violent decisions. With the exception of CAPP Manipulative, my hypothesis was supported such that prototypical traits (e.g., Unempathic, Lacks Remorse; see Kreis et al., 2012) often emerged as highly relevant to violence. That is, certain CAPP traits seem to be conceptually similar with the SPJ decision theory mechanism of violent decisions. For instance, CAPP Domineering (Arrogant, Overbearing, Controlling) is highly similar to and overlapping with the motivating mechanisms of dominance and control (see Ryan et al., in preparation).

This trait–mechanism overlap was most commonly observed among disinhibitors. Lacks anxiety and Unempathic are both word-for-word definitions for both the CAPP traits and corresponding disinhibiting mechanisms. Similarly, CAPP Lacks Remorse is closely aligned with the disinhibiting mechanism of lacking guilt, and CAPP Self-Justifying/Minimizing also has direct overlap with the disinhibiting mechanism of lack of insight/minimization. A clear pattern emerged that certain CAPP traits have strong conceptual overlap with disinhibiting mechanisms, suggesting these traits may have a strong causal role in violent decisions. Although motivators seem to be a generally necessary component for violence, for those with PPD, strong motivators may be less important when a relevant disinhibitor is directly and causally related to violence (e.g., Unempathic). This might help explain why criminal versatility is associated with PPD (see Hare, 2003).

Although these disinhibiting traits are the most salient instances of conceptual overlap, certainly other CAPP traits overlap significantly with SPJ decision theory mechanisms (e.g., CAPP Lacks Concentration or Uncaring with the destabilizing “disturbed concentration”). Interventions might target any of three areas: the CAPP trait, dysfunction (i.e., violence), or the functional link between the two. With this premise in
mind, these identified traits may be higher priority intervention targets given that the trait–mechanism–dysfunction association has strong overlap. Perhaps a single intervention might be able to influence more than one PPD–violence area.

Aggressive and Garrulous were the only two CAPP traits that were not causally related to violence. The concept Aggressive seems related *prima facie* to violence; however, this issue relates back to previous discussions about causes and consequences of a disorder. Engaging in aggressive, threatening, violent, and bullying behaviours are all consequences or correlates of psychopathic traits (Skeem & Cooke, 2010a; cf. Hare & Neumann, 2010). Conceptually, these dysfunctional behaviours do not seem to reflect personality traits or proclivities, and empirically, evidence suggests that antisocial behaviour could be excluded from models of psychopathy, unless it is considered a consequence of psychopathy (e.g., Cooke et al., 2004; cf. Neumann, Vitacco, Hare, & Wupperman, 2005). Further, a tendency to act aggressively or violently does not explain why someone was violent or aggressive—at least from a SPJ decision theory perspective.

Although CAPP Garrulous was not identified as directly causing violence, it may still be pathological. Those who speak with others without any true substance or honesty would likely damage their interpersonal relationships. Indeed, empirical evidence supports a causal model of these traits influencing relationship lability (Cooke et al., 2004). Being glib and pretentious may also help people commit non-violent crimes such as fraud, as such people tend to portray themselves inaccurately. It is important to reiterate that psychopathic traits (e.g., Garrulous) can be important features of the disorder without being associated with or causing violence. Indeed, the current findings should be understood in the larger picture of clinical dysfunction. That is, violence—when used inappropriately—is only one of many unhealthy outcomes associated with PPD. Clinicians and scholars could formulate how CAPP traits cause other problems such as workplace or interpersonal dysfunction.

2.4.1. Limitations and Methodological Considerations

Conceptual analysis has been criticized for being overly pedantic (Machado & Silva, 2007)—even for academic prose. Such strict precision with concepts may hamper creative thought. Machado and Silva (2007) also commented that conceptual analysis
has been criticized for falling under the category of *armchair* psychology where concepts are linked haphazardly at the author’s whim. I tried to buffer against these concerns by systematically and transparently analyzing each CAPP trait for each different type of violence risk influencer (i.e., motivator, destabilizer, and disinhibitor) instead of selecting only the links I initially perceived as most prominent. My aspiration was that this systematic conceptual analysis would foster—rather than hamper—academic and clinical thought regarding putative causal links between PPD and violence.

Nevertheless, the conceptual analysis remains bounded by its non-empirical approach. Others may disagree with the reasoning and logic that underpins my analysis of the links between the CAPP and violent decision-making. In fact, I would hope so. Even at a group-level analysis, multiple pathways may exist between CAPP traits and violent and criminal decisions. Other interpretations will likely emerge regarding how PPD traits can motivate, disinhibit, or destabilize violence. This line of reasoning also applies to idiographic case formulations; there are often multiple plausible interpretations. Absolute truth regarding these matters will likely never be fully identified, but this analysis was meant to improve the transparency and theoretically-driven approach when discussing how PPD influences violent decisions.

2.4.2. Implications

*Clinicians.* Despite its relevance and severity, PPD is not commonly the prominent client presentation in certain forensic contexts. Corrado, DeLisi, Hart, and McCuish (2015) stated that PPD can only explain a circumscribed portion of offending because it is a relatively rare disorder. How then can this conceptual analysis benefit clinicians and threat assessment professionals who working in low-prevalence settings like forensic outpatient clinics? The answer may lie in considering symptoms or trait clusters, regardless of whether a client meets the diagnostic threshold for the personality disorder. Personality disorder research has trended toward conceptualizing personality disorders on a continuum (McCrae & Costa, 2013; Widiger & Costa, 2013), and therefore, the CAPP model may be suitable for explaining offending and violence from a symptom-level perspective of PPD. For example, an examinee may not have enough CAPP symptoms sufficient for a PPD diagnosis, but several Attachment CAPP symptoms (e.g., Unempathic, Detached) may be relevant to explaining their disinhibited
offending. This symptom-level approach may also benefit clinicians who do not comment on diagnosis during their violence risk or threat assessments.

Others have commented that examining violence through a broad lens of psychopathy (i.e., at the unitary construct level) may have poor clinical and explanatory utility (Howard, 2015; Howard & Duggan, 2015). Consider how a clinician answers the question: How does psychopathy cause or contribute to violence? Specific traits or symptoms are needed, and thus, formulating at a granular level of PPD may have better clinical utility. Such detail is especially important when thousands of PPD permutations possibly exist. Clinicians inevitably incorporate symptoms into their formulations, and so the current conceptual analysis may help mental health professionals explain these violence case formulations.

Due to pragmatic time constraints, individual formulations will likely never be as comprehensive as the present analysis, but the findings from this CAPP–violence decision theory framework may serve as a map to help clinicians identify relevant and idiographic risk management targets. Indeed, nomothetic theory can help frame issues at the idiographic level (Persons, 2008). From a nomothetic level, professionals working in organizations with high PPD prevalence may emphasize CAPP traits that motivate violence given their causal role in violent thinking. Professionals might also emphasize treatment targets around those psychopathic traits and decision theory mechanisms that are conceptually overlapping. For instance, Lacks Concentration is both a CAPP trait and mechanism that destabilizes violent thinking. Treating and managing this specific mechanism may influence two areas of concern: the trait and the mechanism of dysfunction that converts the trait into a symptom vis-à-vis violence. Anchoring risk management strategies from a CAPP–SPJ decision theory perspective may have a conceptual rationale, but only empirical inquiry will confirm or disconfirm the efficacy of these hypotheses.

**Policy-Makers.** The pathways between PPD and violence are wide ranging. Such complexity may suggest that forensic policy-makers should prioritize training in formulation of violence risk and specific training in violence risk formulation of those with

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7 Of course, health and threat assessment professionals will need to verify that the trait–mechanism overlap occurs because of a psychopathic trait (e.g., CAPP Lacks Concentration) rather than other risk factors (e.g., ADHD).
prominent psychopathic features. To foreshadow the chapters to come, policy-makers should be made aware of PPD’s association with violence and the conceptual reasons for why the disorder might be proximally causing violence. Communicating these core findings may educate stakeholders regarding the impact that PPD is having at national levels—both psychologically and economically. Expanding the conceptual and empirical literature may also motivate funding increases for research and treatment of people with PPD to help improve their lives.

**Researchers.** Applying formulation principles to a group and abstract level may be counterintuitive. Violence risk formulation is meant to produce an individual’s theory of violence (Hart et al., 2011). Yet, group-level formulation and its underlying theory can produce many testable pathways explaining how people with PPD decide to break the law and act violently. This conceptual analysis provided a series of hypotheses regarding PPD traits and violence that should be tested empirically. Replication and empirical validation are cliché, but they are paramount when authors’ biases—the current study included—may shade the logical reasoning applied in conceptual analysis. Thus, diverse research is needed if the current conceptual analysis is to have longstanding merits among scholars and clinicians.

The issue of scientific causality is central to the implications of the current analysis. From an epistemological realism perspective, disorders cause behaviours and not vice versa (Lovett & Hood, 2011), and from the evidence provided in the introduction (see Chapter 1), psychopathy is a mental disorder. For practicing clinicians and threat assessment professionals, we must select a causal agent, even if causation is difficult to observe. Causality is established when a risk factor (1) precedes and (2) correlates with an outcome, and (3) if the factor changes, such change results in change in the outcome (Haynes, 1992; Kraemer et al., 1997; Kraemer, Stice, Kazdin, Offord, & Kupfer, 2001).

Consider the first criterion: Does psychopathy occur before adult violence? When extending PPD from antisocial personality, markers of this personality constellation emerge in pre-adolescent dysfunction in the form of conduct disorder symptoms (e.g., truancy, stealing, fire setting; American Psychiatric Association, 2013) and features defined as callous-unemotionality (see White & Frick, 2010). Others have commented that the onset of PPD symptoms can begin as young as 6 to 10 years old (Hart & Cook, 2012). Psychopathic features likely precede adult violence, and therefore, it seems the
first criterion is reasonably established. The second criterion is: Does psychopathy increase violence? The introductory sections of this dissertation have established that PPD robustly predicts prospective violence to a moderate degree. It seems the second criterion is reasonably established.

Does PPD change spontaneously or through intervention? This third criterion has been considered the most relevant to violence risk assessment (see Douglas & Skeem, 2005), yet it is the least established. PPD is often conceptualized as a static risk factor (see Andershed, 2010), and this stance is consistent from a PCL-R measurement perspective—a tool that measures PPD lifetime prevalence (Hare, 2003), which is not designed to detect change (Harris & Rice, 2006). There is some cross-sectional evidence that PCL-measured interpersonal/affective factor scores remain stable across the lifespan while antisocial/lifestyle scores decrease across the lifespan (Harpur & Hare, 1994). Nevertheless, there is little empirical work to determine conclusively whether or not PPD changes over the short- or mid-term, particularly given the field’s heavy reliance on the PCL-R. The literature cannot presently resolve this debate; however, scholars should clarify how we define and measure change in PPD. Does the trait (i.e., proclivity) change, or does the manifestation of the trait change (e.g., hurting someone indicative of callousness, lying indicative of deceitfulness, grandiosity indicated by having thoughts that one is superior to others)? Certainly, the latter changes. People with PPD may manipulate, but they are not always manipulating. More thought must be given to theory of personality disorder to determine what exactly must change to establish causality (i.e., traits or indicators of traits).

The CAPP authors designed measures like the CAPP-IRS and CAPP-Staff Rating Scale, in part, because they assumed that PPD can change (Cooke et al., 2012), including both traits and dysfunction. For instance, the CAPP-IRS assessment timeframe spans a 6- to 12-month period (Cooke et al., 2004), and this temporal focus can be adapted to the setting and referral question. No published empirical work has directly examined the dynamic nature of CAPP symptoms; however, some evidence has emerged regarding the short-term reliability of PPD ratings. Using generalizability theory in a sample of Korean offenders, the Korean CAPP-IRS revealed small estimated variance components related to time differences across a short 3-month period, which were likely overshadowed by more influential factors (e.g., raters, evaluatees; Sea, 2018).
Despite minimal direct empirical evidence, a rationale does exist for the hypothesis that PPD symptoms can be somewhat dynamic. Evidence suggests that psychopathic traits are less temporally stable earlier in people’s lives (e.g., Lee, Klaver, Hart, Moretti, & Douglas, 2009; McCuish & Lussier, 2018; cf. Lynam et al., 2009). In adulthood, there is typically moderate or high but not full stability (Cauffman et al., 2016; Hawes et al., 2014; Hemphälä, Kosson, Westerman, & Hodgins, 2015; Loney et al., 2007; Lynam, Caspi, Moffitt, Loeber, & Stouthamer-Loeber, 2007). These findings are congruent with the larger personality and personality disorder literature. General personality traits have been moderately stable up until people’s 50s (Caspi & Roberts, 2001; Roberts & DelVechhio, 2000), and a meta-analytic review reported a dialectic stance that personality is a relatively stable construct that also changes over time (Anusic & Schimmack, 2016). For disordered personality, evidence suggests that symptoms are malleable and subject to developmental change (e.g., Clark, 2007, Tyrer, 2005; Zanarini et al., 2005). Although scholars and clinicians cannot currently measure PPD change with fine sensitivity, there is little reason to believe that PPD is distinct from the rest of normal and dysfunctional personality.

Causal change can also occur from non-spontaneous change (e.g., treatment). Contra to clinical lore, there is growing—albeit mixed—evidence that PPD dysfunction may also change from targeted intervention (e.g., Salekin, 2002). Among the most rigorous empirical examinations, cognitive-behavioural therapy (CBT) programs seem to produce the most promising treatment effects (Salekin, Worley, & Grimes, 2010). For instance, a high-intensity sexual offender treatment program based on CBT and relapse prevention has recently demonstrated some positive effects on recidivism among Canadian federal offenders where psychopathic features were present (Sewall & Olver, 2019). It is important to highlight that to date, most treatment research has not focused or measured PPD symptom change, likely because it is presently challenging to measure within treatment study timeframes (see above). Nevertheless, PPD treatment studies certainly have not supported the argument that PPD is untreatable or unchangeable, but scholars seem undecided on the degree of change that is possible (e.g., Lewis, 2018; Polaschek, 2014).

In summarizing the central issues around causality, the two criteria surrounding temporal precedence and positive correlation have been reasonably established
regarding PPD and violence, but the third criterion of change is undetermined (i.e., causal change between PPD and violence). Scholars are likely far from concluding definitively on this third issue. A true experimental design where PPD could be manipulated randomly across participants would be required to fully rule out extraneous third variables (Haynes, 1992). This aspiration is unlikely given the developmental nature of personality disorders and the multifactorial nature of violence and its risk factors (Douglas & Skeem, 2005). As such, scholars need to develop a robust narrative of non-experimental evidence.

The current study contributed some of this non-experimental evidence using conceptual and theoretical analysis to provide a narrative of why PPD may cause violence. This form of evidence is not trivial. Conceptual understanding can help establish causality (Pearl & Mackenzie, 2018) and provide context for future empirical evidence. Consider a factor (e.g., Sriracha hot sauce consumption) that—hypothetically—has been observed to precede, correlate positively with, and predict changes in violence. This factor has far weaker theoretical backing than the links between smoking and cancer or PPD and violence, because theory cannot explain why hot sauce causes violence. Conceptual analysis can help improve our interpretation of data-driven correlations between PPD and violence. Combining causal graphical models, statistical estimations, and counterfactual algorithms (see Pearl & Mackenzie, 2018) will allow researchers and clinicians to speak more definitively about causal inferences between PPD and violence.

2.4.3. Future Research

Researchers should also survey subject matter experts for consensus ratings of CAPP–violence functional links. This would allow for empirical validation of the present conceptual analysis, including examining the reliability of CAPP–violence causal links when using an SPJ framework. Many iterations of this conceptual analysis also need testing, which can vary as a function of the outcome (e.g., stalking, domestic violence, and sexual violence), PPD conceptualization, and/or theory of antisocial behaviour. For instance, future work could extend beyond violence and analyze general recidivism from a different theoretical lens such as the Psychology of Criminal Conduct (PCC) or the General Personality and Cognitive Social Learning (GPCSL) perspective (see Andrews
This line of research might better address general recidivism given that the SPJ decision theory framework is suited specifically for violence.

Research extending from the present analysis should define PPD using other measures, which may be useful in understanding conceptual differences in violence between, for example, the PCL-R factors and facets. Similarly, future analyses should also conceptualize psychopathy using other models like the Triarchic model of psychopathy (Patrick et al., 2009). From this specific perspective, researchers might clarify how controversial concepts like boldness (see Douglas et al., 2015; Patrick, 2018; Sleep, Weiss, Lynam, & Miller, 2019) may or may not cause violent decisions.

2.4.4. Conclusion

This conceptual analysis of the CAPP and violence risk case formulation demonstrated how PPD might influence or cause violent decisions. Many functional pathways emerged between PPD and violence. In turning toward crime more broadly, there is evidence that across forms of recidivism, violent crime generates the highest costs (Easton et al., 2014; Farrington & Koegl, 2015). The following chapters will consider the economic magnitude of PPD that stems, in part, from these costly functional pathways.
Chapter 3. Top-Down and Bottom-Up Costs of Crime Associated with Psychopathy

Chapter 3 addresses how much. How much of the Canadian and American crime costs are attributable to those diagnosed with PPD? Scholars have argued that PPD is a serious social burden (Beaver et al., 2014; Hare, 1999; Kiehl & Hoffman, 2011; Reidy et al., 2015; Reidy et al., 2013), and as detailed in Chapter 2, PPD is associated with and may cause people to act criminally and violently. Yet, the field is left in the dark regarding the precise cost of crime attributable to PPD. To address this gap, I conducted top-down and bottom-up cost of illness studies, which demonstrated that people with PPD account for a disproportionate amount of the national costs of crime. Bounded national estimates for PPD costs were also provided. Based on these estimates, I recommended to researchers and policy-makers on how treating and managing PPD—difficult as the task may seem—should be prioritized at a national level.

3.1. Introduction

3.1.1. Cost of Illness Studies: An Overview

The cost of illness (COI) approach combines epidemiological data and financial information to calculate the economic costs attributable to a disease (Single, 2001). COI studies estimate and rank the magnitude of burden caused by illnesses and unhealthy behaviours (Segel, 2006). By clarifying economic impacts, COI studies influence decision-making (Bloom, Bruno, Maman, & Jayadevappa, 2012) for different social systems (e.g., countries, cities, CJS or health care systems), which can help efficiently prioritize limited resources (e.g., money, time, staffing, training, equipment). In fact, these studies improved North American tobacco legislation, interventions regarding intoxicated driving, and an understanding of major health concerns such as diabetes, back pain, and Alzheimer’s disease (Segel, 2006). COI studies can benefit society through the wide breadth and utility of their application.

Yet, COI studies are not without their criticisms. For instance, quantified costs do not necessarily equate to economic inefficiency—although it is often implied—and costing studies can produce disparate estimates depending on methodological decisions.
(Byford, Torgerson, & Raftery, 2000; Segel, 2006). Others have noted that COI studies add little new information about diseases and they refer only to static estimates (Currie, Kerfoot, Donaldson, & Macarthur, 2000; World Health Organization, 2009). Nevertheless, in addition to quantifying disability and social burden, COI studies help advocate for interventions and guide public policy planning and financial allocation. COI studies are also prerequisites for conducting cost-benefit studies (Rice, 2000; Robson & Single, 1995). Despite their criticisms, COI studies appear to have, on balance, some value in science and practice.

**Definitions.** Costs are at the heart of COI studies. They hinge on a) core costs related to the illness, and b) other costs related to the illness (Rice, 2000). The COI approach divides these categories again into direct and indirect costs. Direct costs are payments made based on market prices, which are also referred to as productivity costs (Tarricone, 2006). In contrast, indirect costs do not involve a direct monetary exchange and are, instead, based on resources lost because of the illness (Rice, 2000; Segel, 2006). These indirect costs include intangible costs, which incorporate psychosocial losses (e.g., mortality, pain and suffering) that are challenging to quantify (Rice, 2000; Tarricone, 2006). The underlying assumption of intangible costs is opportunity cost where an illness removes valuable resources that could be otherwise allocated to other economic activities (World Health Organization, 2009). That is, in a counterfactual scenario, where the illness does not exist, the market and non-market losses would transform into other economic expenditure opportunities. Not only does a taxonomy exist for cost types, but COI study methods are also organized hierarchically.

COI studies can be divided into top-down and bottom-up approaches. Moving further down this hierarchy, both these COI study approaches may employ incidence- or prevalence-based approaches (Byford et al., 2000). In the incidence approach, researchers calculate lifetime costs of the new incidents of an illness dating back from a given year. Using the prevalence approach, researchers calculate an annual cost estimate based on the total number of people estimated to be suffering from the illness.

The top-down approach estimates a total expenditure cost, which is distributed across disease categories (Tarricone, 2006). This cost in the top-down approach is specified via the prevalence of the illness and the relative risks of the illness as it relates to costs (Segel, 2006). The bottom-up approach estimates individual unit costs and
multiplies these costs by their usage from a particular sample (Tarricone, 2006), and at times, this estimation can be extrapolated to a system or group level (Chapko et al., 2009). A bottom-up approach may also employ an *econometric* approach where mean differences are examined between population cohorts with and without an illness (Bloom et al., 2012; Segel, 2006), and their relative differences are described rather than inferring total system costs. Overall, while the primary purpose is similar between costing methods, significant differences exist between costing approaches and assumptions.

Scholars disagree on which method (i.e., top-down vs. bottom-up) is the gold standard, and some suggest that using both is an appropriate approach (see Berlin & Smith, 2004). When applying both methods across US Veteran Affairs clinics, substantial—but not full—overlap was observed between the top-down and bottom-up cost estimation categories (\(r = .56\) to \(.96\); Chapko et al., 2009). The author suggested that both approaches have utility and their selection must be appropriately justified.

Indeed, in the current dissertation, I employed both COI approaches to maximize their benefits and estimate a broad range of crime costs attributable to PPD.

### 3.1.2. COI Studies of Mental Disorders

The cost of mental disorders entered the public consciousness during the 1990s (Whiteford et al., 2013), and scientific research on the matter has since grown exponentially (Gustavsson et al., 2011). In 1990, neurological, mental, and substance use disorders accounted for approximately 25% of the non-fatal global burden of disease (Murray & Lopez, 1994). Since that time, the cost of mental disorders continues to increase (Murray et al., 2007; Whiteford et al., 2013) as the world’s population increases and ages. In 2010, mental disorders were the 5\(^{th}\) largest disease category contributing to *disability-adjusted life years* (DALY)—a combination of premature mortality and disability-lived years. In the same year, the estimated cost of European brain diseases, including mental disorders and organic brain disorders (e.g., stroke, migraine), was €798 billion (Gustavsson et al., 2011). Overall, the economic burden of mental disorders is substantial and widespread.

When examining specific mental disorders, their global burden is a function of prevalence and severity. By example, schizophrenia has a moderate contribution to the global burden of disease (McGrath, Saha, Chant, & Welham, 2008; Saha, Chant,
Welham, & McGrath, 2005) because its low prevalence is balanced by a severity weight that was highest among 220 disease states (Salomon et al., 2012). Severity weight designates non-fatal consequences associated with its symptomatology. Depression was the overwhelming contributor to the global burden of mental disease; it accounted for 41% of the DALY attributable to mental disorders (Whiteford et al., 2013). Unfortunately, personality disorders have been excluded from global analyses because epidemiological data were inadequate to produce reliable estimates (Whiteford et al., 2013). Either as an amalgamated group or as specific disorders, mental disorders have considerable costs.

Moving from a global to national level, approximately 1/5th of Canadians suffer from a mental illness, and the 2011 annual costs associated with mental illness were conservatively estimated at approximately $50 billion or 2.8% of the Gross Domestic Product (GDP) in Canada (Mental Health Commission of Canada, 2013). These estimates were conservative because of several methodological decisions. First, the estimate was restricted to only the most common adult and youth mental illnesses (e.g., depression, substance use, ADHD), which did not include the impact of personality disorder. Second, the estimate also did not account for personal opportunity costs—an important component of indirect costs in COI studies (World Health Organization, 2009). Third, neither direct nor indirect criminal justice costs attributable to those with mental illness were considered. These limitations notwithstanding, the cost of mental illness imposes a substantial burden on Canadians.

Specific mental disorders have been subjected to COI studies (e.g., anxiety [Koerner et al., 2004], dementia [Ostbye & Crosse, 1994]). For schizophrenia—one type of psychotic disorder—national costs across different countries have been substantial but variable (94 million to 102 billion USD; see Chong et al., 2016). Specific to Canada, this disorder was estimated at $6.85 billion in 2004 (Goeree et al., 2005). Its varied cost sizes notwithstanding, schizophrenia has a major economic impact on global and national levels. If economic burden is a function of prevalence and severity (e.g., McGrath et al., 2008), then it is possible that PPD, a serious personality disorder—with a similar 1% lifetime prevalence estimation to schizophrenia—could be as severe or dysfunctional as schizophrenia.
COI Studies: Personality Disorders. Despite being overlooked in global (Whiteford et al., 2013) and national (Mental Health Commission of Canada, 2013) mental health COI studies, personality disorders have been subject of some economic cost estimation. Generally, substantial variability in cost estimates has emerged for personality disorders as a broad diagnostic group. Personality disorders had cost Europe an estimated €27.35 billion Euros in 2011 or €6,328 per patient (Gustavsson et al., 2011), whereas, in a large ($N = 1,720$) Dutch sample of people with personality disorders seeking treatment, total annual costs were estimated at almost twice as much (i.e., €11,126 in 2005)—direct medical costs and indirect costs were €7,398 and €3,728, respectively (Soeteman, Roijen, Verheul, & Busschbach, 2008). The pattern of variable findings is perhaps best highlighted in a study of intensive inpatient hospital treatment. A small sample ($n = 16$) identified with severe and dangerous personality disorders costed substantially more than the aforementioned studies; in only six months, each patient costed an average of £65,545 of inpatient care (Barrett et al., 2005).

For some of these annual estimates, personality disorders cost more than other mental disorders such as generalized anxiety and schizophrenia (Barrett et al., 2005; Soeteman et al., 2008), whereas the European estimates ranked personality disorders as far less costly than other mental disorders (Gustavsson et al., 2011). Thus, an exact ranking of the burden of personality disorders remains undetermined, but as a broad diagnostic group, personality disorders likely cause significant financial costs to various social systems. Further, the cost of personality disorders remains incomplete because pain and suffering as well as criminal justice costs have not commonly been included in previous estimates.

Borderline personality disorder (BPD) has received substantial empirical attention in comparison with other specific personality disorders. For COI studies, this trend remains. Across developed countries, direct annual per person costs for people with BPD prior to entering treatment have varied substantially from £5,240 GBP to $52,562 USD (Bateman, & Fonagy, 2003; Hall, Caleo, Stevenson, & Meares, 1999; Hörz, Zanarini, Frankenburg, Reich, & Fitzmaurice, 2010; Jerschke, Meixner, Richter, & Bohus, 1998; Palmer et al., 2006). When also estimating for indirect costs, estimations have ranged from €16,852 to €28,026 with indirect costs accounting for approximately 20% to 50% of total costs (Salvador-Carulla et al., 2014; Van Asselt, Dirksen, Arntz, &
Severens, 2007; Wagner et al., 2014). Broad national costs have also been quite staggering. A bottom-up approach estimated BPD costs in the Netherlands at €2.22 billion in 2000 (Van Asselt, Dirksen, Arntz, & Severens, 2007), and a top-down approach estimated German BPD costs at €8.69 billion (Wunsch, Kliem, & Kröger, 2014). Much like personality disorders as a broad group, the economic estimations specifically for BPD have varied based on methodological assumptions and cost components. Still, substantial costs have emerged, particularly when including indirect costs.

Given the substantial intra-individual co-occurrence of personality disorders (Mullins-Sweat, 2013; Widiger, Livesley, & Clark, 2009; Widiger & Trull, 2007) and the conceptual and empirical overlap between BPD and PPD (e.g., Miller et al., 2015; Pauli et al., 2018; Viljoen et al., 2015), one might expect an established body of PPD COI research as well. Yet, this reasoning does not prove true; only few examinations exist on the cost of PPD. In a study of UK community members with APD—an operational variant of PPD—the cost of health care, social work, and criminal justice services ranged from £31,097 to £38,004 per year (Davidson et al., 2009). The direct and indirect costs were not dissected. While these findings are partially relevant, certainly PPD represents a more serious form of APD.

Barrett and colleagues (2009) focused on psychopathic features by examining institutional treatment service costs of offenders designated with dangerous and severe personality disorders. Perhaps counterintuitively, offenders categorized into the high PCL-R group (n = 25) had lower costs than the low PCL-R group (n = 19), such that a one-unit increase in PCL-R scores resulted in a £1,135 decrease in service cost. The authors speculated that their unexpected findings could be explained by people with PPD having been less likely to enter and cooperate with treatment. The authors’ overall conclusions were limited because they did not examine diagnosable PPD. They selected a median split of the PCL-R using a cut-off score of 16—a score below the typical median Total score (e.g., Hare, 2003). Treatment service cost—one fraction of the cost components of an illness—appears to be inversely related to PPD, but the remaining cost components of PPD remain unknown.

What can the reader take from this briefing on COI studies? First, mental disorders have a substantial economic burden on social systems, and personality disorders are no exception. Second, aside for BPD, the costs associated with other
diagnosable personality disorders, including PPD, have been rarely studied. Third, comprehensive costs of crime associated with personality disorders remain under investigated and poorly understood. As detailed in Chapters 1 and 2, PPD is host to many forms of dysfunction and disability, perhaps most notably, criminal recidivism and violence. Consequently, PPD might be a primary driver of national crime costs, and these costs might account for a substantial component of the overall cost of PPD. What follows is an explanation of crime costing methodology and its relation to PPD.

3.1.3. Cost of Crime

Estimating the cost of crime is a complex process that is subject to many known unknowns and unknown unknowns (Wickramasekera, Wright, Elsey, Murray, & Tubeuf, 2015). As is the case for COI studies, cost of crime studies often examine direct, indirect, and intangible cost categories (Ludwig, 2010; Wickramasekera et al., 2015; McCollister et al., 2010). Early attempts at calculating crime costs have focused only on directly measurable or tangible costs. Rajkumar and French (1997) noted that these studies calculated four types of tangible costs. CJS costs include all costs associated with policing, courts, attorneys, and correctional facilities. Career crime/productivity costs comprise the loss in productivity of an individual who commits crime rather than working legally and benefitting society. Victim costs encompasses medical costs, lost wages, reduced productivity and damaged property (although not stolen property, as this does not result in a net financial loss). Other external costs include behaviours used to avoid criminal victimization such as purchasing locks and security systems (Rajkumar & French, 1997). These costs, while important, do not account for indirect resources lost due to crime (i.e., indirect or intangible costs)

For broad COI studies, intangible costs have rarely been considered because of difficulty estimating these indirect financial outputs (Segel, 2006; Tarricone, 2006). Yet, in the specific arena of crime costing studies, several methodologies have been developed for estimating these non-direct costs. A jury compensation model (see Cohen, 1998) estimates victim pain and suffering using financial data from civil court. Using regression equations of injury awards for plaintiffs' pain and suffering damages, one can use the direct measurable losses (medical expenses minus work wages lost) and total jury financial awards to valuate the cost of pain and suffering for civil injuries.
(e.g., sexual assault, robbery). The jury compensation model has been criticized for assuming equality between injuries in civil and criminal cases. It is possible that civil awards may overestimate the reality of victims’ pain and suffering because it is difficult to evaluate jury cost derivation (Ludwig, 2010).

Willingness to-pay (WTP) is an alternative approach to estimating intangible costs. WTP uses contingent valuation to estimate economic values of nonmarket or intangible goods (Cohen, Rust, Steen, & Tidd, 2004). This method estimates non-monetary societal costs of crime (e.g., value of living in a safer community) by surveying public members’ perceptions of their willingness to pay for crime control. For instance, participants were willing to pay approximately $100 to $125 to decrease crime by 10%, and these findings were extrapolated as a function of total crimes and households in the US to estimate specific estimates of the intangible costs of crime (Cohen et al., 2004). These different intangible costing methods have improved and expanded the scope of crime costing studies.

**National Costs of Crime.** Using these different methods and approaches, many comprehensive estimates have emerged for national costs of crime. In a systematic review of national crime costs in developed countries (e.g., US, Australia, United Kingdom (UK), New Zealand; \(k = 21\)), substantial cost variability emerged across nationalities and across studies reporting on the same country (e.g., Australian total crime costs = 9 to 35 billion AUD; Wickramasekera et al., 2015). The US had the highest national costs of crime (450 billion to 3.20 trillion USD), and homicide was the crime category that accounted for the greatest proportion of costs (31%) across all studies. For most crime categories, intangible costs were higher than direct costs except for two property crimes: theft and burglary. Overall, this review revealed substantial heterogeneity in crime costing studies that was attributable to varying conceptual definitions, methodology, crime inclusion, crime categorization, and the underpinning costs.

Several studies have estimated the cost of crime in Canada. Using a general social survey of victimization and worry, Leung (2004) estimated the cost of Canadian pain and suffering attributable to crime at $35.83 billion CAD in 1999. When assumptions were changed regarding property crime, the estimated cost of pain and suffering exceeded $70 billion CAD. To date, two studies have estimated the total cost of
crime in Canada at staggeringly large sums. Zhang (2011) estimated that the national cost of crime was approximately $100 billion in 2008, whereas Easton, Furness, and Brantingham (2014) estimated the total national cost at $81.50 billion in 2012 (for more details of these studies, see the Method section below). At an absolute level, the cost of crime in Canada has been high, and at a relative level, these estimates are equivalent to substantial proportions of the national GDP.

3.1.4. Psychopathy and the Cost of Crime

With such large economic burdens attributed to crime, how much do people with PPD contribute to these national costs? Little has been done to answer this question. Some have hypothesized—without empirical follow-up—that corporate settings, which foster low self-control and financial strain, will increase the association between psychopathy and costly white-collar crime (Pardue, Robinson, & Arrigo, 2013). PPD’s more prevalent operationalization, APD, was estimated to account for $25 billion USD in American corrections costs (Beauchaine et al., 2009), using an estimated 50% lifetime prevalence among those who have been incarcerated. And although PPD is less prevalent than APD, the relative crime risk is greater for the former disorder, and thus crime costs may be higher. It is conceivable that PPD could cost more despite its scarcity.

The cost of crime associated with PPD has been estimated twice using different methodologies. Kiehl and Hoffman (2011) employed a top-down societal perspective and estimated that PPD causes $460 billion (USD) in direct costs. To reach such a conclusion the authors relied on several assumptions. They assumed that (a) 20% of the prison-based offender population was diagnosed with PPD, (b) the cost of crime was $2.3 trillion (see Anderson’s [1999] estimation of the cost of crime), (c) people with PPD and without PPD offend at equal rates, and therefore, (d) the cost of PPD was a simple fraction (i.e., 1/5th) of 2.3 trillion. Under these assumptions, the authors pointed out that this estimation far exceeded the cost of other mental health problems, including substance abuse and schizophrenia.

Yet, some limitations can be raised regarding Kiehl and Hoffman’s estimate. First, the PPD prevalence fluctuates across offenders depending on institution type (e.g., security level, federal vs. provincial/state, community-based supervision). Such
fluctuations were not addressed. Second, the rates of violence are unequal between those with PPD and those without. Third, this PPD-estimate relied on a national cost (Anderson, 1999) that included direct but not indirect costs—the latter accounts for a greater proportion of the overall cost of crime (see Wickramasekera et al., 2015; Zhang, 2011). Kiehl and Sinnott-Armstrong (2013) noted, these logical issues notwithstanding, that this estimate suggested that PPD is “likely the most expensive mental health disorder known to man” (p. 1).

Large economic costs attributable to psychopathic features were also reported in a bottom-up, empirical study of delinquent youth (DeLisi, Reidy, Heirigs, Tostlebe, & Vaughn, 2018). Using self-report measures, psychopathic disturbances among these youth were retrospectively associated with offending costs. The unique effects of individual psychopathy scales—as measured by the Psychopathic Personality Inventory-Short Form (PPI-SF; Lilienfeld & Hess, 2001) and Antisocial Process Screening Device (APSD; Frick & Hare, 2001)—were small and mixed (DeLisi et al., 2018). Yet, the 90th percentile of the PPI-SF Blame Externalization and Machiavellian Egocentricity scales and the APSD Narcissism and Callous-Unemotionality scales were moderately predictive (Area under the curve = .63 to .65) of high crime costs (i.e., costs above the 90th percentile) in the previous year.8 The authors concluded that psychopathic disturbance among youth, when considered aggregately, were relevant to increased criminal costs. At an absolute level, this cost was estimated to be extremely large. On average, a delinquent youth costed $30 million USD annually, and the most criminal youth had costs exceeding $700 million USD.

As novel and compelling as these findings might be, the study was not without limitations. DeLisi and colleagues (2018) used self-report data for the predictor (i.e., psychopathy) and outcome (i.e., crime cost), and this bivariate association was examined retrospectively (i.e., crime in the past year). The self-report psychopathy scales had only moderate internal consistency (α = .55 to .72), and because official criminal records were not used, several types of crimes were not considered in this study (e.g., break and enter, murder). As established previously, homicide has produced the

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8 Impulsivity scales were not associated with increased costs of violent crime.
highest crime costs (Wickramasekera et al., 2015). Thus, although DeLisi and colleagues made an important step in understanding crime costs associated with psychopathy, presently, the full cost of crime attributable to adults diagnosed with PPD remains unspecified.

3.1.5. Purpose

The purpose was to conduct a COI analysis of PPD that focuses on one cost area: crime. I conducted two studies that examined the cost of crime attributed to PPD using top-down (Study 1) and bottom-up (Study 2) approaches. Both approaches were used to maximize their benefits and estimate a comprehensive range of crime costs attributable to PPD. Scholars have suggested that using both is an appropriate approach (see Berlin & Smith, 2004).

In Study 1, I employed a top-down prevalence-based approach to estimate national costs of crime attributable to people with PPD in the US, UK, and Canada. I considered differing rates of offending, PPD prevalence, and national crime cost estimates. Based off these central population parameters, I aimed to refine the assumptions in the Kiehl and Hoffman (2011) estimation, and I provided bounded cost estimates (i.e., lower and upper ranges). A COI prevalence-based approach can inform policy makers when the burden of the illness may be underestimated. This may be particularly relevant for PPD and crime, given that crime costs in the US, for example, were as costly as all health, insurance, and mortgage debt costs (Anderson, 1999). COI prevalence-based studies can also identify economic management strategies by clarifying the breakdown of cost categories (e.g., crime, health care) associated with the illness (Tarricone, 2006). These two goals (i.e., building policy awareness, improving management) are central to the ongoing challenges in managing and treating PPD.

In Study 2, I examined—at a sample and empirical level—the differences in crime costs among Canadian federal offenders with and without PPD. I hoped to address some of the gaps in the literature by providing pseudo-prospective estimates of crime associated with PPD that was assessed using a clinical assessment tool (i.e., not self-report) and by relying on official criminal charges and convictions. Further, this study differed from that of DeLisi and colleagues (2018) because it examined costs among adults, an age group noted to have more serious offending than youth (see Richards,
2011), and thus likely greater costs. Study 2 added depth to the range of estimates produced in Study 1, and it provided additional rationale for shifting priorities around risk management for those with diagnosable PPD.

**Research Questions and Hypotheses.** For Study 1, my research question was: How much is the cost of crime associated with PPD in Canada, the US, and the UK? I hypothesized that PPD would account for a substantial amount of these national crime costs. How much is substantial? First, I expected the PPD-related cost of crime to be disproportionately higher in comparison with the prevalence of PPD, given it is a risk factor for violence and crime. Second, given that the cost of crime accounts for significant portions of national GDPs, I expected that the disproportionate cost of crime associated with PPD would elevate its costs to a level comparable with the overall costs of either borderline personality disorder or schizophrenia.

For Study 2, my research question was: At a sample level, do offenders with PPD have higher crime costs than offenders without PPD? And if so, to what degree? In line with Study 1, I hypothesized that the PPD group would have greater crime costs than the non-PPD group. I expected the effect sizes of these cost differences to be moderate in nature, aligning with effect sizes reported in previous PPD–recidivism research (e.g., Leistico et al., 2008; Yang et al., 2010).

**Supplementary Research Questions.** There is a strong link between PPD and violence risk assessment. Conceptually, violence and criminal risk assessments should—at a minimum—consider psychopathy, among other risk factors. That is, psychopathy is a necessary but non-sufficient component of a comprehensive violence risk assessment (Hart, 1998). In practice, the PCL-R is commonly used in violence risk and forensic assessments (Hurducas, Singh, de Ruiter, & Petrila, 2014; Viljoen, McLachlan, & Vincent, 2010). The PCL-R has been (mis-)used as an actuarial tool guiding risk management practices (Hart, 2016), despite psychopathy being only one of many common risk factors for crime and violence (Bonta, Law, & Hanson, 1988; Douglas et al., 2013).

In sum, psychopathy and forensic risk assessment are intertwined. But given the conflicting claims that (a) psychopathy is an important concept in forensic risk assessment, and (b) HCR-20 violence risk assessments might be as valid without the
PCL-R (Guy et al., 2010), I included the HCR-20 in supplementary research questions for Study 2. Specifically, what is the association between the cost of crime and the HCR-20 Total scale and final summary risk ratings? And how does the HCR-20 compare to PPD in identifying groups associated with disproportionate crime costs? I hypothesized that the HCR-20 would be positively associated with crime costs and that, to a small effect, it would account for greater costs than the PCL-R. This hypothesis rests on two points. First, the HCR-20 includes a more comprehensive set of risk factors than the PCL-R. Second, the HCR-20 has had comparative predictive accuracy to the PCL-R, and at times, provided incremental value above the PCL-R (see Guy et al., 2010).

3.2. Study 1 Method

3.2.1. Procedure

A prevalence-based, top-down approach was selected to estimate costs. I chose a prevalence approach over an incidence approach (i.e., number of new PPD diagnoses) because PPD is predominantly assessed using the PCL-R which assesses a static lifetime prevalence of the disorder. A top-down approach must rely on accurate base rates, but it does not rely on a bottom-up, sample-driven cost extrapolation, which includes sampling generalizability concerns (Tiainen & Rehnberg, 2009).

3.2.2. Assumed Model Parameters

There are three primary parameters for the cost estimation: PPD prevalence, national costs of crime, and offending rates for those with PPD.

Prevalence. Assessing PPD is difficult because it requires extensive and multi-sourced collateral information, which is typically unavailable for most North Americans. The lifetime prevalence of PPD is commonly estimated at 1% in the general population (e.g., Blair, Mitchell, & Blair, 2005)—one third of the upper range of the estimated APD prevalence (American Psychiatric Association, 2013; Grant et al., 2004). Yet, using PPD-specific criteria (i.e., the PCL:SV), the lifetime prevalence of possible psychopathy (i.e., PCL:SV scores greater than 12) was only 0.6% among a representative sample of Great Britain household members (Coid, Yang, Ullrich, Roberts, & Hare, 2009). Only one
A participant ($N = 638$) was above the PCL:SV research cut-off score of 18. These findings may suggest that the 1% prevalence of diagnosable PPD may be an overestimate; however, the Coid and colleagues (2009) study employed a weak methodological design by over selecting at-risk household members to be assessed for PPD and used only a clinical interview to rate the PCL:SV. The soundest conclusion from this study might be that it is difficult to measure PPD prevalence in the community because reliable collateral information is absent.

In prison settings, however, PPD is far more prevalent and easier to assess. Hare, Hart and Harpur (1991) extrapolated from APD DSM-IV criteria to estimate that 25% to 30% of federal inmates would meet criteria for diagnosable PPD. Similar, albeit smaller, empirically estimated prevalence rates have been observed. Across the PCL-R manuals and other investigations (see Table 2), the prevalence of PPD—as defined by PCL-R scores at or above 30 or PCL:SV scores at or above 18—have ranged from 11% to 38% for general or federal Canadian inmates. In the PCL-R manual (Hare, 2003), American offender samples did not exhibit lower mean PCL-R scores than Canadian samples. Canadian-based studies have produced prevalence rates that were higher and lower than American PPD rates. In an examination independent from the PCL-R manual-based samples, 15% met PCL-R criteria for PPD in a large sample of inmates and offenders court-ordered to receive drug treatment (Gatner, Blanchard, Douglas, Lilienfeld, & Edens, 2018). Given the apparent overlap in prevalence ranges, the prevalence rates were assumed to be equal between the two North American countries.
Table 2  Empirical Estimates of the Prevalence of Psychopathic Personality Disorder in Forensic Settings

<table>
<thead>
<tr>
<th>Source</th>
<th>Sample</th>
<th>Psychopathy Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gatner et al., 2018</td>
<td>US inmates and court-ordered substance abuse patients</td>
<td>15%</td>
</tr>
<tr>
<td>Hare, 1991</td>
<td>Canadian inmates</td>
<td>~32%</td>
</tr>
<tr>
<td>Hare, 2003</td>
<td>North American inmates</td>
<td>17%</td>
</tr>
<tr>
<td>Harpur &amp; Hare, 1994</td>
<td>Canadian offenders and forensic psychiatric inpatients</td>
<td>12% to 35%</td>
</tr>
<tr>
<td>Hart et al., 1995</td>
<td>Canadian federal inmates</td>
<td>18% to 34%</td>
</tr>
<tr>
<td>Hart et al., 1995</td>
<td>Canadian federal inmates</td>
<td>18% to 34%</td>
</tr>
<tr>
<td>Olver &amp; Wong, 2015</td>
<td>Representative Canadian federal offenders</td>
<td>11%</td>
</tr>
<tr>
<td>Storey et al., 2016</td>
<td>Representative Canadian federal offenders</td>
<td>17%</td>
</tr>
<tr>
<td>Cooke &amp; Michie, 1999</td>
<td>Scottish offenders</td>
<td>8%</td>
</tr>
<tr>
<td>Coid et al., 2009</td>
<td>UK and Wales offenders</td>
<td>~18%</td>
</tr>
</tbody>
</table>

Note. Psychopathy Prevalence = Sample prevalence of PPD.

Item response theory analyses have provided evidence that PCL-R Total scores should be reduced in the UK to produce equivalent levels of PPD observed in North America (Cooke & Michie, 1999; Cooke, Michie, Hart, & Clark, 2005; cf. Bolt, Hare, & Neumann, 2007). Upon adjustment of the PCL-R cut-off score, the prevalence of PPD in Scottish offenders remained substantially lower than among North American offenders (8% with PCL-R > 25; Cooke & Michie, 1999). A similar prevalence (8%) was observed among male prisoners in Wales and England when applying the traditional PCL-R cut-off of 30 (Coid et al., 2009). Using the relative PCL-R frequencies reported in this study, a cut-off of 25 resulted in an estimated PPD prevalence of approximately 18%. Thus, there appears to be a range of 8% to 18% for UK PPD prevalence among incarcerated offenders.

Given that so much of psychopathy research has occurred among inmates, does PPD prevalence differ among the offending population serving their sentence in the community? The prevalence of psychopathy among offenders supervised in the community (e.g., parole, probation) has generally been variable. Some findings suggest PPD rates are lower among offenders living in the community. For instance, American inmates who received parole had lower PCL-R scores ($d = -.84$) than those who did not receive parole (Guy, Kusaj, Packer, & Douglas, 2015). The prevalence of PCL-R-assessed psychopathy was only approximately 9% (Douglas, 2018) among provincial offenders being released into the community, and among provincially-involved
forensic outpatients convicted of stalking-related offenses, the prevalence was a mere 2% \((n = 1;\) Storey, Hart, Meloy, & Reavis, 2009).

Nevertheless, there is also evidence suggesting that community vs. institutional PPD prevalence rates are less disparate. In samples of Canadian sexual offenders living in the community (i.e., bail, parole, or probation), 15% met the PCL-R-based cut-off for psychopathy, whereas 13% to 30% of participants met the PCL:SV-based cut-off (Harris, 2001; Jackson, 2016). In another Canadian sample of medium-security federal offenders released on parole, 29% met PCL-R cut-off criteria (Porter, Birt, & Boer, 2001). The prevalence of PCL:SV-assessed psychopathy in a US community corrections sample was 13% (Gunter, Chibnall, Antoniak, Philibert, & Hollenbeck, 2011). Overall, these studies suggest that psychopathy rates may be slightly, but not drastically, reduced among a range of offenders serving community-based sentences. The lowest prevalence rates were observed among offenders serving provincial, community-based sentences. This finding is relatively intuitive. Provincial community sentences are given to offenders who have lower risk and service needs. It stands to reason that PPD rates would be lower in this subset of offenders.

If this is true, then what proportion of offenders are on provincially-supervised probation relative to those in custody or on parole? For the 2016/2017 fiscal year in Canada, 117,645 individuals were under correctional supervision (both provincial and federal) in some capacity (Statistics Canada, 2018). Of these individuals, 39,873 or 33% were incarcerated (either remand or serving a custodial sentence; Statistics Canada, 2018) and 58% were serving a provincial community sentence. Despite larger absolute numbers, the relative breakdown of offenders in the US was almost identical to Canada. In the US, of the 6,613,500 people were supervised by all US correctional services, 32% were incarcerated (Kaeble & Cowhig, 2018). Of all the US offenders, 55% were serving a probation sentence.\(^9\) In sum, North American incarceration rates suggest that approximately one-third of offenders are supervised under custody, and approximately half the offending population is serving a probation sentence.

\(^9\) Unlike Canada, US sentencing legislation does not reserve probation for either state or federal offenders. Still, probation is used for individuals who typically sentenced to a brief or no custodial sentence (Bureau of Justice Statistics, 2018)
In the UK, the custody rate was only 7% of the 1,190,000 individuals sentenced in the 2017/2018 fiscal year, whereas approximately ¾ of offenders received only a fine (Ministry of Justice, 2018a). In 2017, there were 265,047 offenders on probation and 84,373 in custody. Thus, the community supervision rate in the UK is estimated at approximately 22% (Ministry of Justice, 2018b). I made a conservative assumption that people who received only a fine had the same PPD prevalence as general population members (i.e., PPD prevalence of 1%). This assumption was made given that no consistent evidence exists regarding PPD prevalence among this group. As a result, estimating a higher prevalence of PPD among those that receive criminal fines would be too speculative and unreliable. The discrepancy between UK and North American custodial and community supervision rates appear to be resulting from recording differences of fines; however, the present UK official records remain the best estimate of official sanctions and criminal justice activity. Thus, although the prevalence rates may be attenuated (see below), this approach is most accurately linked to the outcome of interest: official crime records and their associated costs.

To account for offenders serving community-based sentences, I assumed that 50% of the North American offending population (i.e., offenders with community-based supervision for minor offences) had a 50% reduction in the prevalence of PPD. Mathematically, this reduction results in an overall offender PPD prevalence that is 75% the rate estimated from research focusing on inmates. Thus, the North American PPD prevalence of all offenders was estimated to range from 8.3% to 28.5% (i.e., 0.75 x 11% or 38%). In the UK, I assumed that 71% of offenders received only fines (PPD prevalence of 1%), 7% served time in custody (PPD prevalence of 8% to 18%), and 22% had community supervision at half the PPD prevalence of those in custody (PPD prevalence of 4% to 9%). Thus, in the UK, the range of PPD prevalence among all offenders including those who receive fines is 2.2% to 4%.

**Rate of Crime.** Violence, crime, and psychopathy have been studied meta-analytically many times (see Table 3). These meta-analytic studies can provide a range of effect sizes at which those with PPD offend and are violent. Although the focus of this analysis is on the cost of crime (i.e., recidivism), violence was also considered given that not all crime goes reported and the cost of violent crime far outweighs the cost of non-violent crime (Easton et al., 2014; McCollister et al., 2010).
Table 3 Meta-Analytic Associations Between Psychopathy and Violence and Recidivism

<table>
<thead>
<tr>
<th>Source</th>
<th>Outcome</th>
<th>Psychopathy Scale</th>
<th>Reported Effect Size</th>
<th>Converted Effect Size (OR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salekin et al., 1996</td>
<td>General Recidivism</td>
<td>PCL-R Total</td>
<td>d = 0.55</td>
<td>2.71</td>
</tr>
<tr>
<td></td>
<td>Violence</td>
<td>PCL-R Total</td>
<td>d = 0.79</td>
<td></td>
</tr>
<tr>
<td>Walters, 2003a</td>
<td>Recidivism</td>
<td>PCL-R Total</td>
<td>r = .27</td>
<td>(d = 0.56) 2.76</td>
</tr>
<tr>
<td>Walters, 2003b</td>
<td>General Recidivism</td>
<td>PCL-R Total</td>
<td>r = .15</td>
<td>(d = 0.30) 1.72</td>
</tr>
<tr>
<td></td>
<td>Violent Recidivism</td>
<td>PCL-R Total</td>
<td>r = .32</td>
<td>(d = 0.68) 3.43</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PCL-R F2</td>
<td>r = .18</td>
<td>(d = 0.37) 1.96</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PCL-R F2</td>
<td>r = .26</td>
<td>(d = 0.54) 2.66</td>
</tr>
<tr>
<td>Leistico et al., 2008</td>
<td>Recidivism</td>
<td>PCL tools Total</td>
<td>d = 0.50</td>
<td>2.48</td>
</tr>
<tr>
<td></td>
<td>Antisocial Misconduct</td>
<td>PCL tools Total</td>
<td>d = 0.55</td>
<td>2.71</td>
</tr>
<tr>
<td>Kennealy et al., 2010</td>
<td>Physical Violence</td>
<td>PCL-R F1</td>
<td>log(OR) = 1.04</td>
<td>2.83</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PCL-R F2</td>
<td>log(OR) = 1.15</td>
<td>3.16</td>
</tr>
<tr>
<td>Hawes et al., 2013</td>
<td>Sexual Recidivism</td>
<td>PCL-R Total</td>
<td>d = 0.40</td>
<td>2.07</td>
</tr>
<tr>
<td>Yang et al., 2010</td>
<td>Violent Outcomes</td>
<td>PCL-R Total</td>
<td>d = 0.64</td>
<td>3.19</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PCL:SV Total</td>
<td>d = 0.76</td>
<td>3.97</td>
</tr>
<tr>
<td>Guy et al., 2010</td>
<td>Antisocial Behaviour</td>
<td>PCL tools Total</td>
<td>AUC = .67</td>
<td>(d = 0.62) 3.08</td>
</tr>
<tr>
<td></td>
<td>Violence</td>
<td>PCL tools Total</td>
<td>AUC = .67</td>
<td>(d = 0.62) 3.08</td>
</tr>
</tbody>
</table>

Note. PCL tools total = Total score across multiple PCL-based tools (e.g., PCL-R, PCL:SV, PCL:YV)

Odds ratios (ORs) were used instead of risk ratios because they are the more commonly used effect size in psychological research, and odds and risk ratios become quite similar when the outcome has a low base rate (e.g., recidivism; see Ranganathan, Aggarwal, & Pramesh, 2015). Several sources were relied upon to convert to a common effect size metric (Borenstein, Hedges, Higgins, & Rothstein, 2009; Polanin & Snilstveit, 2016; Wilson, 2018). Researchers are encouraged to consider their reasons for converting different metrics (i.e., continuous vs. dichotomous outcomes), as conversion assumes different population distributions (e.g., logistic vs. bivariate normal). Yet, not converting often means disregarding large portions of the literature (Borenstein et al., 2009). In the current study, d values were converted to ORs using the formula: \( \log(\text{OR}) = d(\pi/\sqrt{3}) \). A meta-analytic calculator (Wilson, 2018) was used to convert Log Odds Ratio to Odds Ratio. Bivariate correlation \( r \) values were converted to \( d \) (and subsequently to OR) using the formula: \( d = 2r(\sqrt{1 - r^2}) \). AUC values were converted to \( d \) using the formula: \( d = \sqrt{2(z(AUC))} \), as outlined by Rice and Harris (2005).

Because the analyses focused on PPD as an entire disorder, I pooled PCL-R factor score effects from meta-analyses that did not report total scores. For instance, Walters’ OR effects for general recidivism (2003b) were 1.96 and 2.66 for Factor 1 and 2, respectively (see Table 3). After dividing the sum of these effects in half, the pooled
OR effect size was 2.31. These estimates were not exact reflections of the total scores, but they served the purpose of increasing the number of considered effects. Across the identified meta-analyses, the OR range was 2.31 to 4.19, with an unweighted mean effect (i.e., 46/16 effects) of 2.88.

**Dark figure of crime.** Unfortunately, I am unaware of any research which can speak to different rates of undetected crime (i.e., the dark figure of crime) between those with and without PPD. Therefore, for the present study, I assumed that the PPD offending rates for detected and undetected crime were equal.

**National Cost of Crime**

**Canada.** Crime rates in Canada have generally decreased over the past 25 years (Allen, 2018; Statistics Canada, 2015), and yet the cost of crime in Canada has paradoxically increased over the same quarter century (Easton et al., 2014). Using a variety of governmental reports (e.g., Uniform Crime Report) and national social surveys (e.g., General Social Survey), Easton and colleagues estimate the annual cost of crime in Canada across the 2000s. For 2009, the year for which the authors had the most comprehensive data, the estimated cost of crime was $85.2 billion. The 2009 estimated total CJS cost (i.e., policing, courts, corrections) was $19.3 billion, and the intangible victim pain and suffering were estimated at $47 billion. For a more recent but less reliable estimate, Easton and colleagues extrapolated that the 2012 cost was $81.5 billion (CJS costing $20.8 billion and victim pain and suffering costing $41.6 billion).

Several of Easton and colleagues’ (2014) methodological decisions suggest that their estimation was responsibly conservative. First, the cost of victim pain and suffering did not comprehensively account for distress and fear or costs to secondary parties (i.e., friends and family). Second, the authors conservatively estimated medical costs by excluding drug-related medical care. Third, an anonymous victim’s life was valued at $5.5 million, yet meta-analytic findings (Viscusi & Aldy, 2003) suggest that the US economic value of life in 2003 was a median of $7 million with a 95% confidence interval of $5.5 to $7.6 million. Viscusi and Aldy (2003) also noted that the statistical value of Canadian and American lives is empirically equal. Thus, before accounting for the

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10 Although there have been small (i.e., 1%) increases in police-reported crime rates in Canada over the past several years (Allen, 2018; Statistics Canada, 2017).
strength of the US dollar and inflation, Easton and colleagues used a lower bound estimate for the cost of criminal fatalities. Taken together, these points suggest that Easton and colleagues’ (2014) Canadian cost of crime was not geared toward sensationallly large estimates.

Zhang (2011) also estimated the cost of crime in Canada in 2008 at approximately 100 billion dollars. The tangible costs of crime in Canada, which included CJS costs (e.g., policing, courts, and corrections), direct victim costs (e.g., medical attention and health care costs), and third-party costs (e.g., loss of productivity, others’ suffering, and other expenditures related to crime) relied on the General Social Survey, Canadian Institute of Health Information, Canadian Criminal Justice Statistics, and Adult Criminal Court Survey as sources of information. The estimated tangible cost of crime was $31.4 billion. Although this estimation accounts for a substantial portion of the total cost of crime, the tangible costs paled in comparison to the intangible costs of crime in Canada. Intangible costs included loss of life and pain and suffering, of which the latter was based on Cohen’s jury compensation methods. These intangible costs of crime were estimated at $68.2 billion and were more than double the economic burden of the tangible costs. Easton and colleagues’ (2014) and Zhang’s (2011) estimates ranged from $81.5 billion to $100 billion, with both estimates comprising substantial intangible costs attributable predominantly to victim pain and suffering.

In the present study, Easton and colleagues’ (2014) and Zhang’s (2011) Canadian costs of crime estimates were transformed to account for inflation. Easton and colleagues’ total cost of crime in 2018 was $92.96 billion when calculated from their 2009 estimate. CJS costs were $21.06 billion and victim pain and suffering costs were $51.28 billion in 2018. Zhang’s (2011) total cost in 2018 was $117.80 billion, with $80.34 billion in intangible costs and $36.99 billion in direct costs.

United States. The estimated burden of crime in the US was $1.7 to $3.2 trillion in 2012 (Anderson, 2012). Several major subcategories underpinned this overall estimate. The crime-induced production cost, or the costs of goods and services that would not exist without crime (e.g., corrections, security systems), was estimated at $646 billion. Opportunity cost, or offenders’ and victims’ lost time and resources (e.g., missed work), was estimated at $253 billion. The value of risks to life and health was estimated at $756 billion. By far, the largest cost category was transfers of goods and
services using criminal means (e.g., selling stolen goods, online fraud), which was estimated at $1,561 billion. Because these transfers do not equate to a net financial loss, the estimated total burden of crime ranged from $1.7 trillion (excluding transfers) to $3.2 trillion (including transfers).

When accounting for inflation, Anderson’s (2012) US cost of crime estimate in 2018 ranged from $1.86 to $3.50 trillion dollars. When considering the subcategory costs in 2018 dollars, crime-induced costs were $706.43 billion, opportunity costs were $276.67 billion, risks to life and health costs were $826.72 billion, and transfers of goods and services using criminal means were $1,707.01 billion.

**United Kingdom.** In an early costing study, Brand and Price (2000) estimated the 1999 cost of crime at approximately £60 billion; however, researchers improved methodological considerations, including intangible and CJS costs and the estimated total number of crimes. This improved study (Dubourg, Hamed, & Thorns, 2005) estimated the 2003 cost of crime in the England and Wales at £36.2 billion, which included direct (CJS expenditures, health services, victim services, property value lost) and indirect national costs. Direct and indirect costs accounted for 36% and 64% of the total costs, respectively. The largest single contributor to the cost of crime was physical and emotional suffering of direct victims of crime (51%). Violent crime accounted for almost three-quarters (74%) of the overall cost of crime (Dubourg et al., 2005). Dubourg and colleagues stated that the previous Brand and Price cost estimate, when accounting for inflation and improved methodology, was 9% greater (i.e., $1.09 x 36.2 = £39.5 billion). In their systematic review, Wickramasekera and colleagues (2015) noted that these two studies were the most comprehensive national cost of crime estimates related for the UK.

When accounting for inflation (Bank of England, 2018), Brand and Price’s (2000) improved total cost of crime was estimated at £59.37 billion in 2017\(^{11}\) pounds. Dubourg and colleagues’ (2005) total cost of crime in 2017 was £54.41 billion.

\(^{11}\) The Bank of England (2018) only calculated inflation rates up to 2017 at the time of writing this dissertation.
3.2.3. Cost Estimation Analysis

The estimated cost of crime attributable to PPD was based off the following original formula:

Cost of crime associated with PPD = (proportion of total crime accounted for by those with PPD) x (the total cost of crime);

Where the first parenthetical component (i.e., proportion of total crime accounted for by those with psychopathy) was estimated from: Total Proportion of Crime = Proportion of PPD Crime + Proportion of non-PPD Crime. More specifically, Total Proportion of Crime = x(PPD rate of crime OR)(PPD offender prevalence) + x(non-PPD relative offending rate)(non-PPD offender prevalence). For instance, a prevalence of 25% and a crime rate for those with PPD of OR = 3.14 would yield the following:

1 = x(3.14)(.25) + x(1)(.75) \rightarrow 1 = x(0.785 + .75) \rightarrow 1 = x(1.535) \rightarrow x = 1/1.535 \rightarrow x = .651465798.

Therefore, 1 (i.e., proportion of crime) = (.65146)(3.14)(.25) + (.65146)(.75) \rightarrow 1 = .5114006515 + .4885993, where the first proportion represents the proportion of crime associated with those suffering from PPD. That is, under these parameters, PPD would account for 51.1% of all crime costs. For the specific proportion calculations, see Appendix A.

I conducted sensitivity analyses to provide bounded estimates given that each parameter has its own set of fixed and random error. These sensitivity analyses estimated the dispersion of annual crime costs attributable to PPD. The parameters ranged from the upper and lower values reported across relevant studies as well as the unweighted mean offending rate (cost of crime = 2 estimates; offending rate = 3 estimates; PPD prevalence = 2 estimates). Twelve separate estimates were reported for the US, UK, and Canada, for a total of 36 cost estimations.

To estimate the central tendency of PPD-related crime while modelling for variability in the underpinning parameters, I also conducted Monte Carlo simulations. This simulation approach is a method of repeated sampling to model numeric results in the face of uncertain parameters (Hunt & Miles, 2015). Monte Carlo simulation requires
that parameters and the nature of chance are specified (Barreto & Howland, 2005). In this dissertation, the Monte Carlo quantitative model was selected by considering the cost estimate formula of the PPD proportion of crime (see above). I specified the distribution (see Hunt & Miles, 2015) for this formula by considering the data’s nature (i.e., discrete proportions) and their limits (i.e., proportions bounded from 0 to 1). I also specified the data shape as relatively symmetrical input, which was centered around the mean without extreme outliers given that it is highly unlikely that all or no crime would be committed by those with PPD. Based on these parameters, I selected a binomial distribution as the best fitting distribution (Mun, 2008). The probability of PPD-attributable crime (see Table 7) in the binomial distribution was specified from the average of all the possible combinations of PPD prevalence and offending rates. These combinations produced 86 North American ($M = 36.55\%$; $SD = 12.92\%$) and 22 UK ($M = 8.73\%$; $SD = 2.89\%$) proportions (see Appendix A for detailed calculations).

3.3. Study 1 Results

3.3.1. Dispersion: Single Estimate Sensitivity Analysis

Using sensitivity analyses to estimate the dispersion of the PPD-related national crime costs, a clear pattern of results emerged that indicated cost differences between the three countries. In descending order, the national cost of crime attributable to PPD was ranked: US, Canada, UK. For the 12 US estimates (see Table 4), the lowest annual total cost of crime attributable to PPD was $321.78 billion, whereas the highest US cost was $2,187.50 billion or $2.19 trillion. By comparison, the Canadian cost estimates were smaller in magnitude (see Table 5). The annual total cost of crime attributable to PPD ranged from $16.08 billion to $73.63 billion. The UK cost estimates were lowest (see Table 6). The lowest total UK cost of crime attributable to PPD was £2.66 billion, whereas the highest estimate was £8.85 billion. Although all costs were substantial, these results demonstrate a clear demarcation between the three countries such that none of the respective cost ranges overlapped.$^{12}$

$^{12}$ When converted to Canadian dollars (CAD; see Bank of Canada, 2018), the highest UK estimate ($15.16$ billion CAD) did not exceed the lowest Canadian estimate ($16.08$ billion).
### Table 4  Total Cost of Crime in the US Associated with Psychopathic Personality Disorder

<table>
<thead>
<tr>
<th>PPD Prevalence</th>
<th>PPD Crime Rate (OR)</th>
<th>PPD Proportion of Crime (%)</th>
<th>US Cost of Crime (Billions)</th>
<th>PPD Total Cost of Crime (Billions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.3%</td>
<td>2.31</td>
<td>17.3</td>
<td>$1,860</td>
<td>$321.78</td>
</tr>
<tr>
<td>8.3%</td>
<td>2.88</td>
<td>20.7</td>
<td>$1,860</td>
<td>$385.02</td>
</tr>
<tr>
<td>8.3%</td>
<td>4.19</td>
<td>27.5</td>
<td>$1,860</td>
<td>$511.50</td>
</tr>
<tr>
<td>28.5%</td>
<td>2.31</td>
<td>47.9</td>
<td>$1,860</td>
<td>$890.94</td>
</tr>
<tr>
<td>28.5%</td>
<td>2.88</td>
<td>52.3</td>
<td>$1,860</td>
<td>$972.78</td>
</tr>
<tr>
<td>28.5%</td>
<td>4.19</td>
<td>62.5</td>
<td>$1,860</td>
<td>$1,162.50</td>
</tr>
<tr>
<td>8.3%</td>
<td>2.31</td>
<td>17.3</td>
<td>$3,500</td>
<td>$2,187.50</td>
</tr>
<tr>
<td>8.3%</td>
<td>2.88</td>
<td>20.7</td>
<td>$3,500</td>
<td>$724.50</td>
</tr>
<tr>
<td>8.3%</td>
<td>4.19</td>
<td>27.5</td>
<td>$3,500</td>
<td>$926.50</td>
</tr>
<tr>
<td>28.5%</td>
<td>2.31</td>
<td>47.9</td>
<td>$3,500</td>
<td>$1,676.50</td>
</tr>
<tr>
<td>28.5%</td>
<td>2.88</td>
<td>52.3</td>
<td>$3,500</td>
<td>$1,830.50</td>
</tr>
<tr>
<td>28.5%</td>
<td>4.19</td>
<td>62.5</td>
<td>$3,500</td>
<td>$2,187.50</td>
</tr>
</tbody>
</table>

### Table 5  Total Cost of Crime in Canada Associated with Psychopathic Personality Disorder

<table>
<thead>
<tr>
<th>PPD Prevalence</th>
<th>PPD Crime Rate (OR)</th>
<th>PPD Proportion of Crime (%)</th>
<th>Canadian Cost of Crime (Billions)</th>
<th>PPD Total Cost of Crime (Billions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.3%</td>
<td>2.31</td>
<td>17.3</td>
<td>$92.96</td>
<td>$16.08</td>
</tr>
<tr>
<td>8.3%</td>
<td>2.88</td>
<td>20.7</td>
<td>$92.96</td>
<td>$19.24</td>
</tr>
<tr>
<td>8.3%</td>
<td>4.19</td>
<td>27.5</td>
<td>$92.96</td>
<td>$25.56</td>
</tr>
<tr>
<td>28.5%</td>
<td>2.31</td>
<td>47.9</td>
<td>$92.96</td>
<td>$44.53</td>
</tr>
<tr>
<td>28.5%</td>
<td>2.88</td>
<td>52.3</td>
<td>$92.96</td>
<td>$48.62</td>
</tr>
<tr>
<td>28.5%</td>
<td>4.19</td>
<td>62.5</td>
<td>$92.96</td>
<td>$58.10</td>
</tr>
<tr>
<td>8.3%</td>
<td>2.31</td>
<td>17.3</td>
<td>$117.80</td>
<td>$20.38</td>
</tr>
<tr>
<td>8.3%</td>
<td>2.88</td>
<td>20.7</td>
<td>$117.80</td>
<td>$24.38</td>
</tr>
<tr>
<td>8.3%</td>
<td>4.19</td>
<td>27.5</td>
<td>$117.80</td>
<td>$32.40</td>
</tr>
<tr>
<td>28.5%</td>
<td>2.31</td>
<td>47.9</td>
<td>$117.80</td>
<td>$56.43</td>
</tr>
<tr>
<td>28.5%</td>
<td>2.88</td>
<td>52.3</td>
<td>$117.80</td>
<td>$61.61</td>
</tr>
<tr>
<td>28.5%</td>
<td>4.19</td>
<td>62.5</td>
<td>$117.80</td>
<td>$73.63</td>
</tr>
</tbody>
</table>
Table 6  Total Cost of Crime in the UK Associated with Psychopathic Personality Disorder

<table>
<thead>
<tr>
<th>PPD Prevalence</th>
<th>PPD Crime Rate (OR)</th>
<th>PPD Proportion of Crime (%)</th>
<th>UK Cost of Crime (Billions)</th>
<th>PPD Total Cost of Crime (Billions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.2%</td>
<td>2.31</td>
<td>4.9</td>
<td>£54.41</td>
<td>£2.66</td>
</tr>
<tr>
<td>2.2%</td>
<td>2.88</td>
<td>6.1</td>
<td>£54.41</td>
<td>£3.32</td>
</tr>
<tr>
<td>2.2%</td>
<td>4.19</td>
<td>8.6</td>
<td>£54.41</td>
<td>£4.68</td>
</tr>
<tr>
<td>4.0%</td>
<td>2.31</td>
<td>8.8</td>
<td>£54.41</td>
<td>£4.79</td>
</tr>
<tr>
<td>4.0%</td>
<td>2.88</td>
<td>10.7</td>
<td>£54.41</td>
<td>£5.82</td>
</tr>
<tr>
<td>4.0%</td>
<td>4.19</td>
<td>14.9</td>
<td>£54.41</td>
<td>£8.11</td>
</tr>
<tr>
<td>2.2%</td>
<td>2.31</td>
<td>4.9</td>
<td>£59.37</td>
<td>£2.91</td>
</tr>
<tr>
<td>2.2%</td>
<td>2.88</td>
<td>6.1</td>
<td>£59.37</td>
<td>£3.62</td>
</tr>
<tr>
<td>2.2%</td>
<td>4.19</td>
<td>8.6</td>
<td>£59.37</td>
<td>£5.10</td>
</tr>
<tr>
<td>4.0%</td>
<td>2.31</td>
<td>8.8</td>
<td>£59.37</td>
<td>£5.22</td>
</tr>
<tr>
<td>4.0%</td>
<td>2.88</td>
<td>10.7</td>
<td>£59.37</td>
<td>£6.35</td>
</tr>
<tr>
<td>4.0%</td>
<td>4.19</td>
<td>14.9</td>
<td>£59.37</td>
<td>£8.85</td>
</tr>
</tbody>
</table>

3.3.2. Central Tendency: Monte Carlo Simulation

I conducted a Monte Carlo simulation to analyze the central tendency of the PPD cost estimates. Table 7 details the results of the simulation analysis, which yielded mean proportions of PPD-related crime in North America ($M = .3646$) and the UK ($M = .0876$) that were consistent with the single-estimate sensitivity analyses (see above). The simulated range of proportions for North America (.2100 to .5300) fell within the minimum and maximum estimates that resulted from these sensitivity analyses. The simulated proportion range for the UK (.0200 to .1800), however, extended beyond the upper bound of the UK sensitivity analyses (maximum estimate = .1490). Figures 6 and 7 present the simulated distributions for the proportion of PPD-attributable crime. A visual comparison of the figures demonstrates that the UK proportions were smaller than the North American proportions.

Table 7  Monte Carlo Simulation of the Proportion of Crime Attributable to Psychopathic Personality Disorder

<table>
<thead>
<tr>
<th>Descriptive Statistic</th>
<th>North America</th>
<th>United Kingdom</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>1,000</td>
<td>1,000</td>
</tr>
<tr>
<td>Mean</td>
<td>.3646</td>
<td>.0876</td>
</tr>
<tr>
<td>SD</td>
<td>.0485</td>
<td>.0280</td>
</tr>
<tr>
<td>Minimum</td>
<td>.2100</td>
<td>.0200</td>
</tr>
<tr>
<td>Maximum</td>
<td>.5300</td>
<td>.1800</td>
</tr>
<tr>
<td>IQR</td>
<td>.3300 to .4100</td>
<td>.0700 to .1100</td>
</tr>
</tbody>
</table>

Note. n = Number of simulation trials; IQR = Interquartile Range from the 25th to 75th Percentile.
Figure 6  Frequency Distribution of Monte Carlo Simulation for North American PPD-Related Crime Costs

Figure 7  Frequency Distribution of Monte Carlo Simulation for UK PPD-Related Crime Costs
When multiplying the low and high 2018 Canadian costs of crime with these simulated proportions, the mean cost of PPD-related crime in Canada was estimated at $33.89 billion (Interquartile Range [IQR] = $30.68 to $38.11) and $42.95 billion (IQR = $38.87 to $48.30), respectively. In the US, the 2018 mean cost of PPD-related was estimated at $678.16 billion (IQR = $613.80 to $762.20) for the lower estimate and $1,276.10 billion (IQR = $1,115.00 to $1,435.00) for the higher estimate. In the UK, the 2017 mean cost of PPD-related crime was £4.77 billion (IQR = £3.81 to £5.99) and £5.20 billion (IQR = £4.16 to £6.53) for the respective low and high cost estimates. These results demonstrate that PPD accounted for substantial crime costs, which were disproportionate to the relatively smaller PPD prevalence estimates within the offender population. For instance, using a low-end single prevalence estimate (8.3%) with an average recidivism odds ratio (OR = 2.88), offenders with PPD will create approximately 2.49 times the proportion of crime costs relative to their prevalence.

3.4. Study 1 Summary and Discussion

In Study 1, I investigated the cost of crime attributable to PPD using a top-down cost of illness approach. PPD prevalence and recidivism rates among offenders were combined and applied to national costs of crime in the US, UK, and Canada. These parameters yielded a range of cost dispersion using single-point sensitivity analysis and central tendency using Monte Carlo simulation. The results supported my hypothesis that the PPD-related cost of crime would be disproportionately higher relative to the prevalence of PPD.

The 2018 estimated Canadian cost of crime attributable to PPD ranged from $16.08 billion to $73.63 billion. The simulated mean cost was $33.89 billion. According to the World Bank Organization (2018), Canada’s GDP was $1.65 trillion USD in 2017, which converts to $2.13 trillion CAD (Bank of Canada, 2018). Therefore, the 2018 annual cost of crime attributable to PPD would account for the equivalent of 1.6% of Canada’s latest GDP estimate. For comparison, this cost would greatly exceed all transportation injury costs in Canada in 2010 (i.e., $4.30 billion; see Parachute, 2015).

The current estimated Canadian costs for a specific domain (i.e., crime costs) of a specific illness (i.e., PPD) were not too discrepant from the estimated cost for all Canadian major mental illness, excluding personality disorders (see Mental Health
Commission of Canada, 2013). This overall cost was approximately $50 billion or 2.8% of the Canadian GDP, which resulted in a call for a large-scale, multi-system action plan with primary and tertiary interventions targeting mental illness (Mental Health Commission of Canada, 2013). In the present dissertation, the simulated cost of crime attributable to PPD at the 75th percentile ($48.30 billion) was comparable to the Canadian cost of all major mental illness. The similarity in these economic impacts suggests that large-scale interventions are also likely needed for PPD.

The US PPD-related crime costs were higher than the Canadian costs even when accounting for a substantially larger American economic footprint. The estimated US cost of crime attributable to PPD ranged from $322 billion to $2.19 trillion. The US GDP was $19.39 trillion in 2017 (World Bank Organization, 2018). Therefore, the mean simulated cost of crime attributable to PPD ($678 billion) in this dissertation would account for the equivalent of 3.5% of the national GDP. By comparison, these PPD-costs were higher than direct costs due to American motor vehicle crashes in 2010 ($242 billion) and similar to motor-vehicle costs when accounting for quality-of-life losses ($836 billion; see Blincoe, Miller, Zaloshnja, & Lawrence, 2015).

The UK PPD-related crime costs were the lowest of the three nations with a range from £2.66 to £8.85 billion. The UK GDP was $2.62 trillion USD in 2017 (World Bank Organization, 2018), which converts to £1.94 trillion. Therefore, the mean simulated cost of crime attributable to PPD (£4.77 billion) in this dissertation would account for the equivalent of 0.2% of the UK’s GDP. By way of comparison, the annual Canadian per capita cost of crime attributable to PPD was $914.49 based on a national population rate of 37,058,856 in 2018 (Statistics Canada, 2018). In the US, the PPD per capita crime cost was $2,072.33 based on a national population rate of 327,167,434 in 2018 (United States Census Bureau, 2019). In the UK, the PPD per capita crime cost was £71.80 based on a national population rate of 66,436,470 in 2018 (Office of National Statistics, 2018). These per capita patterns suggest that irrespective of country population, the estimated cost of PPD was highest in the US and lowest in the UK.

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13 The most recent official UK population estimate was 66,040,229 in 2017 with an annual growth rate of 0.6%. This growth rate was applied to the 2017 population to create an estimated national population in 2018 of 66,436,470.
In comparison with Canada and the US, the lower estimated UK costs likely resulted from unique national criminal justice decision-making procedures. In the UK, a greater proportion of justice-involved people are formally handled using only fines (Ministry of Justice, 2018a, 2018b). These fine-only individuals are incorporated into the national offender management figures, which reduces the incarceration rates for all offenders. This lowered incarceration rate among offenders, in turn, lowers the prevalence of PPD—a central parameter for estimating this disorder’s effect on crime costs. While speculative in nature, it is quite possible that the UK PPD crime cost was an underestimate. Nevertheless, even at its smallest financial impact in the UK, the cost of crime attributable to PPD appears to have a massive economic burden in each of these three Western nations.

When comparing the economic impacts of PPD to other mental disorders, these dissertation findings support the hypothesis that PPD-related crime costs were at least comparable to overall cost of illness estimates for either BPD or schizophrenia. European national cost estimates of BPD have ranged from €2.22 to €8.69 billion (Van Asselt et al., 2007; Wunsch et al., 2014). In Canada, the 2004 estimated cost of schizophrenia was estimated at $6.85 billion (Goeree et al., 2005). These overall costs were well below the reported American and Canadian PPD-related crime costs and were comparable with the UK costs. These findings suggest that PPD may have similar or greater societal costs than BPD or schizophrenia. Because different costing methodologies and outcomes were considered across these disorders, such a claim must be viewed as a scientific possibility that requires extensive and prolonged empirical research. There are many different explanations and cost possibilities that require ruling out.

For instance, PPD is associated with significant harm to others, but a significant minority of those with BPD will die by suicide (Oldham, 2006). The cost of self-injurious behaviours with BPD may balance the cost of violence with PPD. It is also possible to conduct similar crime-specific costing analyses for BPD to determine its own impact on national costs of crime; however, the resulting costs would likely be far lower than PPD given that APD and PPD have been the central personality disorder presentation contributing to crime and violence (Leistico et al., 2008; Yu et al., 2012). Clinically, treatment services are provided far less frequently to those with PPD than psychotic
disorders or BPD, which may result in substantial differences in health care costs between these disorders.

Certainly, these are only a few considerations among many other economic issues that require investigating between PPD and other major mental health conditions. An answer regarding differences in the economic burden of PPD and other mental disorders will remain unspecified until comprehensive and comparative cost of illness studies are conducted. Nevertheless, the present findings suggest that more resources and emphasis should be given to treating and managing PPD because its economic impact is possibly similar to disorders like BPD and schizophrenia, which rightfully lie at the forefront of clinical research.

3.4.1. Limitations and Methodological Considerations

The Study 1 results are underpinned by many methodological decisions and assumptions. Chief among these decisions were those surrounding the three primary parameters of interest: PPD prevalence, PPD relative offending rates, and national crime costs. PPD prevalence was estimated from empirical investigations using the PCL-R and PCL:SV to measure PPD among federal and provincial/state offenders, as well as some forensic psychiatric samples. Incarcerated offenders are only a subset of the entire offender population, and so these empirically sampled prevalence rates were reduced to account for offenders serving only community-based supervision where PPD prevalence is likely lower. This prevalence alteration notwithstanding, the North American upper prevalence estimate of 28.5% in this dissertation was derived from a study that reported a PPD prevalence of 38% among provincial offenders (see Hart et al., 1995). This upper bound is objectively high and likely does not accurately reflect the total prevalence among all people who committed crimes in Canada and the US. Caution is warranted around interpreting the upper bounded results from the sensitivity analyses, and readers are encouraged to consider these findings in the broader context of all the results (i.e., lower and middle bound estimates and Monte Carlo simulations).

The relative PPD offending rates were also possibly too extreme at the upper bound. The highest converted odds ratio was 4.19, meaning that those with PPD were approximately four times more likely to offend than those without PPD. This odds ratio was derived from an empirical source (i.e., meta-analysis, see Salekin et al., 1996)
where the effect size considered violence as the outcome rather than general recidivism. This study has also been criticized for having other methodological issues (see Gendreau et al., 2002). Nevertheless, the methodology of the current dissertation was to canvas many peer-reviewed meta-analyses that investigated PPD and antisociality, and the Salekin and colleagues (1996) work met this criterion. Still, much like readers of this dissertation should consider inflated PPD prevalence rates, they should also be aware of this potentially inflated offending rate and attend to the entire range of PPD-crime related costs including the Monte Carlo cost simulations.

Readers should also consider my assumption that each crime was independent of other crimes. This decision allowed me to equate the proportion of committed crimes with the proportion of the overall cost of crime. Certainly, some crimes may share direct costs (e.g., one unit of policing, judicial, and correctional costs is applied to five convictions that occurred concurrently). Whether these co-occurring crimes are randomly distributed is unclear. People with PPD may be more likely to commit crimes concurrently, or vice versa. To my knowledge, there is no evidence explicitly addressing this question. Because the PCL-R measures criminal versatility and moderate associations exist between psychopathy and offending, it is plausible that PPD is associated with more crimes that are handled concurrently. If this were found true, then in this dissertation I may have overestimated direct crime costs associated with PPD. Of note, these direct criminal justice costs account for a small portion of the total cost of crime compared with indirect costs (e.g., victim pain and suffering).

National crime costs were derived from original sources that conducted comprehensive estimations. Although there were no serious concerns regarding these sources, it remains unclear whether the authors’ internal reviews went through the same scrutiny as peer-reviewed journal articles given that most sources were governmental reports (see Brand & Price, 2000; Dubourg et al., 2009; Easton et al., 2014; Zhang 2011). The US cost of crime (Anderson, 2012) was the exception; it was published in a reputable peer-reviewed academic journal. The Anderson (2012) study provided two different overall US crime costs, but an independent cost estimation from a different authorship group could have increased reliability in the range of American crime costs.

The other concern regarding national crime costs involves transforming costs to a more present year (i.e., 2018). These national costs had to be adjusted for inflation—
the general economic principle that prices and costs tend to increase over time (Black, Hashimzade, & Myles, 2017). Using inflation calculators, I adjusted costs to 2018 for North America and 2017 for the UK. Crime costs may not have followed the same trajectory as inflation. For instance, inflation may have increased over a 5-year period while the criminal justice system may have become more economically efficient. If there was a significant mismatch between inflation and changes in crime costs in 2018 then additional error would be introduced into the current cost estimates.

I employed a prevalence-based costing approach to Study 1. In comparison with incidence-based studies, prevalence-based approaches can be susceptible to overestimating costs (Tarricone, 2006). Such overestimation occurs when the illness incidence is declining across cohorts and when the disability costs are either declining over time or rising over the course of the disease (Tarricone, 2006). PPD does not appear to meet any of these criteria; there is no evidence suggesting its incidence is declining nor is there evidence of fluctuations in treatment and disability costs. As such, there was no indication that the current prevalence-based costing approach was subject to more bias or inaccuracy than other methods.

Finally, to my knowledge this was the first systematic cost of illness (COI) study of PPD, which always warrants caution. It was only one study. It was not a comprehensive COI because only crime costs were considered (e.g., health and direct work productivity costs were not considered). Across the COI literature, variable cost estimates frequently emerge for the same disorder across different comprehensive studies. Researchers of PPD that are interested in its social burden need to test different financial assumptions and outcomes to achieve a better sense of the central tendency and dispersion of PPD crime costs and overall costs. Much like how larger sample sizes provide tighter statistical confidence intervals, more PPD cost of illness studies will increase the reliability of the resulting estimates.

### 3.4.2. Study 1 Conclusion

The Study 1 findings suggest that PPD may cause an enormous annual societal burden through crime costs. Even at the lowest and most conservative estimates, PPD-related financial costs were objectively meaningful and warrant economic, policy, and clinical intervention. The societal top-down approach of Study 1 has its merits and
limitations. To counterbalance this approach in Study 2, I conducted a bottom-up, sample-driven examination of the crime costs attributable to PPD among Canadian offenders. Much like clinicians should take a multi-method approach to assessment (Campbell & Fiske, 1959), Study 1 and 2 can provide possible converging evidence regarding PPD costs.

3.5. Study 2 Method

3.5.1. Participants

The sample under investigation was from an existing research project (see Douglas, Yeomans, & Boer, 2005). Participants were 188 male federal offenders released from federal correctional institutions in Western Canada. Three-quarters were White (73%) and a sizeable minority were identified as Indigenous or partially Indigenous (19%). The mean age at release into the community was 38.3 years old (SD = 10.8). Prior to their reintegration into the community, approximately half the participants had previously committed a violent crime (55%), and almost all participants (98%) were convicted of a violent offence as a part of the index offenses that resulted in their most recent federal custodial sentence. The modal index offences (see Table 8) were theft (64%), robbery (47%), and homicide (42%). Most participants (89%) had a criminal history prior to their index offenses, and the mean age of first criminal justice contact occurred in early adulthood (M = 19.1; SD = 8.6).

Table 8: Descriptive Statistics of Previous Offenses and Index Offenses

<table>
<thead>
<tr>
<th>Conviction</th>
<th>Offense history</th>
<th>Index offenses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Theft</td>
<td>144</td>
<td>77</td>
</tr>
<tr>
<td>Robbery</td>
<td>100</td>
<td>53</td>
</tr>
<tr>
<td>Drug-related</td>
<td>73</td>
<td>39</td>
</tr>
<tr>
<td>Assault</td>
<td>71</td>
<td>38</td>
</tr>
<tr>
<td>Homicide</td>
<td>81</td>
<td>43</td>
</tr>
<tr>
<td>Possession of weapon</td>
<td>62</td>
<td>33</td>
</tr>
<tr>
<td>Sexual-related</td>
<td>31</td>
<td>17</td>
</tr>
<tr>
<td>Major driving</td>
<td>75</td>
<td>40</td>
</tr>
<tr>
<td>Fraud</td>
<td>56</td>
<td>30</td>
</tr>
<tr>
<td>Escape</td>
<td>113</td>
<td>60</td>
</tr>
<tr>
<td>Kidnapping</td>
<td>20</td>
<td>11</td>
</tr>
<tr>
<td>Obstruction of justice</td>
<td>44</td>
<td>23</td>
</tr>
<tr>
<td>Other</td>
<td>82</td>
<td>44</td>
</tr>
</tbody>
</table>
3.5.2. Measures and Outcomes

Psychopathy Checklist—Revised (Hare, 1991). The PCL-R is a clinician-rated measure of psychopathy comprising 20 items indexing psychopathic features that are rated 0 (not present or does not apply), 1 (maybe or partly present), or 2 (definitely present). Total scores can range from 0 to 40, and a research cut-off of 30 or greater has typically been used to represent a diagnosis of PPD, whereas scores below 20 has been used to designate non-psychopathic individuals (Douglas et al., 2015; Hare, 1991). Ratings are made from reviewing file information, collateral sources, and clinical interview, but the manual does allow for assessments based solely on file information (i.e., no direct clinical interview) when sufficient file information exists (see Hare, 2003).

The file-only approach has been common in research contexts (Harris, Rice, & Cormier, 2013). In the current study, the PCL-R was scored using only file information. Although evidence is mixed regarding differences between PCL-R scores based only on file vs. file and interview (Harris et al., 2013), the PCL-R manual (Hare, 2003) reported a substantial difference between the two assessment methods such that file-based Total scores were approximately 5.6 points lower than assessments supplemented with interview information. As such, two classification systems were used for psychopathic groups. The first classification was the standard research cutoff score of 30 or greater to indicate PPD membership, whereas the second classification was a cutoff score of 25 to account for the potential of suppressed PCL-R Total scores.

Finally, given the evidence for a 3-facet model that excludes the PCL-R Antisocial Facet (see Cooke & Michie, 2001; Cooke & Sellbom, 2018), PPD vs non-PPD groups were calculated using a PCL-R cut-off score of ≥17, using only the items related to the 3-facet model. A cut-off of 17 was selected because in the current sample, 20% of offenders met this PPD threshold. This prevalence was in keeping with empirical evidence (e.g., Hare, 1991, 2003; Storey et al., 2016) and fell within the prevalence rates operationalized by PCL-R cut-offs of 25 and 30 in the current study (see Descriptive Statistics section). Interrater reliability of the PCL-R—as indexed by intraclass coefficients (ICCs)—has been greater than .80 for single raters, and .90 when averaged
across two raters (Hare, 2003; DeMatteo, Edens, & Hart, 2010). In the current study, 15% of the participants (n = 28) were rated by two raters and interrater reliability was excellent (see Cicchetti & Sparrow, 1981) for PCL-R Total scores (ICC₁ = .94, ICC₂ = .97; see Table 9). PCL-R Total scores also had excellent internal consistency (α = .92).

### Table 9  Descriptive Statistics of the PCL-R and HCR-20

<table>
<thead>
<tr>
<th>Scale</th>
<th>M (SD)</th>
<th>Median</th>
<th>Skewness</th>
<th>Kurtosis</th>
<th>ICC₁</th>
<th>ICC₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCL Interpersonal</td>
<td>2.76 (2.67)</td>
<td>3</td>
<td>0.42</td>
<td>-0.82</td>
<td>.86</td>
<td>.93</td>
</tr>
<tr>
<td>PCL Affective</td>
<td>4.35 (2.26)</td>
<td>4</td>
<td>-0.19</td>
<td>-0.70</td>
<td>.83</td>
<td>.91</td>
</tr>
<tr>
<td>PCL Lifestyle</td>
<td>4.97 (2.89)</td>
<td>5</td>
<td>-0.22</td>
<td>-0.99</td>
<td>.92</td>
<td>.96</td>
</tr>
<tr>
<td>PCL Antisocial</td>
<td>5.33 (2.89)</td>
<td>6</td>
<td>-0.39</td>
<td>-0.94</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCL Total</td>
<td>18.85 (8.68)</td>
<td>20</td>
<td>-0.37</td>
<td>-0.62</td>
<td>.94</td>
<td>.97</td>
</tr>
<tr>
<td>HCR H</td>
<td>11.14 (3.92)</td>
<td>12</td>
<td>-0.58</td>
<td>-0.36</td>
<td>.90</td>
<td>.95</td>
</tr>
<tr>
<td>HCR C</td>
<td>4.35 (2.47)</td>
<td>5</td>
<td>-0.16</td>
<td>-1.00</td>
<td>.81</td>
<td>.89</td>
</tr>
<tr>
<td>HCR R</td>
<td>4.62 (2.76)</td>
<td>5</td>
<td>0.07</td>
<td>-1.01</td>
<td>.91</td>
<td>.96</td>
</tr>
<tr>
<td>HCR Total</td>
<td>20.10 (7.94)</td>
<td>21</td>
<td>-0.37</td>
<td>-0.54</td>
<td>.93</td>
<td>.96</td>
</tr>
<tr>
<td>HCR Total without H7</td>
<td>19.47 (7.47)</td>
<td>20</td>
<td>-0.42</td>
<td>-0.48</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. ICC₁ = Intraclass correlation coefficient representing single rater reliability; ICC₂ = Intraclass correlation coefficient representing average rater reliability if two raters completed the assessment. PCL = Psychopathy Checklist—Revised; HCR H = Historical-Clinical-Risk Management-20 (HCR-20) Historical Scale; HCR C = HCR-20 Clinical Scale; HCR R = HCR-20 Risk Management Scale; HCR Total = HCR-20 Total score; HCR Total without H7 = HCR-20 Total score excluding H7 scores (Psychopathy).

**Historical-Clinical-Risk Management-20 (HCR-20; Webster et al., 1997).**

The HCR-20 is a set of structured professional judgment guidelines for assessing general violence. Among its procedures and considerations, it includes 20 risk factors for violence, which are considered for the examinee and coded as *absent, possibly or partially present, or definitely or clearly present*. Risk factors are divided into three groups. Ten *Historical* risk factors capture an examinee’s past and are relatively unchanging (e.g., employment problems, relationship problems). Five *Clinical* risk factors capture an examinee’s current and dynamic functioning (e.g., insight, violent ideation and attitudes). Finally, five *Risk Management* risk factors capture an examinee’s future, particularly in regard to areas that can reduce the likelihood of violence (e.g., plans, social support, stress and coping).

HCR-20 guidelines intend for evaluators to consider the presence and relevance of risk factors to inform a summary risk rating of *low, moderate, or high*. Risk factors are not simply summed up in an actuarial fashion. Instead, evaluators are expected to consider how the risk factors contribute to an examinee’s violence risk and management based on a guided clinical judgment. In general, the greater the number of present and
relevant risk factors, the greater the risk for violence; however, this is a guiding principle rather than a rule of law. Nevertheless, for statistical and research applications, risk factors are typically scored 0, 1, 2 (i.e., 0 = absent, 1 = possibly or partially present, or 2 = definitely or clearly present, respectively) and summed into their domains (i.e., Total, Historical, Clinical, and Risk Management scores), including a Total score that ranges from 0 to 40.

Psychometric examinations of the HCR-20 have resulted in good to excellent interrater reliability (Douglas & Reeves, 2010). Across 36 studies, the reported median ICCs were: Total (.85), Historical (.86), Clinical (.74), Risk Management (.68), and summary risk ratings (.65; nine samples only). The HCR-20 has demonstrated moderate to large predictive effects for future violence and crime among a variety of clinical populations (Campbell, French, & Gendreau, 2009; Guy et al., 2010; O'Shea, Mitchell, Picchioni, & Dickens, 2013; Singh, Grann, & Fazel, 2011). In the current study (see Table 9), ICC₁ values for HCR-20 Total and subscale scores ranged from .81 to .93 and ICC₂ values ranged from .89 to .96. These interrater reliability indices were considered excellent (see Cicchetti & Sparrow, 1981), but HCR-20 summary risk ratings (ICC₁ = .41; ICC₂ = .58) were fair.

**Crime-specific costs.** Each crime in the data set was given a per-unit cost (see Table 10), which was derived primarily from previous empirical works that estimated per-unit costs for specific crimes in Canada (Easton et al., 2014) and the US (McCollister et al., 2010). Several other empirical cost estimates were used for specific crimes to provide cost ranges, including Aos, Phipps, Barnoski, and Lieb's (2003) estimate of drug-related crimes, Cohen's (1988) estimate of kidnapping, and Miller, Cohen, and Wiersema's (1996) estimate of general assault costs. The frequency of participants’ prospective charges and convictions were summed and then transformed into a financial outcome using the crime-specific costs. Costs were transformed by inflation into 2018 Canadian dollars. If American costs were used, they were also transformed into Canadian dollars by a factor of 1.24—the USD to CAD exchange rate on January 1st, 2018 (Bank of Canada, 2018). For a comprehensive explanation of cost calculations, see Appendix B.
Table 10  Unit Costs for Specific Violent and Non-Violent Crimes in 2018 Canadian Dollars

<table>
<thead>
<tr>
<th>Crime</th>
<th>Lower cost per crime</th>
<th>Upper cost per crime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Violent crime</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Murder</td>
<td>$6,099,372.89\textsuperscript{a}</td>
<td>$13,080,074.38\textsuperscript{b}</td>
</tr>
<tr>
<td>Attempted Murder</td>
<td>$586,350.48</td>
<td>—</td>
</tr>
<tr>
<td>Sexual assault - broad</td>
<td>$29,750.89\textsuperscript{a}</td>
<td>$350,595.64\textsuperscript{b}</td>
</tr>
<tr>
<td>Sexual assault I</td>
<td>$27,235.82\textsuperscript{a}</td>
<td>—</td>
</tr>
<tr>
<td>Sexual assault II</td>
<td>$153,064.42\textsuperscript{a}</td>
<td>—</td>
</tr>
<tr>
<td>Sexual assault III</td>
<td>$155,832.57\textsuperscript{b}</td>
<td>$180,157.31\textsuperscript{a}</td>
</tr>
<tr>
<td>Assault - broad</td>
<td>$22,351.79\textsuperscript{a}</td>
<td>$46,444.40\textsuperscript{e}</td>
</tr>
<tr>
<td>Assault I</td>
<td>$12,758.64\textsuperscript{a}</td>
<td>—</td>
</tr>
<tr>
<td>Assault II</td>
<td>$36,031.46\textsuperscript{a}</td>
<td>—</td>
</tr>
<tr>
<td>Assault III</td>
<td>$352,773.78\textsuperscript{a}</td>
<td>—</td>
</tr>
<tr>
<td>Kidnapping</td>
<td>$51,180.78\textsuperscript{a}</td>
<td>$51,708.84\textsuperscript{d}</td>
</tr>
<tr>
<td>Robbery</td>
<td>$61,607.89\textsuperscript{b}</td>
<td>$159,554.50\textsuperscript{a}</td>
</tr>
<tr>
<td>Non-violent crime</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Theft</td>
<td>$5,142.97\textsuperscript{b}</td>
<td>$55,998.14\textsuperscript{a}</td>
</tr>
<tr>
<td>Break-and-enter</td>
<td>$9,409.37\textsuperscript{b}</td>
<td>$66,133.70\textsuperscript{a}</td>
</tr>
<tr>
<td>Drug-related</td>
<td>$3,315.20\textsuperscript{a}</td>
<td>$45,260.62\textsuperscript{c}</td>
</tr>
<tr>
<td>Other crimes</td>
<td>9,955.52\textsuperscript{a}</td>
<td>—</td>
</tr>
</tbody>
</table>

Note. — = An upper bound cost was not empirically available for this crime category.
\textsuperscript{a} Easton and colleagues (2014)
\textsuperscript{b} McCollister and colleagues (2010)
\textsuperscript{c} Aos and colleagues (2003)
\textsuperscript{d} Cohen (1988)
\textsuperscript{e} Miller and colleagues (1996)

**Total costs of crime.** Costs were calculated for participants’ prospective convictions, charges, and a total of both these sanctions. Charges and convictions were also categorized by violent, non-violent, and combined crimes (i.e., both violent and non-violent), resulting in a three-by-three cost matrix. Violent costs included the following crimes that caused direct physical harm: assaults, robbery, kidnapping, sexual assaults, attempted murder, and murder (including manslaughter). Non-violent crimes included the following crimes that did not cause physical harm: drug-related, theft, break and enter, and other crimes. Other crimes included all crimes that could not be categorized into specific costs. Finally, the three-by-three matrix was calculated for lower bound and upper bound costs, resulting in 18 broad cost variables.\textsuperscript{14}

\textsuperscript{14} No differences emerged when calculating specific costs for different severities of assault and sexual assault, therefore, they were not described in detail.
Convictions and charges were separated and amalgamated because they are qualitatively different outcomes; however, convictions and charges may also be more similar than different. First, differences in custodial costs are mitigated because over half of the inmates in Canada and B.C. were remanded in pre-trial centres to await a potential custodial sentence rather than serve a sentence (Statistics Canada, 2017). Thus, the corrections and policing costs are possibly more similar than anticipated between criminal charges and convictions. Second, despite the growing number of wrongful convictions (see the National Registry of Exonerations, 2014), the charged participants were the most likely people for which the crime costs could be attributed. In the current study, I applied a lower burden of criminal culpability than the Canadian legal system. Third, a charge suggests a crime was committed, which resulted in many of the intangible victim costs and tangible CJS costs (arrests, police investigations, legal proceedings), and these costs need to be accounted for (i.e., through a criminal charge). Overall, there are several reasons to equate convictions and charges in a costing study, yet they are still different legal outcomes with different civil consequences, therefore, they were analyzed separately and concurrently.

**Cost of crime per year living in the community.** Because participants offended and were sentenced at different rates, they spent different times in the community. Each participant’s cost of crime was divided by his time spent in the community during his follow-up period. Time spent in the community was calculated by first coding the length of time sentenced in custody. Custodial sentence length was then divided in half to account for parole and statutory release because federal sentencing and release guidelines (Government of Canada, 2016) dictate that offenders are eligible for parole in seven years or 1/3 of the sentence, whichever comes earlier. Statutory release—a mandatory conditional release into the community—occurs at 2/3 of an offender’s determinate sentence. Averaging parole and statutory release guidelines (i.e., 1/3 and 2/3 of sentences) resulted in an estimated release time of ½ of an offender’s custodial sentence.

Finally, the estimated custodial sentence length was subtracted from the participant’s overall follow-up length to calculate the time spent in the community. Follow-up length was created by calculating the time between participant’s original community release date and the final data collection date, June 15, 2000. For
participants who were sentenced with an indefinite dangerous offender designation \((n = 3)\) or serving a life sentence \((n = 3)\) during their follow-up period, they were assumed not to have been released after this severe sentence/designation.

Note that time spent in the community included living free of supervision, but it also included time spent on bail, parole, conditional sentences, and probation. Presumably, community supervision would differ from unsupervised living with respect to recidivism rates, but the current data provide insufficient information to disentangle this issue.

### 3.5.3. Design and Procedure

Approval was received by the relevant institutional ethical review boards. The data from Study 2 were derived from a previous study (see Douglas et al., 2005) that employed a pseudo-prospective, known-outcomes group design. That is, offenders with known violent recidivism that resulted in provincial or federal sentences during the study timeframe were randomly selected into the violent recidivist group \((n = 93)\). Similarly, offenders without violent recidivism during the same study timeframe were randomly selected into the non-recidivist group \((n = 95)\). With the goal of increasing the base rate of violence, sampling procedures aimed for approximately 100 participants per group. Participants from both groups were sampled from federal correctional populations starting with release dates in 1994 dating back to 1989. The follow-up period ended June 15, 2000; follow-up length ranged from 6 to 11 years \((M = 7.69; SD = 1.31)\).

All variables of interest were coded using correctional file information by two raters who were researchers employed by the Correctional Service of Canada. The correctional records had a wide breadth and depth of social, psychological, health, and criminal information, which was sufficient for coding the measures of interest (i.e., HCR-20 and PCL-R) using only file information (i.e., no clinical interview). Missing data for the PCL-R and HCR-20 were addressed as per the tools’ manuals (i.e., prorating for the PCL-R, no prorating for the HCR-20).
3.5.4. Analyses

**Descriptive Statistics.** Descriptive statistics included central tendency (mean and median values), dispersion (standard deviation), and distribution shape (skewness and kurtosis) for the primary independent group variables (i.e., PCL-R, HCR-20 scores). Similar sample statistics were provided for the dependent variables (i.e., different costing variables), including frequencies.

**Inferential Procedures.** An econometric bottom-up approach was conducted by testing mean differences between cohorts of a population with and without an illness. Specifically, illness differences (e.g., PPD vs. non-PPD) were tested to reflect the general purpose of the dissertation, which was to examine the cost of crime associated with offenders who have PPD. Independent sample t-tests were first investigated as a possible analytic procedure to test crime cost differences between the PPD vs. non-PPD groups. However, core assumptions were not met, including normality and equal variance of the dependent variable. Many costing variables were non-normal as evidenced by Kolmogorov-Smirnov statistic tests, histogram inspections, and inspections of skewness and kurtosis values. Further, Levene’s tests also revealed that the cost variables had significantly unequal variances at different levels of PCL-R groups. Data transformations did not resolve these assumption violations.

In turn, the Mann-Whitney U test, a non-parametric test, was selected because it holds fewer assumptions than its parametric sibling, the independent samples t-test. According to Nachar (2008), a sound Mann-Whitney test assumes (a) independent samples with little measurement and sampling error (b) independent observations, (c) a continuous or ordinal dependent variable, and (d) similar distribution shapes at different levels of the independent variable. The current study met all of these assumptions.

The Mann-Whitney U test examines group differences in the mean ranks of the dependent variable. Effect size was reported by calculating an $r$ value from $z/\sqrt{N}$. The standard effect sizes of .1, .3, and .5 were interpreted as small, moderate, and large (Cohen, 1992). The Mann-Whitney U test has demonstrated similar statistical power to the t-test (Nachar, 2008), therefore, the total and group sample sizes appear adequate to detect significant differences between the low and high PPD groups. Further, when extreme or skewed distributions exist, Mann-Whitney U is less susceptible to Type I
errors than the t-test (Siegel & Castellan, 1988). Using G*Power, a calculator of statistical power (Faul, Erdfelder, Lang, & Buchner, 2007), power values for moderate Mann-Whitney effect sizes with different group proportions were typically above the .80 threshold with alpha values of .01 and .05 (Power = .80 to .94). However, for the traditional PCL-R (i.e., ≥30) groups, the power value for a moderate effect size was weaker (Power = .57).

For supplementary analyses concerning the HCR-20, the Analysis of Variance (ANOVA) assumption of normality for dependent variable scores was seriously violated, as evidenced by Kolmogorov-Smirnov statistic tests, histogram inspections, and inspections of skewness and kurtosis values. Data transformation did not resolve these assumption violations. As such, the Kruskal-Wallis H test was conducted, a non-parametric one-way ANOVA of ranks test, which is similar to the Mann-Whitney U but instead examines more than two independent groups (e.g., HCR Low, Moderate, High summary risk ratings).

The Kruskal-Wallis H test assumes the same four assumptions as the Mann-Whitney U test, as noted above. The current study met each of these assumptions. Because the Kruskal-Wallis H test is an omnibus test of whether any group differences exist, pairwise Dunn-Bonferroni test comparisons were also conducted (e.g., comparing HCR-20 low vs. moderate groups) if the omnibus test rejected the null hypothesis (i.e., no cost differences between HCR risk judgments). This decision was made to protect against an inflated Type 1 error rate within this family of statistical hypotheses. Kruskal-Wallis effect sizes were reported as eta-squared ($\eta^2$; i.e., the proportion of variance in the dependent variable attributable to group membership), and effect sizes of .01, .06, and .14 were interpreted as small, moderate, and large, respectively (Cohen, 1988).

To examine the effect size of cost differences between the PCL-R and HCR-20 categorical groups, Steiger’s test (Steiger, 1980) was conducted for comparing two dependent correlations using an online calculator (Lee & Preacher, 2013). To reduce the number of ad hoc statistical hypotheses, differences were only tested if the HCR-20 and PCL-R coefficients had an absolute difference of $r > .10$, representing a small effect size (Cohen, 1992). Further, the alpha threshold was set to a value of .001 for establishing
statistically significant differences to reduce Type I errors given that there were many differences tested.

Categorical group difference notwithstanding, evidence suggests that PCL-measured psychopathy may present itself dimensionally across a continuum (Edens et al., 2006; Guay et al., 2007; Walters et al., 2007). Multiple regression analysis was considered to test the unique effects of PCL-R and HCR-20 Total scores. To remove double counting psychopathy in the regression, HCR-20 Total scores were calculated without considering item H7 (i.e., psychopathy). Even when removing H7 from the HCR-20, multicollinearity between HCR-20 and PCL-R scores appeared to have a significant influence on the analyses. Although the relevant indicators (i.e., Variance Inflation Factor = 3.60, Tolerance = 0.28) were within heuristic cutoff values (i.e., 10 and .10, respectively), these guidelines have been described as overly lenient by social science authorities (see Cohen, Cohen, West, & Aiken, 2003).

Several markers were consistent with this concern, suggesting that multicollinearity was significantly affecting multiple regression analyses. First, HCR-20 Total scores (without H7) were correlated with PCL-R Total scores to a large degree ($r = .85$). As this bivariate correlation coefficient approaches its limit (i.e., $r = 1.0$), it indicates problems with multicollinearity (Cohen et al., 2003). Second, in comparison with the bivariate correlations, the multiple regression standardized coefficients for the predictors (i.e., HCR-20 and PCL-R) had substantial changes in magnitude and direction when predicting cost outcomes simultaneously. For example, when predicting non-violent charges and convictions, PCL-R scores had a moderate positive correlation with this outcome ($r = .21$); however, when included simultaneously with the HCR-20 in a multiple regression, PCL-R scores ($\beta = -.20, p = .118$) had a non-significant main effect that was trending toward a negative association. These statistical markers suggested substantial multicollinearity between HCR-20 (without H7) and PCL-R Total scores. Multicollinearity can drastically change individual regression coefficients (Cohen et al., 2003)—the central parameters of interest when understanding unique effects of these measures. As such, the HCR-20 and PCL-R were analyzed separately in single regression models.

The assumptions for ordinary least squares (OLS) single regressions were tested (i.e., univariate and bivariate normality, linearity of the relationship, acceptable measurement error, homoscedasticity, and independence of residuals). Regarding
normality and independence of residuals, the scatterplots, q-q plots, and histograms revealed moderate assumption violations (e.g., residual histogram centered at zero but positively skewed). These assumption violations were likely attributable to the unusual semi-continuous dependent cost variables. Visual inspections of the cost variables revealed overdispersed (i.e., variances greater than the mean) and zero-inflated distributions. Despite OLS regression being robust against assumptions violations (Cohen et al., 2003; Stevens, 2002), Tobit censored regressions (Tobin, 1958) were conducted because they can better account for left-centered and semi-continuous non-count data (i.e., many 0s; see Breen, 1996). Tobit regressions are commonly used in econometric analyses, and they model predictors’ influence on the underlying latent uncensored dependent variable (Grogan-Kaylor & Otis, 2003).

3.6. Study 2 Results

3.6.1. Descriptive Statistics

**PCL-R.** For PCL-R Total scores ($M = 18.85; SD = 8.68; \text{median} = 20$; see Table 9), a quarter (26%) of participants were rated at or above the cut-off of 25, whereas 11% of participants received PCL-R scores at or above 30. For the 3-factor model cut-off, 20% had PCL-R scores at or above 17 when summing only the related 3-factor items. A t-test did not reveal significant PCL-R Total score differences between offenders who were White and those who were not. The limited diversity in the sample composition did not allow a more sophisticated analysis of culture or ethnicity. Age was uncorrelated with PCL-R Total scores ($r = -.04, p = .585$).

**HCR-20.** The median HCR-20 Total score was 21 ($M = 20.10; SD = 7.94$; see Table 9). For summary risk ratings, 36% of participants were classified as low risk, 45% moderate risk, and 19% high risk. A t-test did not reveal significant HCR-20 Total score differences between offenders who were White and those who were not. However, a test of linear-by-linear association between ethnicity and summary risk ratings did reveal a significant difference (Linear-by-linear value = 4.068, $p = .044$), such that greater proportions of non-White participants were rated as moderate and high risk (52% and 24%, respectively) in comparison with White participants (42% and 17%). Age was completely uncorrelated with HCR-20 Total scores ($r = .00, p = .976$).
Crime during follow-up period. Table 11 presents the number of participants that were charged and convicted of the different crimes used to calculate crime costs. Unsurprisingly, Other crime, which captures various crimes under this amalgamated category, was the most frequently occurring type of charge and conviction. Participants were also frequently convicted of or charged with robbery (33%, 13%) and assault (16%, 17%). Murder and attempted murder were rare, with only 3% \((n = 5)\) and 1% \((n = 2)\) of participants being convicted of each of these crimes over the follow-up period, respectively. Each charge and conviction outcome was heavily positively skewed (skewness values 2.54 to 10.99).

Table 11 Descriptive Statistics of Prospective Criminal Charges and Convictions

<table>
<thead>
<tr>
<th>Conviction</th>
<th>Convictions</th>
<th>Charges</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Theft</td>
<td>33</td>
<td>18</td>
</tr>
<tr>
<td>Drug-related</td>
<td>16</td>
<td>9</td>
</tr>
<tr>
<td>Break and Enter</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Other</td>
<td>58</td>
<td>31</td>
</tr>
<tr>
<td>Assault</td>
<td>30</td>
<td>16</td>
</tr>
<tr>
<td>Robbery</td>
<td>62</td>
<td>33</td>
</tr>
<tr>
<td>Sexual-related</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td>Kidnapping</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>Attempted Murder</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Murder</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>

Specific crime costs during the follow-up period. Specific crime costs (see Table 12) were calculated by transforming charge and conviction frequencies as a function of unit costs per specific crimes (see Table 10). The prospective median and mode values for each individual crime type was 0. Across both dispositions (i.e., charges and convictions), drug-related crimes had the lowest costs. There were no charges (without conviction) for murder; however, murder convictions yielded the highest mean costs of all specific crime types when applying both the lower \((M = $162,217.36; SD = $984,002.05)\) and higher \((M = $347,874.32; SD = $2,110,187.44)\) cost estimates. Of note, there was substantial variability for all costing outcome variables. Each specific mean cost was substantially lower than its respective standard deviation. For example, the mean lower cost estimate for Break and Enter charges was $900.90 \((SD = $5,342.13)\).
Table 12  Mean and Standard Deviation of Cost Estimates for Prospective Criminal Charges and Convictions

<table>
<thead>
<tr>
<th>Crime</th>
<th>Lower Estimates ($)</th>
<th>Higher Estimates ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Charges</td>
<td>Convictions</td>
</tr>
<tr>
<td>Theft</td>
<td>656.55</td>
<td>2,845.04</td>
</tr>
<tr>
<td></td>
<td>(2,285.70)</td>
<td>(9,413.32)</td>
</tr>
<tr>
<td>Drug-related</td>
<td>141.07</td>
<td>440.85</td>
</tr>
<tr>
<td></td>
<td>(8,956.00)</td>
<td>(1,872.78)</td>
</tr>
<tr>
<td>Break and Enter</td>
<td>900.90</td>
<td>1,551.55</td>
</tr>
<tr>
<td></td>
<td>(5,342.13)</td>
<td>(9,873.15)</td>
</tr>
<tr>
<td>Other</td>
<td>11,544.17</td>
<td>11,438.26</td>
</tr>
<tr>
<td></td>
<td>(26,602.25)</td>
<td>(29,246.37)</td>
</tr>
<tr>
<td>Assault</td>
<td>6,182.41</td>
<td>7,014.66</td>
</tr>
<tr>
<td></td>
<td>(17,268.58)</td>
<td>(18,955.14)</td>
</tr>
<tr>
<td>Robbery</td>
<td>18,351.29</td>
<td>61,935.59</td>
</tr>
<tr>
<td></td>
<td>(59,311.49)</td>
<td>(122,802.83)</td>
</tr>
<tr>
<td>Sexual-related</td>
<td>1,740.74</td>
<td>2,373.74</td>
</tr>
<tr>
<td></td>
<td>(10,737.06)</td>
<td>(12,649.05)</td>
</tr>
<tr>
<td>Kidnapping</td>
<td>2,994.62</td>
<td>3,539.10</td>
</tr>
<tr>
<td></td>
<td>(16,035.39)</td>
<td>(17,595.13)</td>
</tr>
<tr>
<td>Attempted Murder</td>
<td>0.00</td>
<td>6,237.77</td>
</tr>
<tr>
<td></td>
<td>(60,315.51)</td>
<td>(60,315.51)</td>
</tr>
<tr>
<td>Murder</td>
<td>0.00</td>
<td>162,217.36</td>
</tr>
<tr>
<td></td>
<td>(984,002.05)</td>
<td>(2,110,187.44)</td>
</tr>
</tbody>
</table>

Note. Values in parentheses represent standard deviations; — = An upper bound cost was not empirically available for this crime category.

Crime category costs during the follow-up period. Broad crime category costs (see Table 13) were calculated by summing specific crime costs into the relevant categories (i.e., non-violent, violent, and all crime costs). Much like specific crimes, the crime category costs were left-centered (i.e., higher standard deviations than means), and frequently, the median costs were 0, except for violent and all crime costs when combining charges and convictions. For both total costs and costs per year in the community (see Table 14), an intuitive trend emerged where costs increased for violent crime when combining sanction dispositions and when using the higher per-crime cost estimates. For instance, low estimated non-violent charges ($M = $13,242.69; $SD = $30,166.20; see Table 13) were far less costly than all crime for combined sanctions using high cost estimates ($M = $730,842.35; $SD = $2,230,859.69). Across all categories, violent crime was far more costly than non-violent crime.
### Table 13  
Mean and Standard Deviation of Prospective Total Cost Estimates

<table>
<thead>
<tr>
<th>Sanction</th>
<th>Non-Violent Crime</th>
<th>Violent Crime</th>
<th>All Crime</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low Estimates</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charges</td>
<td>13,242.69</td>
<td>29,269.06</td>
<td>42,511.75</td>
</tr>
<tr>
<td></td>
<td>(30,166.20)</td>
<td>(66,298.32)</td>
<td>(80,983.27)</td>
</tr>
<tr>
<td>Convictions</td>
<td>16,275.70</td>
<td>243,318.22</td>
<td>259,593.92</td>
</tr>
<tr>
<td></td>
<td>(39,159.55)</td>
<td>(1,002,009.64)</td>
<td>(1,007,026.49)</td>
</tr>
<tr>
<td>Combined</td>
<td>29,518.39</td>
<td>272,587.28</td>
<td>302,105.67</td>
</tr>
<tr>
<td></td>
<td>(64,075.60)</td>
<td>(1,013,094.84)</td>
<td>(1,020,784.83)</td>
</tr>
<tr>
<td><strong>High Estimates</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charges</td>
<td>26,950.80</td>
<td>83,912.29</td>
<td>110,863.09</td>
</tr>
<tr>
<td></td>
<td>(68,746.05)</td>
<td>(159,029.80)</td>
<td>(219,217.43)</td>
</tr>
<tr>
<td>Convictions</td>
<td>59,339.68</td>
<td>560,639.59</td>
<td>619,979.26</td>
</tr>
<tr>
<td></td>
<td>(159,029.80)</td>
<td>(2,153,296.38)</td>
<td>(2,192,197.43)</td>
</tr>
<tr>
<td>Combined</td>
<td>86,290.48</td>
<td>644,551.88</td>
<td>730,842.35</td>
</tr>
<tr>
<td></td>
<td>(204,331.47)</td>
<td>(2,187,938.65)</td>
<td>(2,230,859.69)</td>
</tr>
</tbody>
</table>

Note. Values in parentheses represent standard deviations.

### Table 14  
Mean and Standard Deviation of Prospective Total Cost Estimates Per Year in the Community

<table>
<thead>
<tr>
<th>Sanction</th>
<th>Non-Violent Crime</th>
<th>Violent Crime</th>
<th>All Crime</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low Estimates</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charges</td>
<td>2,770.20</td>
<td>6,692.70</td>
<td>9,462.88</td>
</tr>
<tr>
<td></td>
<td>(6,087.76)</td>
<td>(18,507.68)</td>
<td>(21,956.13)</td>
</tr>
<tr>
<td>Convictions</td>
<td>3,312.73</td>
<td>53,780.83</td>
<td>57,093.56</td>
</tr>
<tr>
<td></td>
<td>(7,615.07)</td>
<td>(218,728.41)</td>
<td>(219,821.27)</td>
</tr>
<tr>
<td>Combined</td>
<td>6,082.93</td>
<td>60,473.52</td>
<td>66,556.45</td>
</tr>
<tr>
<td></td>
<td>(12,535.65)</td>
<td>(221,731.38)</td>
<td>(223,655.05)</td>
</tr>
<tr>
<td><strong>High Estimates</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charges</td>
<td>5,516.25</td>
<td>18,422.00</td>
<td>23,938.25</td>
</tr>
<tr>
<td></td>
<td>(13,790.65)</td>
<td>(50,371.06)</td>
<td>(54,778.39)</td>
</tr>
<tr>
<td>Convictions</td>
<td>12,265.74</td>
<td>123,992.01</td>
<td>136,257.75</td>
</tr>
<tr>
<td></td>
<td>(31,699.55)</td>
<td>(470,800.88)</td>
<td>(478,956.07)</td>
</tr>
<tr>
<td>Combined</td>
<td>17,781.99</td>
<td>142,414.01</td>
<td>160,196.00</td>
</tr>
<tr>
<td></td>
<td>(41,259.58)</td>
<td>(479,624.51)</td>
<td>(489,293.52)</td>
</tr>
</tbody>
</table>

Note. Values in parentheses represent standard deviations.

### 3.6.2. PCL-R Group Differences

**Absolute cost differences.** To determine if mean rank cost differences existed between Low and High PPD groups, Mann-Whitney U tests were conducted (see Tables 15, 16, 17). When applying a PCL-R cut-off of 30 (see Table 15), the results indicate that the High PPD group had higher absolute crime costs, with small-to-moderate effects, in comparison with the Low PPD group. Cost differences emerged for all convictions ($r = .15$ to $.20$) as well as combined charges and convictions.
(r = .14 to .19); however, Mann-Whitney U tests revealed non-significant differences for the mean rank costs for charges (r = .05 to .10).

Table 15  Mann-Whitney U Test Results for Absolute Cost Differences Between High and Low PPD Groups (PCL-R Cut-Off of 30)

<table>
<thead>
<tr>
<th>Cost Outcome</th>
<th>Low Estimates</th>
<th></th>
<th></th>
<th>High Estimates</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>U</td>
<td>Z</td>
<td>r</td>
<td>U</td>
<td>Z</td>
<td>r</td>
</tr>
<tr>
<td>Charges</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Violent</td>
<td>1508.50</td>
<td>1.22</td>
<td>.09</td>
<td>1523.50</td>
<td>1.15</td>
<td>.08</td>
</tr>
<tr>
<td>Violent</td>
<td>1603.00</td>
<td>0.80</td>
<td>.06</td>
<td>1627.00</td>
<td>0.67</td>
<td>.05</td>
</tr>
<tr>
<td>Combined</td>
<td>1470.50</td>
<td>1.33</td>
<td>.10</td>
<td>1489.50</td>
<td>1.24</td>
<td>.09</td>
</tr>
<tr>
<td>Convictions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Violent</td>
<td>1311.50</td>
<td>2.19*</td>
<td>.16</td>
<td>1336.50</td>
<td>2.06*</td>
<td>.15</td>
</tr>
<tr>
<td>Violent</td>
<td>1148.00</td>
<td>2.78**</td>
<td>.20</td>
<td>1199.00</td>
<td>2.55**</td>
<td>.19</td>
</tr>
<tr>
<td>Combined</td>
<td>1190.00</td>
<td>2.58**</td>
<td>.19</td>
<td>1274.00</td>
<td>2.19*</td>
<td>.16</td>
</tr>
<tr>
<td>Charges and Convictions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Violent</td>
<td>1332.50</td>
<td>1.95*</td>
<td>.14</td>
<td>1338.50</td>
<td>1.93*</td>
<td>.14</td>
</tr>
<tr>
<td>Violent</td>
<td>1180.50</td>
<td>2.58**</td>
<td>.19</td>
<td>1231.50</td>
<td>2.35**</td>
<td>.17</td>
</tr>
<tr>
<td>Combined</td>
<td>1240.00</td>
<td>2.28*</td>
<td>.17</td>
<td>1305.00</td>
<td>1.99*</td>
<td>.15</td>
</tr>
</tbody>
</table>

*Note. U = Mann-Whitney U test statistic; Z = z-score; r = bivariate correlation coefficient.
* p < .05 ** p < .01 ***p < .001

When applying a PCL-R cut-off of 25 (see Table 16), qualitatively slightly larger effects were observed for absolute costs. The High PPD group had higher mean cost ranks than the Low PPD group for convictions (r = .25 to .29) as well as combined charges and convictions (r = .25 to .28). Likewise, when applying the 3-facet, PCL-R cut-off of 17 (see Table 17), the High PPD group had higher costs for these two outcomes (r = .21 to .25; .20 to .23, respectively). Unlike the PCL-R cut-off of 30, for both the PCL-R cut-offs of 17 and 25, the High PPD groups had higher costs for non-violent and all charges (r = .12 to .19). Overall, these results indicate that across various PPD operationalizations (i.e., different PCL-R cut-offs), PPD was typically—to a small-to-moderate degree—associated with higher absolute crime costs across the follow-up period for violent and non-violent costs.
Table 16  Mann-Whitney U Test Results for Absolute Cost Differences Between High and Low PPD Groups (PCL-R Cut-Off of 25)

<table>
<thead>
<tr>
<th>Cost Outcome</th>
<th>Low Estimates</th>
<th></th>
<th></th>
<th></th>
<th>High Estimates</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>U</td>
<td>Z</td>
<td>r</td>
<td></td>
<td>U</td>
<td>Z</td>
<td>r</td>
</tr>
<tr>
<td>Charges</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Violent</td>
<td>2670.00</td>
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<td>.18</td>
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<td>2653.00</td>
<td>2.55**</td>
<td>.19</td>
<td></td>
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<tr>
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<td></td>
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<td></td>
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<td>Convictions</td>
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<td>Non-Violent</td>
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<td>3.34***</td>
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</tbody>
</table>

Note. U = Mann-Whitney U test statistic; Z = z-score; r = bivariate correlation coefficient.
*p < .05  ** p < .01  *** p < .001

Table 17  Mann-Whitney U Test Results for Absolute Cost Differences Between High and Low PPD Groups (3-Facet PCL-R Cut-Off of 17)

<table>
<thead>
<tr>
<th>Cost Outcome</th>
<th>Low Estimates</th>
<th></th>
<th></th>
<th></th>
<th>High Estimates</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>U</td>
<td>Z</td>
<td>r</td>
<td></td>
<td>U</td>
<td>Z</td>
<td>r</td>
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<td>Charges</td>
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<td></td>
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<td>1.96*</td>
<td>.14</td>
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<td>Combined</td>
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<td>2340.00</td>
<td>1.69*</td>
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<tr>
<td>Non-Violent</td>
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<td>2052.50</td>
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<tr>
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<td>3.43***</td>
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<td></td>
<td>1936.50</td>
<td>3.12**</td>
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<tr>
<td>Combined</td>
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<td>3.27***</td>
<td>.24</td>
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<td>1988.50</td>
<td>2.92**</td>
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<td>Charges and</td>
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<td></td>
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<tr>
<td>Convictions</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Non-Violent</td>
<td>2039.50</td>
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<td>Violent</td>
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<td>3.18***</td>
<td>.23</td>
<td></td>
<td>1994.00</td>
<td>2.85**</td>
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<tr>
<td>Combined</td>
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<td>.22</td>
<td></td>
<td>1989.00</td>
<td>2.83**</td>
<td>.21</td>
<td></td>
</tr>
</tbody>
</table>

Note. U = Mann-Whitney U test statistic; Z = z-score; r = bivariate correlation coefficient.
*p < .05  ** p < .01  *** p < .001

**Group cost differences per community-lived year.** When examining the costs of crime while accounting for time lived in the community (see Tables 18, 19, 20), a similar pattern of results emerged from the Mann-Whitney U analyses.\textsuperscript{15} That is, the High PPD groups had higher mean rank costs than the Low PPD groups. For the

\textsuperscript{15}Highly similar results emerged for costs per year without accounting for time in community.
traditional PCL-R cut-off of 30 (see Table 18), small-to-moderate effects ($r = .14$ to $.20$) emerged where the High PPD group had higher mean rank conviction and combined (i.e., charges and convictions) costs than the Low PPD group. Of note, no significant differences were observed for charge-related costs per year in the community when applying a cut-off of 30.

When applying the PCL-R cut-off of 25 (see Table 19), moderate group differences emerged for convictions and combined costs per year in the community ($r = .26$ to $.30$), and small-to-moderate differences were observed for some charge-related costs ($r = .18$ to $.20$). A similar trend was observed when applying the 3-factor PCL-R cut-off of 17 (see Table 20). In comparison with the Low PPD group, the High PPD group had higher mean rank costs ($r = .12$ to $.26$) per year in the community for charges, convictions, and combined legal dispositions. The only emerging exception was that for the PCL-R cut-offs of 17 and 30, there were no significant group cost differences for non-violent charges. Similar to the absolute costs of crime, when accounting for offenders’ time in the community, the High PPD group typically had higher costs across disposition type (i.e., charges, convictions, combined), cost estimation (i.e., high vs. low), and PCL-R operationalization (i.e., cut-offs of 17, 25, 30).
Table 19  Mann-Whitney U Test Results for Cost Differences Per Year Living in the Community Between High and Low PPD Groups (PCL-R Cut-Off of 25)

| Cost Outcome | Low Estimates | | | High Estimates | | |
|--------------|--------------|-----------------|--------------|-----------------|-----------------|
|               | U       | Z      | r   | U       | Z      | r   |
| Charges       |          |        |     |          |        |     |
| Non-Violent  | 2625.50  | 2.65** | .19 | 2611.50  | 2.70** | .20 |
| Violent      | 2972.00  | 1.48   | .11 | 3024.00  | 1.29   | .09 |
| Combined     | 2582.00  | 2.65** | .19 | 2651.00  | 2.41** | .18 |
| Convictions  |          |        |     |          |        |     |
| Non-Violent  | 2316.00  | 3.73***| .27 | 2302.00  | 3.78***| .28 |
| Violent      | 2132.00  | 4.07***| .30 | 2217.00  | 3.79***| .28 |
| Combined     | 2161.50  | 3.96***| .29 | 2240.50  | 3.70***| .29 |
| Charges and Convictions |          |        |     |          |        |     |
| Non-Violent  | 2249.00  | 3.73***| .27 | 2179.00  | 3.96***| .29 |
| Violent      | 2193.00  | 3.79***| .28 | 2257.00  | 3.59***| .26 |
| Combined     | 2150.50  | 3.88***| .28 | 2216.50  | 3.67***| .27 |

Note. U = Mann-Whitney U test statistic; Z = z-score; r = bivariate correlation coefficient.
*p < .05 ** p < .01 ***p < .001

Table 20  Mann-Whitney U Test Results for Cost Differences Per Year Living in the Community Between High and Low PPD Groups (3-Facet PCL-R Cut-Off of 17)

| Cost Outcome | Low Estimates | | | High Estimates | | |
|--------------|--------------|-----------------|--------------|-----------------|-----------------|
|               | U       | Z      | r   | U       | Z      | r   |
| Charges       |          |        |     |          |        |     |
| Non-Violent  | 2254.00  | 2.13*  | .16 | 2267.00  | 2.08*  | .15 |
| Violent      | 2616.00  | 0.75   | .05 | 2649.00  | 0.61   | .04 |
| Combined     | 2278.00  | 1.92*  | .14 | 2323.00  | 1.76*  | .12 |
| Convictions  |          |        |     |          |        |     |
| Non-Violent  | 2046.00  | 2.93** | .21 | 2027.00  | 3.00** | .22 |
| Violent      | 1831.50  | 3.50***| .26 | 1926.50  | 3.16** | .23 |
| Combined     | 1892.50  | 3.26***| .24 | 1961.50  | 3.01** | .22 |
| Charges and Convictions |          |        |     |          |        |     |
| Non-Violent  | 2032.00  | 2.80** | .20 | 2023.00  | 2.83** | .21 |
| Violent      | 1901.00  | 3.18***| .23 | 1994.00  | 2.85** | .21 |
| Combined     | 1924.50  | 3.06** | .22 | 1991.500 | 2.82** | .21 |

Note. U = Mann-Whitney U test statistic; Z = z-score; r = bivariate correlation coefficient.
*p < .05 ** p < .01 ***p < .001

3.6.3. HCR-20 Summary Risk Rating Differences

**Absolute cost differences.** Kruskal-Wallis tests were conducted to investigate mean rank differences in absolute crime costs between HCR-20 summary risk judgment groups (i.e., Low, Moderate, High). Pairwise, post-hoc Mann-Whitney U
analyses were conducted between these groups with adjusted probability values to account for inflated familywise Type I errors. For all low (see Table 21) and high (see Table 22) estimated absolute costs, the Kruskal-Wallis tests revealed statistically significant moderate to large differences between HCR summary risk judgments, $\chi^2(2) = 17.70$ to $45.86$, $p < .001$, $\eta^2 = .09$ to .24.

When examining specific pairwise differences, the comparatively higher summary risk group had higher mean rank total costs. Specifically, cost differences between Low and High HCR-20 groups were typically large ($r = .34$ to .61), whereas cost difference between Low and Moderate groups were moderate ($r = .25$ to .42). Significant differences between the Moderate and High HCR-20 summary risk groups were smaller ($r = .20$ to .24), and often these cost differences were not statistically significant. Cost differences were also typically smaller for charges in comparison with either convictions or combined charges and convictions. Overall, these results demonstrate that the HCR-20 summary risk ratings were predictive of prospective crime costs, particularly when comparing the Moderate or High risk groups with the Low risk group.

Table 21

<table>
<thead>
<tr>
<th>Cost Outcome</th>
<th>$\chi^2(2)$</th>
<th>L vs. M</th>
<th>L vs. H</th>
<th>M vs. H</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$Z$</td>
<td>$r$</td>
<td>$Z$</td>
<td>$r$</td>
</tr>
<tr>
<td>Charges</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Violent</td>
<td>$23.43^{***}$</td>
<td>$-3.13^{**}$</td>
<td>.25</td>
<td>$-4.62^{***}$</td>
</tr>
<tr>
<td>Violent</td>
<td>$18.39^{***}$</td>
<td>$-3.83^{***}$</td>
<td>.31</td>
<td>$-3.41^{**}$</td>
</tr>
<tr>
<td>Combined</td>
<td>$26.99^{***}$</td>
<td>$-4.10^{***}$</td>
<td>.33</td>
<td>$-4.65^{***}$</td>
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<tr>
<td>Convictions</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Non-Violent</td>
<td>$37.47^{***}$</td>
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<td>$-5.74^{***}$</td>
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<td>$-4.79^{***}$</td>
<td>.39</td>
<td>$-5.84^{***}$</td>
</tr>
<tr>
<td>Combined</td>
<td>$45.04^{***}$</td>
<td>$-5.01^{***}$</td>
<td>.41</td>
<td>$-6.20^{***}$</td>
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<td>Charges and</td>
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</tr>
<tr>
<td>Non-Violent</td>
<td>$39.51^{***}$</td>
<td>$-4.48^{***}$</td>
<td>.36</td>
<td>$-5.92^{***}$</td>
</tr>
<tr>
<td>Violent</td>
<td>$43.05^{***}$</td>
<td>$-5.16^{***}$</td>
<td>.42</td>
<td>$-5.90^{***}$</td>
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<tr>
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<td>$-5.14^{***}$</td>
<td>.42</td>
<td>$-6.21^{***}$</td>
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</tbody>
</table>

Note. L vs. M = Low vs. Moderate HCR-20 summary risk groups; L vs. H = Low vs. High HCR-20 summary risk groups; M vs. H = Moderate vs. High HCR-20 summary risk groups; $Z = z$-score; $r = bivariate correlation coefficient.

*p < .05 ** p < .01 ***p < .001
Table 22  Differences of High Estimated Absolute Costs Between HCR-20 Summary Risk Judgment Groups

<table>
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<tr>
<th>Cost Outcome</th>
<th>( \chi^2(2) )</th>
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<th>L vs. H</th>
<th>M vs. H</th>
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<td>( Z )</td>
<td>( r )</td>
<td>( Z )</td>
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<tr>
<td><strong>Charges</strong></td>
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<td>-4.53***</td>
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<td>-3.79***</td>
<td>.31</td>
<td>-3.29**</td>
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<td>-4.66***</td>
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<td><strong>Convictions</strong></td>
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<td></td>
</tr>
<tr>
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<td>.34</td>
<td>-5.62***</td>
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<td>39.13***</td>
<td>-5.02***</td>
<td>.41</td>
<td>-5.55***</td>
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<td>.42</td>
<td>-5.93***</td>
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<tr>
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<td>-5.13***</td>
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<td>-4.78***</td>
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<td>.43</td>
<td>5.48***</td>
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<td>-5.33***</td>
<td>.43</td>
<td>-6.00***</td>
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</table>

Note. L vs. M = Low vs. Moderate HCR-20 summary risk groups; L vs. H = Low vs. High HCR-20 summary risk groups; M vs. H = Moderate vs. High HCR-20 summary risk groups; \( Z \) = z-score; \( r \) = bivariate correlation coefficient.

\* \( p < .05 \) ** \( p < .01 \) *** \( p < .001 \)

**Group cost differences per community-lived year.** In comparison with the absolute costs, a similar pattern of HCR-20 results was observed for the estimated costs per year in the community (see Table 23 and 24). The omnibus Kruskal-Wallis test revealed moderate to large mean rank cost differences between Low, Moderate, and High summary risk groups for every outcome, \( \chi^2(2) = 18.36 \) to \( 46.68, p < .001, \eta^2 = .09 \) to \(.24 \). The pairwise analyses also revealed higher costs per year in the community for the comparatively higher summary risk group. Large effects were typically observed between Low and High risk HCR-20 groups \( (r = .33 \) to \( .62) \), whereas moderate effects were typically observed between the Low and Moderate risk groups \( (r = .24 \) to \( .43) \). When comparing the Moderate and High risk groups, the mean rank cost differences per year in the community were smaller \( (r = .20 \) to \( .26) \). Indeed, unlike the other pairwise comparisons, the Moderate vs. High group cost comparisons were occasionally non-significant. Overall, these results demonstrate that the HCR-20 summary risk judgments were predictive of prospective costs when accounting for the offenders' time spent in the community (i.e., time at-risk for offending), particularly when comparing Moderate or High risk offenders with Low risk offenders.
Table 23  
Differences of Low Estimated Costs Per Year in the Community Between HCR-20 Summary Risk Judgment Groups

<table>
<thead>
<tr>
<th>Cost Outcome</th>
<th>L vs. M</th>
<th>L vs. H</th>
<th>M vs. H</th>
</tr>
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<td>23.79***</td>
<td>-3.22**</td>
<td>.26</td>
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<td>Violent</td>
<td>18.65***</td>
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</tr>
<tr>
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<td>27.51***</td>
<td>-4.05***</td>
<td>.33</td>
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<td>.40</td>
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<tr>
<td>Non-Violent</td>
<td>40.71***</td>
<td>-4.04***</td>
<td>.43</td>
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<tr>
<td>Violent</td>
<td>44.12***</td>
<td>-5.09***</td>
<td>.41</td>
</tr>
<tr>
<td>Combined</td>
<td>46.42***</td>
<td>-5.07***</td>
<td>.41</td>
</tr>
</tbody>
</table>

Note. L vs. M = Low vs. Moderate HCR-20 summary risk groups; L vs. H = Low vs. High HCR-20 summary risk groups; M vs. H = Moderate vs. High HCR-20 summary risk groups; Z = z-score; $r$ = bivariate correlation coefficient.

* $p < .05$ ** $p < .01$ ***$p < .001$

Table 24  
Differences of High Estimated Costs Per Year in the Community Between HCR-20 Summary Risk Judgment Groups

<table>
<thead>
<tr>
<th>Cost Outcome</th>
<th>L vs. M</th>
<th>L vs. H</th>
<th>M vs. H</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\chi^2(2)$</td>
<td>$Z$</td>
<td>$r$</td>
</tr>
<tr>
<td>Charges</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Violent</td>
<td>23.18***</td>
<td>-2.92**</td>
<td>.24</td>
</tr>
<tr>
<td>Violent</td>
<td>18.36***</td>
<td>-3.83***</td>
<td>.31</td>
</tr>
<tr>
<td>Combined</td>
<td>27.30***</td>
<td>-3.92***</td>
<td>.32</td>
</tr>
<tr>
<td>Convictions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Violent</td>
<td>36.40***</td>
<td>-4.20***</td>
<td>.34</td>
</tr>
<tr>
<td>Violent</td>
<td>40.87***</td>
<td>-4.96***</td>
<td>.40</td>
</tr>
<tr>
<td>Combined</td>
<td>46.47***</td>
<td>-5.17***</td>
<td>.42</td>
</tr>
<tr>
<td>Charges and Convictions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Violent</td>
<td>38.77***</td>
<td>-4.15***</td>
<td>.34</td>
</tr>
<tr>
<td>Violent</td>
<td>43.49***</td>
<td>-5.32***</td>
<td>.43</td>
</tr>
<tr>
<td>Combined</td>
<td>46.51***</td>
<td>-5.26***</td>
<td>.43</td>
</tr>
</tbody>
</table>

Note. L vs. M = Low vs. Moderate HCR-20 summary risk groups; L vs. H = Low vs. High HCR-20 summary risk groups; M vs. H = Moderate vs. High HCR-20 summary risk groups; Z = z-score; $r$ = bivariate correlation coefficient.

* $p < .05$ ** $p < .01$ ***$p < .001$

3.6.4. HCR-20 and PCL-R Group Comparisons

When using a qualitative examination or eyeball test, the HCR-20 and PCL-R group-based analyses revealed that while both measures had positive associations with crime costs, the HCR-20 often had larger effects. Steiger’s test (Steiger, 1980) for
comparing two dependent correlations was conducted, and these statistical results were partially consistent with this qualitative observation. Tables 25, 26, and 27 demonstrate that for almost all crime costs (52 of 54; 96%), correlation coefficients for HCR-20 Low and High group comparisons were larger than comparisons between PPD vs non-PPD groups, regardless of PCL-R cut-off scores. Fewer statistical differences emerged between effects for the PCL-R groups compared to HCR-20 Low vs. Moderate groups, yet a sizeable minority of these tests revealed larger correlations for the HCR-20 (10 of 46; 22%). There were, however, no statistically significant different correlation effects between the PCL-R PPD vs non-PPD groups and the HCR-20 Moderate vs. High groups.

Table 25  Steiger’s Test of Differences Between the HCR-20 and PCL-R (Cut-Off of 30) Correlation Coefficients for Total Costs

<table>
<thead>
<tr>
<th>Cost Outcome</th>
<th>Low Estimates</th>
<th></th>
<th>High Estimates</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>z1</td>
<td>z2</td>
<td>z3</td>
<td>z1</td>
</tr>
<tr>
<td>Charges</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Violent</td>
<td>-2.02</td>
<td>-4.95***</td>
<td>—</td>
<td>-2.02</td>
</tr>
<tr>
<td>Violent</td>
<td>-3.19***</td>
<td>-3.60***</td>
<td>—</td>
<td>-3.32***</td>
</tr>
<tr>
<td>Combined</td>
<td>-2.96</td>
<td>-3.37***</td>
<td>—</td>
<td>-2.95</td>
</tr>
<tr>
<td>Convictions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Violent</td>
<td>-2.61</td>
<td>-5.81***</td>
<td>—</td>
<td>-2.50</td>
</tr>
<tr>
<td>Violent</td>
<td>-2.51</td>
<td>-5.47***</td>
<td>—</td>
<td>-2.92</td>
</tr>
<tr>
<td>Combined</td>
<td>-2.92</td>
<td>-4.42***</td>
<td>—</td>
<td>-3.45***</td>
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<tr>
<td>Charges and Convictions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Violent</td>
<td>-2.86</td>
<td>-6.26***</td>
<td>—</td>
<td>-3.56***</td>
</tr>
<tr>
<td>Violent</td>
<td>-3.06</td>
<td>-5.58***</td>
<td>—</td>
<td>-3.47***</td>
</tr>
<tr>
<td>Combined</td>
<td>-3.32***</td>
<td>-6.40***</td>
<td>—</td>
<td>-3.72***</td>
</tr>
</tbody>
</table>

Note. z1 = Comparison between PCL-R using cut-off ≥ 30 vs. HCR-20 Low and Moderate Groups; z2 = Comparison between PCL-R using cut-off ≥ 30 vs. HCR-20 Low and High Groups; z3 = Comparison between PCL-R using cut-off ≥ 30 vs. HCR-20 Moderate and High Groups; — = Statistical test not conducted due to small differences between HCR-20 and PCL-R correlations (i.e., > .10). ***p < .001
Table 26  Steiger's Test of Differences Between the HCR-20 and PCL-R (Cut-Off of 25) Correlation Coefficients for Total Costs

<table>
<thead>
<tr>
<th>Cost Outcome</th>
<th>Low Estimates</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>High Estimates</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>z1</td>
<td>z2</td>
<td>z3</td>
<td>z1</td>
<td>z2</td>
<td>z3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charges</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Violent</td>
<td>—</td>
<td>-4.15***</td>
<td>—</td>
<td>—</td>
<td>-3.69***</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Violent</td>
<td>-2.96</td>
<td>-3.41***</td>
<td>—</td>
<td>-3.10***</td>
<td>-3.25***</td>
<td>—</td>
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<tr>
<td>Combined</td>
<td>-2.14</td>
<td>-2.58</td>
<td>—</td>
<td>-2.13</td>
<td>-4.30***</td>
<td>—</td>
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<tr>
<td>Convictions</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Violent</td>
<td>—</td>
<td>-4.90***</td>
<td>—</td>
<td>—</td>
<td>-4.39***</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Violent</td>
<td>—</td>
<td>-4.64***</td>
<td>—</td>
<td>-2.21</td>
<td>-4.53***</td>
<td>1.54</td>
<td></td>
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</tr>
<tr>
<td>Combined</td>
<td>-1.92</td>
<td>-3.54***</td>
<td>—</td>
<td>-2.51</td>
<td>-5.24***</td>
<td>—</td>
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<tr>
<td>Charges and</td>
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<td>Convictions</td>
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<td></td>
</tr>
<tr>
<td>Non-Violent</td>
<td>—</td>
<td>-5.09***</td>
<td>—</td>
<td>1.92</td>
<td>-2.87</td>
<td>—</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Violent</td>
<td>-2.22</td>
<td>-4.94***</td>
<td>—</td>
<td>-2.81</td>
<td>-4.65***</td>
<td>1.67</td>
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</tr>
<tr>
<td>Combined</td>
<td>-2.22</td>
<td>-5.52***</td>
<td>—</td>
<td>-2.67</td>
<td>-5.43***</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. z1 = Comparison between PCL-R using cut-off ≥ 25 vs. HCR-20 Low and Moderate Groups; z2 = Comparison between PCL-R using cut-off ≥ 25 vs. HCR-20 Low and High Groups; z3 = Comparison between PCL-R using cut-off ≥ 25 vs. HCR-20 Moderate and High Groups; — = Statistical test not conducted due to small differences between HCR-20 and PCL-R correlations (i.e., > .10). ***p < .001

Table 27  Steiger's Test of Differences Between the HCR-20 and PCL-R (Cut-Off of 17) Correlation Coefficients for Total Costs

<table>
<thead>
<tr>
<th>Cost Outcome</th>
<th>Low Estimates</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>High Estimates</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>z1</td>
<td>z2</td>
<td>z3</td>
<td>z1</td>
<td>z2</td>
<td>z3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charges</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Violent</td>
<td>—</td>
<td>-4.13***</td>
<td>—</td>
<td>—</td>
<td>-3.97***</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Violent</td>
<td>-3.29***</td>
<td>-3.70***</td>
<td>—</td>
<td>-3.42***</td>
<td>-3.55***</td>
<td>—</td>
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<tr>
<td>Combined</td>
<td>-2.43</td>
<td>-2.84</td>
<td>—</td>
<td>-2.55</td>
<td>-4.52***</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Convictions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Violent</td>
<td>1.95</td>
<td>-5.09***</td>
<td>—</td>
<td>-1.68</td>
<td>-4.76***</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Violent</td>
<td>1.85</td>
<td>-4.73***</td>
<td>—</td>
<td>-2.38</td>
<td>-4.49***</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combined</td>
<td>-2.25</td>
<td>-3.72***</td>
<td>—</td>
<td>-2.78</td>
<td>-5.27***</td>
<td>—</td>
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<td>Charges and</td>
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<tr>
<td>Convictions</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Violent</td>
<td>-2.08</td>
<td>-5.40***</td>
<td>—</td>
<td>-2.64</td>
<td>-3.51***</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Violent</td>
<td>-2.52</td>
<td>-5.00***</td>
<td>—</td>
<td>-2.92</td>
<td>-4.60***</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combined</td>
<td>-2.65</td>
<td>-5.66***</td>
<td>—</td>
<td>-2.92</td>
<td>-5.44***</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. z1 = Comparison between PCL-R using cut-off ≥ 17 vs. HCR-20 Low and Moderate Groups; z2 = Comparison between PCL-R using cut-off ≥ 17 vs. HCR-20 Low and High Groups; z3 = Comparison between PCL-R using cut-off ≥ 17 vs. HCR-20 Moderate and High Groups; — = Statistical test not conducted due to small differences between HCR-20 and PCL-R correlations (i.e., > .10). ***p < .001

To reduce the number of statistical hypotheses, differences between the HCR-20 and PCL-R groups were not tested for the per community year costs. Nevertheless,
these per annum outcomes held a similar pattern where the HCR-20 had larger cost differences between its higher risk groups than the PCL-R comparisons. Overall, these comparative analyses demonstrated that the HCR-20 summary risk ratings—particularly Low vs. High judgments—had larger positive associations with economic costs of crime than the PCL-R diagnostic groups.

3.6.5. PCL-R and HCR-20 Continuous Total Score Analysis

Tobit censored regressions with single predictors were conducted to estimate the PCL-R and HCR-20 (without H7) Total scores’ prospective effects on the latent costs of crime. The PCL-R had statistically significant main effects with all latent absolute cost outcomes (see Table 28).\(^\text{16}\) The largest unstandardized effect was observed for all conviction costs where a 1-point increase in PCL-R Total scores corresponded with an increase in the propensity of crime costs by $73,650, \(z = 12.37, p < .001, 95\% \text{ CI} [61,315 \text{ to } 84,925]\). The PCL-R’s smallest unstandardized effect was observed for non-violent charges, \(b = 2,943, z = 3.85, p < .001, 95\% \text{ CI} [1,446 \text{ to } 4,440]\).

\(^{16}\) To reduce the number of statistical tests, Tobit regressions were only conducted for the low estimates for the absolute and per community year costs. Further, as Tobit regression predict latent outcomes, there was less of a rationale to also analyze the unstandardized betas for the high cost estimates as well.
The latent costs per community year (see Table 29) followed the same pattern of results as the absolute costs. The PCL-R Total score had statistically significant effects for all these outcomes, albeit smaller unstandardized beta values were observed given the per annum nature of these outcomes. For instance, PCL-R Total scores predicted all latent conviction costs per community year, $b = $16,700, $z = 12.95, p < .001, 95% CI [14,172–19,228], which was a smaller effect in comparison with the absolute costs associated with this outcome ($b = $73,650). Overall, these findings demonstrate that PCL-R Total scores significantly predicted latent prospective costs of crime that were financially sizeable at face-value ($b$s range = $666 to $73,650).

For the HCR-20 Total scores, similar results were observed with significant main effects emerging with all the latent absolute cost outcomes (see Table 28). Like the PCL-R, the largest unstandardized beta effect was observed for all conviction costs where a 1-point increase in HCR-20 Total scores corresponded with an increase in the propensity of these prospective crime costs by $93,050, $z = 15.71, p < .001, 95% CI [81,440–104,659]. The smallest effect of HCR-20 Total scores predicting latent crime costs was for non-violent charge costs, $b = $4,126, $z = 4.72, p < .001, 95% CI [2,412–

<table>
<thead>
<tr>
<th>Cost Outcome</th>
<th>HCR</th>
<th>PCL-R</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>b [95% CI]</td>
<td>Z</td>
</tr>
<tr>
<td>Charges</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Convictions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combined</td>
<td>93,050 [81,440–104,659]</td>
<td>15.71***</td>
</tr>
<tr>
<td>Charges and Convictions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Violent</td>
<td>7,702 [6,909–8,495]</td>
<td>19.05***</td>
</tr>
</tbody>
</table>

Note. b = unstandardized beta coefficient; Z = z-score.

***p < .001

Table 28  Tobit Regression Results for PCL-R and HCR-20 (Without H7) Total Scores Predicting Absolute Costs of Crime

The latent costs per community year (see Table 29) followed the same pattern of results as the absolute costs. The PCL-R Total score had statistically significant effects for all these outcomes, albeit smaller unstandardized beta values were observed given the per annum nature of these outcomes. For instance, PCL-R Total scores predicted all latent conviction costs per community year, $b = $16,700, $z = 12.95, p < .001, 95% CI [14,172–19,228], which was a smaller effect in comparison with the absolute costs associated with this outcome ($b = $73,650). Overall, these findings demonstrate that PCL-R Total scores significantly predicted latent prospective costs of crime that were financially sizeable at face-value ($b$s range = $666 to $73,650).

For the HCR-20 Total scores, similar results were observed with significant main effects emerging with all the latent absolute cost outcomes (see Table 28). Like the PCL-R, the largest unstandardized beta effect was observed for all conviction costs where a 1-point increase in HCR-20 Total scores corresponded with an increase in the propensity of these prospective crime costs by $93,050, $z = 15.71, p < .001, 95% CI [81,440–104,659]. The smallest effect of HCR-20 Total scores predicting latent crime costs was for non-violent charge costs, $b = $4,126, $z = 4.72, p < .001, 95% CI [2,412–

109
5,840]. A similar pattern of results emerged when accounting for offenders’ time in the community, such that the HCR-20 Total score was a statistically significant predictor of all latent costs per year in the community (see Table 29). Overall, these findings demonstrate that the HCR-20 (without H7) had meaningful associations with latent costs of crime (bs range = $916 to $93,050).

Table 29  Tobit Regression Results for PCL-R and HCR-20 (Without H7) Total Scores Predicting Total Costs of Crime Per Year in the Community

<table>
<thead>
<tr>
<th>Cost Outcome</th>
<th>HCR</th>
<th>PCL-R</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>b [95% CI]</td>
<td>Z</td>
</tr>
<tr>
<td>Charges</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Violent</td>
<td>916 [575–1,257]</td>
<td>5.27***</td>
</tr>
<tr>
<td>Violent</td>
<td>2,549 [1,392–3,706]</td>
<td>4.32***</td>
</tr>
<tr>
<td>Combined</td>
<td>2,729 [1,788–3,670]</td>
<td>5.67***</td>
</tr>
<tr>
<td>Convictions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Violent</td>
<td>1,397 [929–1,865]</td>
<td>5.85***</td>
</tr>
<tr>
<td>Charges and Convictions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Violent</td>
<td>1,777 [1,235–2,319]</td>
<td>6.43***</td>
</tr>
</tbody>
</table>

Note: b = unstandardized beta coefficient; Z = z-score.

***p < .001

**Differences between HCR-20 and PCL-R groups.** Because of multicollinearity concerns, the unique effects of the PCL-R and HCR-20 Total scores could not be compared concurrently within the same regression models. Nevertheless, a clear qualitative pattern emerged across Tobit regressions: HCR-20 (without H7) Total scores had larger unstandardized beta coefficients for all latent cost outcomes in comparison with PCL-R Total scores. Although this is an unsophisticated and non-statistical comparison, the PCL-R and HCR-20 total scores had similar univariate distributions (i.e., means, medians, standard deviations) and the standard error coefficients were relatively similar in the Tobit regression models. This qualitative difference demonstrates that the HCR-20 Total score, in comparison with the PCL-R, may have predicted—to some degree—greater offender propensity to produce crime costs.
3.7. Study 2 Summary and Discussion

In Study 2, I employed an empirical and sample-driven approach to examine the association between PPD and financial crime costs. Participants were Canadian federal offenders who had a quasi-prospective follow-up period averaging approximately seven years. Research questions were examined from two conceptual and measurement perspectives of psychopathy (i.e., categorical vs. dimensional). I explored whether offenders with PPD have higher crime costs than offenders without PPD, and the current study results were consistent with my antecedent hypotheses and previous empirical work (e.g., DeLisi et al., 2018; Leistico et al., 2008; Yang et al., 2010). That is, across different PCL-R diagnostic operationalizations, the High PPD groups typically had higher prospective crime costs. The magnitude of these group differences was partially in keeping with my expectation of moderate effects, although more variability emerged with groups differences ranging from small to moderate effects ($r = .12$ to $.30$). These findings suggest that offenders diagnosed with PPD or identified as highly psychopathic are an at-risk group for accruing substantial crime costs. Specific implications will be discussed in more detail (see the General Discussion section); however, broadly, these findings align with Study 1 and past opinions that PPD produces massive social costs (e.g., Hare, 1999; Reidy et al., 2015).

The costs associated with the three PCL-R operationalizations differed modestly. A general pattern emerged where a cut-off score of 25 often had moderate effects in comparison to the small-to-moderate effects observed when applying the traditional PCL-R cut-off of 30. This small difference likely resulted from the methodology of the present study. Raters scored the PCL-R using only file information (i.e., no interview), which can attenuate Total scores (Hare, 2003). The traditional cut-off score possibly yielded an overly selective PPD group (11%) from the overall sample, which may have affected cost differences. The cost differences between the two operationalizations were small but nonetheless noteworthy. There was also no significant evidence suggesting that crime costs associated with the High and Low PPD groups differed as a function of violent vs. non-violent crime costs.

I also operationalized PPD using a PCL-R cut-off score of 17 for those items reflecting the 3-factor model of psychopathy detailed by Cooke and Michie (2001).
magnitude of crime costs that emerged between these Low and High PPD groups (i.e., ≥
17) typically fell between the effects observed for the two other PCL-R
operationalizations. These findings may suggest that the core features of PPD (e.g., lack
of empathy, callousness, recklessness, manipulativeness) are comparable drivers of
future crime costs in comparison with sequelae of the disorder found in the Antisocial
PCL-R Facet (e.g., past criminal convictions). This explanation is consistent with my
conceptual analysis of the causal role of PPD on violence (see Chapter 2). From a SPJ
decision theory perspective (Felson, 2009; Hart & Logan, 2011; Wikström & Treiber,
2009), it is difficult to explain how past antisocial behaviour motivates, disinhibits, or
destabilizes decisions to engage in future crime and produce associated financial costs.
Conversely, the conceptual analysis identified many functional links with violent
recidivism that stemmed from PPD traits related to the 3-factor model.

A similar pattern of results emerged when conceptualizing and operationalizing
PCL-R Total scores dimensionally. All types of latent prospective crime costs were
associated with the PCL-R, suggesting that psychopathic personality may increase the
propensity to produce financial costs through criminal activity. Because of the unusual
nature of the outcome data (i.e., semi-continuous left censored), Tobit regression could
only address the PCL-R association with latent non-observable cost outcomes.
Nevertheless, the unstandardized main effects were financially noteworthy. Over the
follow-up periods, 1-point increases in PCL-R Total scores resulted in sizeable increases
in all categories of crime costs, ranging from $2,943 to $73,650. This pattern of crime
costs attributable to PCL-R scores remained relatively similar when accounting for
offenders’ recidivism per year lived in the community.

Although violent vs. non-violent differences were not observed among the group
comparisons, there were relatively large differences in the unstandardized beta
coefficients in the dimensional PCL-R analyses. For convictions and combined
convictions/charges, increased PCL-R scores were associated with larger cost increases
for violent crimes. This trend was similar for HCR-20 Total scores (see the HCR-20 and
the Cost of Crime section below). Yet, these findings may simply be reflected by higher
specific costs for violent crimes (Cohen, 1998; Easton et al., 2014). Caution is warranted
in over weighting the importance of this violent vs. non-violent discrepancy given that
these statistics used unstandardized beta coefficients. It is possible that the strength of
association is far more similar between violent and non-violent crime when standardized units can be examined. Indeed, the predictive validity effects for the PCL-R have been highly similar between violent and non-violent antisocial behaviour (i.e., not financially operationalized) in a wide-scale meta-analytic review (Leistico et al., 2008).

For both the PCL-R and HCR-20 continuous analyses, crime costs resulting from criminal charges (without a conviction) had the smallest coefficients. This pattern is partially explained by the nature of this type of dependent variable. Charges often had far lower costs than convictions. Further, from clinical and policy perspectives, charges alone may represent an outcome with very little ecological validity because someone with only a criminal charge (i.e., no subsequent conviction) will not have prolonged contact with the criminal justice system and its rehabilitative services.

Overall, there were generally similar results between PCL-R continuous scores and categorical PPD groups. This is a relatively encouraging indicator regarding the reliability of these findings. If the pattern of results changed as a function of PPD operationalizations (i.e., dimensional vs. categorical), it may have suggested that the findings were a statistical aberration. For researchers, these findings are in keeping with those who conceptualize PPD with dimensional variables (see Edens et al., 2006; Guay et al., 2007; Walters et al., 2007). Crime costs were correlated with increases in psychopathic traits, which may also suggest that similar moderate associations with crime costs might emerge in less severe samples (e.g., civil psychiatric) where PPD prevalence rates are lower. For policy-makers in correctional contexts, offenders with PPD or who are highly psychopathic may represent a group of offenders with many opportunities to reduce substantial crime costs.

### 3.7.1. HCR-20 and the Cost of Crime

Given practical and conceptual overlap between the PCL-R and HCR-20 in forensic and violence risk evaluations (Hart, 1998, 2016; Hurducas et al., 2014), Study 2 included supplementary research questions regarding the predictive validity of the HCR-20 with respect to prospective crime costs. As hypothesized, the HCR-20 predicted increased prospective crime costs. This finding held true for both HCR-20 summary risk ratings and Total scores.
From a clinical perspective, it is promising that final risk ratings were predictive of crime costs. Indeed, moderate to large cost differences emerged when comparing Low risk offenders with Moderate or High risk offenders. These results were consistent with previous meta-analytic works (Chevalier, 2017; Guy, 2008), which found that SPJ summary risk ratings had medium-to-large effects predicting violence, and that there was some evidence of improved prediction above and beyond SPJ risk tools' total scores (cf. Scurich, 2018). Overall, summary risk ratings predict antisocial conduct, which would explain why the HCR-20 summary risk ratings were predicting the associated costs of violent and general recidivism in the present study. This finding is also consistent with, and supports, the risk principle from the RNR model (Andrews et al., 1990). The RNR model outlines that more services—which presumably cost more—should be proportionally delivered to offenders who have higher risk ratings. The current results suggest these high-risk offenders have a potential for the greatest cost-saving opportunities.

From a research perspective—where Total scores are often the primary consideration—the HCR-20 seemed to have objectively large predictive effects on crime costs. For instance, a 1-point increase in HCR-20 Total scores resulted in a $4,126 to $93,050 increase in latent total crime costs, with larger unstandardized effects for violent costs. Again, these findings are consistent with the broader literature, which has detailed that risk assessment total scores, including the HCR-20, are associated with violence and criminal recidivism (Douglas et al., 2017; Singh et al., 2011). Overall, the current findings suggest that the HCR-20 summary risk rating and Total score have utility in identifying offenders who are likely to produce substantial economic costs.

The study results also supported the hypothesis that the HCR-20 would predict higher crime costs than the PCL-R. Among the group-based analyses, the HCR-20 summary risk ratings often had significantly stronger associations with prospective costs than the PCL-R groups. From a dimensional approach, the HCR-20 Total score also had larger unique contributions than the PCL-R for each latent cost variable, and these two predictors had similar univariate distributions (i.e., mean, range, standard deviation) and standard errors. This risk tool comparison was, however, relatively weak because both the categorical and dimensional models could not simultaneously compare both tools to account for co-occurring error. Moreover, although the HCR-20 seemed to be a stronger
predictor of crime costs than the PCL-R, the current data could not clarify the magnitude of these differences.

From a theoretical perspective, there are several reasons why the HCR-20 might be a stronger tool for predicting crime costs. If violent crime has higher associated crime costs (McCollister et al., 2010), then the HCR-20, which is a comprehensive violence risk assessment tool, has been designed to detect those crimes with the highest costs. Moreover, the Big Four risk factors for general recidivism (i.e., criminal history, antisocial peers, antisocial personality patterns, and antisocial cognitions; see Bonta et al., 2014) are all canvassed and considered during an HCR-20-guided risk assessment. The PCL-R, on the other hand, is designed to narrowly assess psychopathic personality (Hare, 2003), which is only one of many necessary factors to be considered in a violence or general recidivism risk assessment (Bonta et al., 2014; Douglas et al., 2013; Hart, 1998).

From an empirical perspective, there is also evidence suggesting that the HCR-20 might be a relatively superior crime cost predictor given that it predicts violence equally well when excluding psychopathy as a risk factor (Guy et al., 2010). Further, a meta-analysis discovered that for individuals classified as high risk, base rates of violence were higher for the HCR-20 than the PCL-R (41% vs. 18%; Singh, Fazel, Gueorguieva, & Buchanan, 2014). Much like the theoretical arguments, there is empirical evidence that the HCR-20 may have better predictive validity of violence—the costliest of criminal outcomes.

One of the goals of violence risk assessment, including the HCR-20, is to inform risk management strategies to prevent future violence (Andrews & Bonta, 2010; Douglas et al., 2013; Hart, 1998). Although empirical evidence regarding this goal remains underdeveloped (Viljoen, Cochrane, & Jonnson, 2018), the HCR-20 is a risk assessment tool that may prioritize areas for reducing economic costs associated with violence and crime. Violence prevention and cost reduction may seem like two distinct and unrelated outcomes; however, risk assessment and offender management parameters can be influenced by economic and resource allocation concerns (Bonta & Andrews, 2018; Roychowdhury & Adshead, 2014). Implementing risk assessment tools can also be bounded and impacted by financial considerations (e.g., Hilton & Ham, 2015; Vincent, Guy, & Grisso, 2012). Thus, the HCR-20 may have some utility in improving its own
effectiveness in real-world settings by highlighting to stakeholders its potential auxiliary use of identifying cost-reduction targets. Indeed, in comparison with the PCL-R, the comprehensiveness of the HCR-20 will likely identify more treatment targets amenable to reducing crime costs. More evidence is needed to solidify this claim, but spending money on the HCR-20 appears a financially wise institutional investment.

Should, then, attention only be given to the HCR-20 when identifying high cost-producing offenders? Despite the HCR-20’s possibly improved validity, the results suggest that PPD was also associated with increased prospective crime costs. Further, the PCL-R may have better sensitivity in detecting differences in certain settings (e.g., high security forensic psychiatric hospitals) where most patients would have—by virtue of the setting—a high risk HCR-20 designation. Thus, when considering cost reduction strategies, it is likely a useful practice to consider both the HCR-20 and PCL-R and determine which is most clinically relevant and feasible for each evaluatee and his or her environment. For instance, in outpatient settings, the PCL-R may have a floor effect that would make it difficult to distinguish most patients in this context.

**Limitations and Methodological Considerations**

The results and their potentially large implications need to be couched within several limitations observed in Study 2, including methodological issues that limit the scope of the current study. Generalizing the specific crime cost estimates attributable to PPD from this study is perhaps unwarranted given its known-outcome group design, which increased the base rate of violence and recidivism in the sample. As such, the absolute cost values may be inflated. Nevertheless, because PPD was not a known outcome, the group differences (i.e., PPD vs non-PPD) were less likely to have been influenced by the study design. Additionally, the recidivism follow-up period concluded in 2000, which is dated, and these data had to be transformed to 2018 Canadian dollars via inflation. Canadian police-reported crime rates and severity have generally declined since the early 1990s (Allen, 2018; Statistics Canada, 2017). Thus, the present findings were limited by the method-inflated recidivism rates compared to typical 1990s rates (i.e., higher base rates) and differing national crime rates at present day.

The generalizability of the current findings also rests upon the nature of the estimated cost categories (e.g., non-violent crime costs), which were calculated using
per-crime costing studies. Because certain crime costs lacked a specific estimate, the Other cost category was quite broad, which may have masked major cost differences between certain crimes. For instance, a breach costed as much as weapon-related or vehicular crimes. Moreover, although many specific unit costs were derived from a Canadian source for this Canadian sample (see Easton et al., 2014), US-based estimates (see Aos et al., 2003; Cohen 1988, McCollister et al., 2010; Miller et al., 1996) were also applied for several specific crime costs when no Canadian estimates were available. Even though the Canadian and US criminal justice systems share many similarities, differences between these systems also exist (e.g., incarceration rates; Reitano, 2017), which likely produce different national per crime cost estimates. The overall pattern of results would have likely remained similar if only Canadian-based estimates were applied because only small discrepancies were observed between low and high PPD-cost estimates in the present study. Yet, there would certainly have been specific and minor differences if all Canadian-based crime estimates had been implemented. It is difficult to estimate with any certainty the degree of variation this methodological change would have caused without conducting further research.

Sample selection in Study 2 also impacted the scope of inference. The study examined recidivism rates among federal offenders who represent a minor and severe group of individuals involved in the Canadian correctional system. Most offenders serve provincial sentences, including community supervision (Statistics Canada, 2018). The 1-year recidivism rates (i.e., official reconviction) for federal offenders was 41% to 44% across several years in the mid 1990s (Bonta, 2003). In contrast, for Ontario provincial offenders, the 2-year recidivism rates ranged from 21% to 25% for those serving community sentences (Ministry of Community Safety & Correctional Services, 2018). This study, therefore, speaks to costs associated with federal offenders; it may not generalize to provincial offenders, particularly those serving a community supervision sentence where lower recidivism and PPD rates are typically observed.

Readers should also consider the nature of the outcome data in Study 2: recidivism transformed into economic form. Frequency counts alone are susceptible to being overrepresented by commonly occurring low-level crime and violence (Sweeten, 2012). Thus, one advantage of the present study is that crime frequencies were weighted by financial impact outcomes. For instance, one minor theft and one sexual
assault are measured differently. Yet, the major limitation of weighted data is that they can become skewed (Sweeten, 2012), which ostensibly, may diminish effective data analysis. The present study mitigated this concern by implementing analyses that are sensitive to skewed and censored data. Another outcome-related limitation was using a single source for coding recidivism (i.e., official convictions) given that multi-source methods result in higher base rates (e.g., Mulvey, Shaw, & Lidz, 1994) and improved validity (Doulgas & Ogloff, 2003). Nevertheless, this sample had an already inflated violent recidivism rate (see above), and this single-source limitation was addressed in Study 1 where the top-down findings included unofficial, unreported crime.

Certain study limitations affected the independent variables or forensic-relevant assessment tools, including the quasi-prospective study design. HCR-20 and PCL-R assessment ratings were based on only information prior to the follow-up periods, but recidivism follow-up data were obtained retrospectively. The claims drawn from this study are therefore weaker than a truly prospective design (see Campbell & Stanley, 1966). Nevertheless, the raters were blind to follow-up data when coding the HCR-20 and PCL-R, which diminished the risk of criteria contamination. These forensic-relevant assessment instruments were, however, coded using file information only. Without a direct clinical interview, constructs of interest (e.g., glibness, violent ideation) may have been more difficult to evaluate, which may have influenced validity indices. Finally, this study implemented the second version of the HCR-20 (Webster et al., 1997). Future economic research should evaluate the third version of the HCR-20 (HCR-20V3; Douglas et al., 2013) given that the different HCR-20 versions have substantial overlap but are empirically and conceptually distinct (Douglas et al., 2017).

Overall, the Study 2 findings and conclusions have established a broad picture that the HCR-20 and PCL-R-measured PPD were consistently associated with economic costs of crime for federal offenders. Yet, because of the present methodological limitations, specific findings (e.g., specific cost valuations or effect sizes) should be extrapolated or generalized with caution. In time, future research will reveal the precise accuracy of these findings. While the present study established a foundation for future PPD cost of illness studies in Canada, these findings—in isolation—are likely not sufficiently reliable enough to enact major policy changes.
**Future Research**

Bloom and colleagues (2012) noted that cost estimates for a given illness have considerable heterogeneity. This assertion likely holds for PPD cost of illness studies given the early stage of this research area where specific hypotheses have rarely been tested. To influence practical policy changes, a consistent body of scientific evidence needs to be established regarding PPD-related crime costs. In the current study, I modulated methods and assumptions to simulate and provide a range of estimates. Nevertheless, substantial variability in the findings remained. For instance, the unstandardized unique regression effects were significant but had large 95% confidence intervals (e.g., PCL-R predicting non-violent charges, $b = $4,126, 95% CI [2,412–5,840]). Further, the reported regression effects were unobserved latent predictions, and if the higher estimated cost categories had been included in these regression analyses, even greater variability would have resulted. More independent work (e.g., DeLisi et al., 2018) with various cost estimates (e.g., all Canadian costs), statistical procedures (e.g., multivariate models with other relevant variables), and measurement tools are needed to understand the dispersion of these findings. Only with replication will researchers be able to confidently draw conclusions about whether PPD is a definitive and substantial driver of crime costs.

**Conclusion**

Overall, the empirical results of Study 2 indicated that the HCR-20 and PCL-R-measured PPD were predictive of prospective crime costs. A discussion follows below regarding the broad implications and future directions that were derived from the commonalities of Study 1, 2, and 3.
Chapter 4. General Discussion: Conclusions & Implications

PPD is an important clinical forensic consideration (Hart, 1998); it is a risk factor for recidivism and violence (Leistico et al., 2008; Yu et al., 2012); scholars have postulated that it causes substantial economic burden on different systems and organizations (Beaver et al., 2014; Hare, 1999; Kiehl & Hoffman, 2011; Reidy et al., 2015; Reidy, Kearns, & DeGue, 2013). Yet, the precise magnitude of this burden has remained unspecified. I addressed this research gap by estimating the financial cost of crime attributable to people with PPD. My primary aspiration was that this economic quantification would bolster our understanding of the societal burden of PPD, which in turn, could promote greater mental health services for those with this personality disorder.

To explore this general research aim, I implemented a three-pronged approach with conceptual, top-down, and bottom-up studies. First, using a SPJ decision theory framework, the conceptual analysis revealed a host of functional links between PPD and violence. Second, the top-down societal study examined prevalence rates, offending rates, and national costs of crime to produce national estimates of PPD-related crime costs for the US, UK, and Canada. The results suggested that PPD had staggeringly high crime costs in the US (simulated $678 to $1,276 billion) and Canada (simulated $33 to $42 billion), whereas relatively modest costs (simulated £4.77 billion) emerged in the UK. Third, the bottom-up approach was an empirical study of Canadian federal offenders. The results aligned with those from the top-down approach: Higher PPD traits were predictive of prospective crime costs. Across all three studies, a narrative emerged suggesting that people suffering from PPD produce disproportionately high crime costs.

This project was both novel and traditional. I examined whether recidivism rates differed between highly psychopathic and non-psychopathic groups—a research avenue that is old and well-established (see Guy et al., 2010; Leistico et al., 2008; Salekin et al., 1996). The outcome of interest is where readers can find novelty. I estimated the financial cost of crime attributable to PPD. By converting these outcome data into financial form, a new and ecologically applicable effect size was emphasized. Social scientists may revel in the small-moderate-large effect size nomenclature, but policy
makers who do not commonly interpret these effects (e.g., \( d, r, g, AUC \)) may better understand the present findings from an economic perspective. By making these costs more intellectually palatable, funding agencies and policy makers may be motivated to increase treatment and management strategies for those with PPD.

The findings from my dissertation studies were consistent with my research hypotheses and with previous work suggesting that psychopathic traits are associated with increased crime costs. Certainly, PPD is likely to produce higher crime costs than the estimated $25 billion attributable to APD (Beauchaine et al., 2009). But the top-down US cost estimates from the current dissertation (i.e., $678 to $1,276 billion) far exceeded the estimates of Kiehl and Hoffman (2011) who reported $460 billion (USD) in crime costs attributable to PPD. Such differences are likely explained by including increased offending rates associated with PPD in my cost formulae. Further, the small-to-moderate effects observed in the Canadian federal offender sample were consistent with the economic costs reported in an empirical study of offending youth with psychopathic disturbances (DeLisi et al., 2018). Overall, the current dissertation provides the most methodologically robust financial estimation to date. And while I will temper my conclusions in comparison with assertions such as PPD is “likely the most expensive mental health disorder known to man” (Kiehl & Sinnott-Armstrong, 2013, p. 1), the current data lead me to conclude that—other health costs notwithstanding—PPD has a massive economic burden due to crime.

Psychopathy is an established risk factor for violence and recidivism, and it was the risk factor emphasized throughout this dissertation. Yet, violence and risk state are likely affected by a confluence of factors rather than one single causal risk factor (Douglas & Skeem, 2005). This interpretation is central to the present findings. From a variable-centric perspective, even for those offenders who were highly psychopathic, additional risk factors also likely influenced recidivism. Consider the interplay of two risk factors: PPD and antisocial attitudes and their influence on crime costs. Could these factors have a mediating relationship? On one hand, PPD could be the primary variable that initiates a causal chain with antisocial attitudes, which in turn, influences violent recidivism. On the other hand, a transactional association is possible where, instead, early antisocial attitudes serve as markers or evidence for symptoms of PPD (e.g., callousness in intimate relationships). This pattern is complex and other risk factors
(e.g., substance use, psychosis, antisocial peers) are also likely involved. Therefore, it is important to understand that PPD has a central role in the economic burden of crime but that many factors that were not addressed in this dissertation are also important drivers of crime costs.

To better understand the degree to which PPD causes crime costs, several criteria must be established: (a) PPD would need to temporally precede other variables; (b) a correlation would need to exist between PPD and the other variables; (c) PPD would need statistical domination of other variables where its main effect maximally predicts recidivism—or a PPD × variable interaction partially mediates recidivism (see Baron & Kenny, 1986; Kraemer et al., 2001). As noted in Chapter 2, more work is needed to tease apart which risk factors are the proximal causes of violence and crime. Indeed, the multifactorial explanations of crime and violence (see Douglas & Skeem, 2005) may explain why the results from Study 2 suggest that the HCR-20 predicted larger prospective crime costs than the PCL-R.

Beyond considerations of equifinality, many other limitations have been detailed within the studies’ specific discussion sections. However, one overarching methodological limitation warrants highlighting: This dissertation assumed a great deal. The claims that stem from the results are only as strong as its underpinning assumptions (e.g., offending rates, specific crime costs, national costs of crime, statistical models, theories of violence risk formulation). I combined logic and empirical evidence to develop rigorous assumptions, yet these assumptions all had decision points that were often accompanied by reasonable alternatives. Readers should consider these assumptions when making their own interpretations, and researchers should test different models, measures, and costs to reliably and comprehensively understand the economic burden of PPD.

4.1. Implications

**Policy.** For policy-makers, the overall message of this dissertation is that because of criminal behaviour, PPD has a very large economic footprint. These high costs should compel more resources for research, intervention, and management. This is no simple task. How many charitable donors would attend a golf fundraiser for people
with PPD? Likely, very few. Based on the current dissertation findings, I recommend that national research and public health agencies increase funding for PPD. In light of a clear need for PPD-related funding, researchers and clinicians should continue advocating for financial support because economic estimates of disease burden have been inconsistently correlated with funding size (Gross, Anderson, & Powe, 1999).

This burden–funding mismatch is potentially present for funding of personality disorder research. A review of the funding database for the Canadian Research Information System (2018) revealed five unique projects related to the search terms “psychopathy and treatment,”17 amounting to $1,227,818 in funding resources, whereas “borderline and therapy” had 12 unique matches, amounting to $3,341,505 in funding resources. When excluding the term treatment, “borderline personality” had 43 funded projects in Canada, whereas “psychopathy” only had eight matches. Similar trends were observed for US funding. A review of the Federal RePORTER (STAR METRICS, 2018), a database of American research and development investments, revealed 315 projects resulting in approximately $140 million in funding resources for “borderline personality and treatment.” A query of “psychopathy and treatment” had only 102 projects worth $26 million, and my own review of these PPD project titles revealed very little direct emphasis on treatment of psychopathy. Overall, relative to its large potential economic burden, PPD treatment research funding is impoverished in North America. I am not arguing that resources be diverted from studying BPD, but certainly increased funds should be applied to PPD.

If more resources were available, how should researchers, health professionals, policy-makers, and justice professionals intervene and reduce PPD dysfunction? Based on the current literature, it would be prudent for stakeholders to invest in early intervention. PPD is likely more malleable earlier in people’s developmental course (e.g., Cauffman et al., 2016; Hawes et al., 2014; Loney et al., 2007; Rutherford et al., 1999), and evidence suggests that early intervention is cost effective among at-risk youth (National Institute for Health & Clinical Excellence [NICE], 2010). Cohen and Piquero (2009) estimated that stopping at-risk youth (i.e., greater than 6 police contacts) from offending by the age of 18 could result in $2.6–$5.3 million in savings per youth. These

17 Various search terms were tested, and the terms with the most matches were included.  
potential financial savings were driven primarily by reduced crime costs. Indeed, there are robust cost-benefit analysis (CBA) data suggesting that early intervention can efficiently reduce financial costs attributable to crime.

For instance, Schweinhart, Barnes, and Weikart (1993) famously discovered significant financial gains from an intellectual improvement program for preschoolers. Spending $1 resulted in $7.16 in savings for participants at age 27, and even greater savings emerged when participants turned 40 (Schweinhart et al., 2005). Most relevant to the present findings, approximately one-third of these benefits resulted from reduced criminal activity. More recently, a CBA of a cognitive-behavioural skills program for preventing offending in at-risk boys resulted in a savings ratio of 17.3 to 31.8 when accounting for official convictions and undetected crime (Farrington & Koegl, 2015). The evidence suggests that interventions for at-risk youth often accrue net financial benefits. And although such at-risk youth are by no means destined to develop PPD, they often represent a group with early markers of PPD disturbances. Intervening among a small subset of youth who are most at risk for developing PPD (i.e., on a trajectory of high-frequency chronic offending) has been estimated to have the largest economic benefits, possibly accounting for approximately 50% of all crime costs in adolescence and adulthood (Cohen, Piquero, & Jennings, 2010).

Targeting early intervention has empirical support for cost effectiveness, and the public is willing to fund early interventions and take rehabilitative (i.e., non-punitive) approaches to helping at-risk youth (Nagin, Piquero, Scott, & Steinberg, 2006). Such attitudes might further intensify if this approach were directly compared to economic funding of adult PPD. It is plausible that early primary intervention is a more pragmatic funding avenue that tertiary adult intervention. However, to adequately address the large economic burden of PPD, treatment and management will likely need to occur at older developmental stages as well.

How might we translate these research-based recommendations into policy change (e.g., increase funding, program development)? Despite the utility of evidence-based policies (e.g., Beelman & Raabe, 2009), often scientific research is not adequately integrated into policy in health (Malekinejad, Horvath, Snyder, & Brindis, 2018) and justice systems (e.g., Cook & Roesch, 2012; Crocker et al., 2015). Two major discordances have been identified between policy and research: First, there may be
inadequate or poorly synthesized evidence, or second, recommended policies are not enacted because of interfering social, moral, or political values (Malekinejad et al., 2018). The current state of PPD research, including this dissertation, has demonstrated a significant burden of disease; however, this is only 1 of 4 types of public health evidence (Malekinejad et al., 2018). The other types of evidence include intervention efficacy, intervention effectiveness, and cost effectiveness (Chambless & Hollon, 1988; Malekinejad et al., 2018). These latter forms of evidence for adult PPD treatment are weak and still developing, and there is growing, intuitive evidence that PPD and other personality disorders are stigmatized (e.g., Sheehan, Nieweglowski, & Corrigan, 2016). Thus, both discordances seem present between research and policy for PPD interventions.

To address some of this discordance, our views of PPD require change (for more details, see below), but such change needs to be balanced with reality acceptance of the current assumptions about PPD. I suggest that pragmatic approaches that fit within relevant systems may increase the likelihood of effective research translation. For instance, the majority of PPD treatment and management will happen within criminal justice institutions. Using system-congruent language such as crime-prevention programs in place of concepts like mental health treatment may result in policy buy-in. If policy-makers need to answer, in part, to voters (Malekinejad et al., 2018), I speculate that similar linguistic decisions could impact politically-based decision-making.

It may also be beneficial to disseminate PPD-based recommendations with different forms of discourse, particularly those that are directed toward policy-makers. For example, a standing committee of Canadian psychologists have written a position paper to influence the federal government and its Criminal Code to allow psychologists to conduct fitness to stand trial and criminal responsibility assessments (Kayfitz et al., 2017; Roesch et al., 2019). To enact their recommendations, this committee made lobbying efforts by contacting members of parliament within different major political parties. Lobbying efforts for evidence-based crime reduction for those with PPD may also be effective at overcoming barriers for research translation. The most effective advocacy has a clear yet simplistic message that is voiced persistently (Canadian Psychological Association, 2013). Specific advocacy efforts include contacting elected officials verbally or using personalized letters, inviting elected officials to events or work,
Clinical Practice. For clinicians and other justice professionals working in adult mental health contexts, the significant costs associated with PPD imply that increased resources and intensive interventions should also be allocated to adults with prominent PPD traits. Although there is some evidence supporting cognitive-behavioural therapy (CBT) approaches for treating PPD (e.g., Salekin et al., 2010; Sewall & Olver, 2019), no randomized-controlled trials (RCTs) have been conducted for the disorder. The NICE guideline development group (2010) conducted a systematic review of treating APD and found only one study (Davidson et al., 2009) that adequately met criteria for measuring treatment efficacy. This RCT studied group CBT and treatment as usual for community-living people with APD. Differences in treatment modalities were small and non-significant, although both treatment conditions had reduced verbal and physical aggression over a 1-year follow-up (Davidson et al., 2009). Despite modest outcomes, the analysis of all relevant treatment studies (Kendall et al., 2009; NICE, 2010) led to the recommendation of treating APD with group-based CBT that targets personality difficulties (e.g., impulsivity, relationship problems) and offending behaviours.

Consistent with the views of others (e.g., Salekin et al., 2010), the NICE workgroup (2010) also recommended applying highly intensive (i.e., individual and group) cognitive-behavioural interventions for PPD, which specifically target violence and recidivism. From an economic perspective, this treatment approach may produce cost savings. NICE (2010) reported that a group CBT program for reducing criminal recidivism among general offenders resulted in a net savings of £637 in one year per offender. Using sensitivity-modelling analysis, these savings ranged from £1,578 to £3,424 over a 5-year period. In considering the large economic burden reported in the current dissertation, this evidence suggests that CBT approaches have the potential to reduce crime costs associated with PPD. Indeed, international evidence has demonstrated that CBT is a cost-effective treatment approach for many common mental health problems (Myhr & Payne, 2006).

Detailing relevant therapeutic approaches for PPD is important, and increased services are urgently needed. This request is also idealistic—it is equally important to recognize the serious challenges that mental health professionals face in researching
and intervening with PPD. A dilemma exists between ethical practice and personal boundaries. From an aspirational perspective, the Canadian Psychological Association Code of Ethics (2017) details that services should (a) be fairly distributed without discrimination toward disadvantaged groups (e.g., PPD), (b) be designed to benefit society, and (c) maximize benefits. To this end, psychologists are ethically encouraged to improve psychological services for those with PPD.

And yet, many well-intentioned clinicians might remark that executing this task is overwhelming (cf. Murray, 2014). Those with prominent antisocial personality disturbances do not receive or seek out relevant psychological services, and they have reduced treatment completion rates (NICE, 2010; Sewall & Olver, 2019). NICE (2010) also commented that service providers need additional supports when treating PPD. With these issues in mind, Dialectical Behavior Therapy (DBT; see Linehan, 1993, 2015) may maximize clinicians' treatment efforts toward PPD. DBT is a multi-component treatment that includes group consultation among therapists and takes an explicit, behavioural approach to reducing problem behaviours. DBT has direct application to therapy interfering behaviours (e.g., not attending, diminished commitment, attendance problems) and therapist burnout via explicit professional consultation.

Fortunately, mental health professionals have adapted DBT for forensic settings (McCann, Ball, & Ivanoff, 2000; Galietta, 2018) and psychopathic offenders (Galietta & Rosenfeld, 2012), which address criminogenic factors and etiological models of psychopathy. There is a small but growing empirical literature detailing that DBT interventions were effective in forensic settings (e.g., Mills, Murphy, Lee, & Clarke, 2018; Rosenfeld et al., 2007; Tomlinson, 2018). Essentially, DBT is a highly intensive form of CBT that integrates individual therapy, group therapy, and therapy for the therapists. These supports are in keeping with NICE guidelines (2010) regarding intervention for PPD and other severe personality disorders. Further, research partially supports DBT as a potentially cost savings treatment (e.g., Haga, Aas, Grøholt, Tørmoen, & Mehlum, 2018; Wagner et al., 2014). It is plausible that DBT provides an evidence-based approach that may also reduce crime costs attributable to offenders with PPD. Thus, while treatment efficacy is always a high-priority need (Chambless & Hollon, 1998), cost-benefit analyses can test treatment effectiveness by highlighting potential financial incentives from PPD treatments.
Researchers. For researchers, one indirect path to influencing treatment progress is by further humanizing PPD. In an era where stigma of mental illness is well known and negatively impacts recovery (e.g., Clement et al., 2014; Corrigan, 2004), PPD has been excluded from this important discourse. A shift can be made around subtle language use. The field should continue to move away from describing someone as a psychopath to a person with psychopathy, psychopathic traits, or psychopathic personality disorder. In academic and clinical writing, we no longer describe someone as a “borderline” or “schizophrenic,” but for psychopathy or PPD, people continue to be equated with their disorder. This distinction may affect views within forensic psychology and, over time, may trickle into mainstream consciousness. Humanizing PPD and discussing this disorder with dignity may contribute to improved expectations about treating and managing people with PPD.

And although this subtle change may seem obvious, the field should press to remove even more uncomfortable descriptions from our writings. Scientific titles centered around psychopathy include, among others, “Bargaining with the devil: Using economic decision-making tasks to examine the heterogeneity of psychopathic traits” (Berg, Lilienfeld, & Waldman, 2013), “Putting the “IRT” in “Dirty”: Item response theory analyses of the Dark Triad Dirty Dozen—An efficient measure of narcissism, psychopathy, and Machiavellianism” (Webster & Jonason 2013), and “Spotting psychopaths using technology” (Hulbert & Adeli, 2015). My own Google Scholar search yielded six titles on the first page using the term fledgling (i.e., a young bird) to describe psychopathic features among youth. Certainly, a title alone does not fully represent the care that many of these researchers apply to this domain, but nonetheless, the field needs to move away from derogatory terminology immediately.

Respectfully, such descriptions are understandable. It can be difficult to remain balanced when PPD dysfunction is so severe and costly (i.e., economically, physically, emotionally). But writing about PPD is a medium that deserves and requires greater diligence. Otherwise the field may risk discouraging clinicians and researchers from helping this challenging and complex population. Perhaps a set of guiding assumptions like those developed in DBT would be useful to help understand the harmful and violent decisions made by those with PPD (see Linehan, 1993; e.g., clients are trying their best and need to try harder).
For a more direct pathway to affecting change in PPD costs, researchers should prioritize working with clinicians to examine the evidence base for treating PPD. Additionally, collaboration among different academic disciplines will help refine our understanding of the social burden of PPD. Psychologists, economists, psychiatrists, public health researchers, and criminologists are among many disciplines that can bring different strengths to this research domain. A multidisciplinary approach to studying the burden of PPD is in keeping with contemporary biopsychosocial approaches to understanding health and illness (Poole, Matheson, & Cox, 2016).

4.2. Future Research

A multidisciplinary approach could likely expand upon this dissertation’s current findings which extend only to crime costs. To produce a full cost-of-illness estimate for PPD, many other economic domains need to be examined such as non-criminal related health care costs and job productivity. Some might expect PPD to have massive economic impacts in the workplace given the growing literature that such traits are associated with employment dysfunction (Boddy, 2011; Mathieu et al., 2014; Mathieu et al., 2015; Mathieu & Babiak, 2016). Further, a sentiment exists that PPD may result in disproportionate white collar crime (Pardue et al., 2013; Smith & Lilienfeld, 2013). Comprehensive health care costs also require greater scrutiny given that PPD may either be associated with increased or decreased health costs. PPD is associated with recklessness and impulsive behaviours (e.g., Hare, 2003) likely requiring health services, and yet those with PPD are less likely to receive or seek out such services (Barrett et al., 2009; NICE, 2010). Beyond these specific domains, the non-criminal interpersonal costs of PPD could also be quite extensive.

Most PPD research examines how the disorder leads to pain, violence, and the death of others, but what about the inverse? Very little research explicitly addresses harm toward those with PPD (Boccio & Beaver, 2019). Perhaps most importantly, research should address the standardized mortality rate of PPD. Some evidence does exist regarding the less severe variant (i.e., APD), and those with APD are far more likely to die prematurely (Black, Baumgard, Bell, & Kao, 1996; Repo-Tiihonen et al., 2001; Swanson, Bland, & Newman, 1994). This finding holds true even when compared with other psychiatric conditions (Martin, Cloninger, Guze, & Clayton, 1985), and
increased mortality for PPD is often attributed to suicide and reckless behaviour (Black et al., 1996). Because PPD is a more severe operationalization of APD, it is likely that such mortality rates would hold or become even more disproportionate. Unfortunately, to my knowledge, no research has directly examined PPD mortality rates using relevant measurement tools such as the PCL-R. If this hypothesis were supported, the financial burden of PPD would substantially increase.

The most pressing research need is to conduct an RCT—the best evidence for treatment efficacy (Chambless & Hollon, 1998)—examining interventions for treating people diagnosed with PPD. This dissertation presents a case that PPD may directly cause crime and violence, and as a result, those with the disorder produce considerable economic costs. Researching PPD treatment efficacy can be an important avenue to reduce these systemic costs. And although financial cost is a fiscal motivator to treat PPD, it cannot be the sole benefit for improving health services for this disorder. PPD affects people. The underlying purpose for treating these people is to improve their quality of life so that everyone can live healthier and more fulfilling lives. Finances, important as they are, only comprise a portion of this aspiration.
References


133


155


Appendix A.

Proportion of PPD Crime Estimates

North America:

8.3%  2.31: $1 = x(2.31)(.083) + x(1)(.917) \rightarrow 1 = x(.19173 + .917) \rightarrow 1 = x(1.10873) \rightarrow x = 1/1.10873 \rightarrow x = .9019328421.

8.3%  2.88: $1 = x(2.88)(.083) + x(1)(.917) \rightarrow 1 = x(.23904 + .917) \rightarrow 1 = x(1.15604) \rightarrow x = 1/1.15604 \rightarrow x = .8650219716.

8.3%  4.19: $1 = x(4.19)(.083) + x(1)(.917) \rightarrow 1 = x(.34777 + .917) \rightarrow 1 = x(1.26477) \rightarrow x = 1/1.26477 \rightarrow x = .7906575899.

28.5%  2.31: $1 = x(2.31)(.285) + x(1)(.715) \rightarrow 1 = x(.65835 + .715) \rightarrow 1 = x(1.37335) \rightarrow x = 1/1.37335 \rightarrow x = .7281465031.

28.5%  2.88: $1 = x(2.88)(.285) + x(1)(.715) \rightarrow 1 = x(.8208 + .715) \rightarrow 1 = x(1.5358) \rightarrow x = 1/1.5358 \rightarrow x = .6511264488.

28.5%  4.19: $1 = x(4.19)(.285) + x(1)(.715) \rightarrow 1 = x(1.19415 + .715) \rightarrow 1 = x(1.90915) \rightarrow x = 1/1.90915 \rightarrow x = .5237933112.

United Kingdom (UK)

2.2%  2.31: $1 = x(2.31)(.022) + x(1)(.978) \rightarrow 1 = x(0.05082 + .978) \rightarrow 1 = x(1.02882) \rightarrow x = 1/1.02882 \rightarrow x = .9719873253.

2.2%  2.88: $1 = x(2.88)(.022) + x(1)(.978) \rightarrow 1 = x(0.06336 + .978) \rightarrow 1 = x(1.04136) \rightarrow x = 1/1.04136 \rightarrow x = .9602827072.

2.2%  4.19: $1 = x(4.19)(.022) + x(1)(.978) \rightarrow 1 = x(0.09218 + .978) \rightarrow 1 = x(1.07018) \rightarrow x = 1/1.07018 \rightarrow x = .9344222467.

4.0%  2.31: $1 = x(2.31)(.040) + x(1)(.960) \rightarrow 1 = x(0.0924 + .960) \rightarrow 1 = x(1.0524) \rightarrow x = 1/1.0524 \rightarrow x = .950209046.

28.5%  2.31: $1 = x(2.31)(.285) + x(1)(.715) \rightarrow 1 = x(.65835 + .715) \rightarrow 1 = x(1.37335) \rightarrow x = 1/1.37335 \rightarrow x = .7281465031.

28.5%  2.88: $1 = x(2.88)(.285) + x(1)(.715) \rightarrow 1 = x(.8208 + .715) \rightarrow 1 = x(1.5358) \rightarrow x = 1/1.5358 \rightarrow x = .6511264488.

28.5%  4.19: $1 = x(4.19)(.285) + x(1)(.715) \rightarrow 1 = x(1.19415 + .715) \rightarrow 1 = x(1.90915) \rightarrow x = 1/1.90915 \rightarrow x = .5237933112.

4.0%  2.31: $1 = x(2.31)(.040) + x(1)(.960) \rightarrow 1 = x(0.0924 + .960) \rightarrow 1 = x(1.0524) \rightarrow x = 1/1.0524 \rightarrow x = .950209046.

28.5%  2.31: $1 = x(2.31)(.285) + x(1)(.715) \rightarrow 1 = x(.65835 + .715) \rightarrow 1 = x(1.37335) \rightarrow x = 1/1.37335 \rightarrow x = .7281465031.

28.5%  2.88: $1 = x(2.88)(.285) + x(1)(.715) \rightarrow 1 = x(.8208 + .715) \rightarrow 1 = x(1.5358) \rightarrow x = 1/1.5358 \rightarrow x = .6511264488.

28.5%  4.19: $1 = x(4.19)(.285) + x(1)(.715) \rightarrow 1 = x(1.19415 + .715) \rightarrow 1 = x(1.90915) \rightarrow x = 1/1.90915 \rightarrow x = .5237933112.
Monte Carlo PPD Proportion of Crime Calculations

Proportion of crime calculations were estimated by taking the product of multiplying reported prevalence rates by different offending rates. All effect sizes reported for general recidivism and violence were included in the calculations; however, sexual recidivism was considered too specific of an outcome. PPD prevalence was multiplied by .75 to account for PPD rates in the proportion of offenders sentenced to community supervision.

All North American PPD prevalence estimates, divided by 0.75.

15% = 11.25
32% = 24
17% = 12.75
12% = 9
35% = 26.25
18% = 13.5
34% = 25.5
38% = 28.5
11% = 8.25
17% = 12.75

OR 2.71
15% = 11.25
1 = x(2.71)(.1125) + x(1)(.8875) \rightarrow 1= x(0.304875 + .8875) \rightarrow 1=x(1.192375) \rightarrow x =
1/1.192375 \rightarrow x = .8386623336
\rightarrow (.8386623336)(2.71)(.1125) + (.8386623336)(1)(.8875) = .2557 + .7443

32% = 24
1 = x(2.71)(.2400) + x(1)(.7600) \rightarrow 1= x(0.6504 + .7600) \rightarrow 1=x(1.4104) \rightarrow x = 1/1.4104
\rightarrow x = .7122507123
\rightarrow (.7122507123)(2.71)(.2400) + (.7122507123)(1)(.7600) = .4632 + .5413

17% = 12.75
1 = x(2.71)(.1275) + x(1)(.8725) \rightarrow 1= x(0.345525 + .8725) \rightarrow 1=x(1.218025) \rightarrow x =
1/1.218025 \rightarrow x = .821001211
\rightarrow (.821001211)(2.71)(.1275) + (.821001211)(1)(.8725) = .2837 + .7163
12% = 9
1 = x(2.71)(.0900) + x(1)(.9100) \rightarrow 1= x(0.2439 + .9100) \rightarrow x = 1/1.1539
\rightarrow x = .8666262241
\rightarrow (.8666262241)(2.71)(.0900) + (.8666262241)(1)(.9100) = .2114 + .7886

35% = 26.25
1 = x(2.71)(.2625) + x(1)(.7375) \rightarrow 1= x(0.711375 + .7375) \rightarrow x = 1/1.448875\rightarrow x = .6901906652
\rightarrow (.6901906652)(2.71)(.2625) + (.6901906652)(1)(.7375) = .9100 + .5090

18% = 13.5
1 = x(2.71)(.1350) + x(1)(.8650) \rightarrow 1= x(0.36585 + .8650) \rightarrow x = 1/1.23085\rightarrow x = .6901906652
\rightarrow (.6901906652)(2.71)(.1350) + (.6901906652)(1)(.8650) = .2972 + .7028

34% = 25.5
1 = x(2.71)(.2550) + x(1)(.7450) \rightarrow 1= x(0.69105 + .7450) \rightarrow x = 1/1.43605\rightarrow x = .6901906652
\rightarrow (.6901906652)(2.71)(.2550) + (.6901906652)(1)(.7450) = .4812 + .5188

38% = 28.5
1 = x(2.71)(.2850) + x(1)(.7150) \rightarrow 1= x(0.77235 + .7150) \rightarrow x = 1/1.48735\rightarrow x = .6901906652
\rightarrow (.6901906652)(2.71)(.2850) + (.6901906652)(1)(.7150) = .5193 + .4807

11% = 8.25
1 = x(2.71)(.0825) + x(1)(.9175) \rightarrow 1= x(0.223575 + .9175) \rightarrow x = 1/1.141075\rightarrow x = .876365841
\rightarrow (.876365841)(2.71)(.0825) + (.876365841)(1)(.9175) = .1959 + .8041

17% = 12.75
1 = x(2.71)(.1275) + x(1)(.8725) \rightarrow 1= x(0.345525 + .8725) \rightarrow x = 1/1.218025\rightarrow x = .821001211
\rightarrow (.821001211)(2.71)(.1275) + (.821001211)(1)(.8725) = .2837 + .7163

OR 2.76
15% = 11.25
1 = x(2.76)(.1125) + x(1)(.8875) \rightarrow 1= x(0.3105 + .8875) \rightarrow x = 1/1.198\rightarrow x = .8347245409
\rightarrow (.8347245409)(2.76)(.1125) + (.8347245409)(1)(.8875) = .2592 + .7408

32% = 24
1 = x(2.76)(.2400) + x(1)(.7600) \rightarrow 1= x(0.6624 + .7600) \rightarrow x = 1/1.4224\rightarrow x = .70300371204
\rightarrow (.70300371204)(2.76)(.2400) + (.70300371204)(1)(.7600) = .4657 + .5343

17% = 12.75
1 = x(2.76)(.1275) + x(1)(.8725) \rightarrow 1= x(0.3519 + .8725) \rightarrow x = 1/1.2244\rightarrow x = .8167265599
\rightarrow (.8167265599)(2.76)(.1275) + (.8167265599)(1)(.8725) = .2874 + .7126
12% = 9
1 = x(2.76)(.0900) + x(1)(.9100) \rightarrow 1= x(0.2484 + .9100) \rightarrow 1=x(1.1584) \rightarrow x = \\
1/1.1584 \rightarrow x = .8632596685 \\
\rightarrow (.8632596685)(2.76)(.0900) + (.8632596685)(1)(.9100) = .2144 + .7856

35% = 26.25
1 = x(2.76)(.2625) + x(1)(.7375) \rightarrow 1= x(0.7245 + .7375) \rightarrow 1=x(1.462) \rightarrow x = 1/1.462 \rightarrow x = .683994528 \\
\rightarrow (.683994528)(2.76)(.2625) + (.683994528)(1)(.7375) = .4956 + .5044

18% = 13.5
1 = x(2.76)(.1350) + x(1)(.8650) \rightarrow 1= x(0.3726 + .8650) \rightarrow 1=x(1.2376) \rightarrow x = 1/1.2376 \rightarrow x = .8080155139 \\
\rightarrow (.8080155139)(2.76)(.1350) + (.8080155139)(1)(.8650) = .3011 + .6989

34% = 25.5
1 = x(2.76)(.2550) + x(1)(.7450) \rightarrow 1= x(0.7038 + .7450) \rightarrow 1=x(1.4488) \rightarrow x = 1/1.4488 \rightarrow x = .6902263943 \\
\rightarrow (.6902263943)(2.76)(.2550) + (.6902263943)(1)(.7450) = .4858 + .5142

38% = 28.5
1 = x(2.76)(.2850) + x(1)(.7150) \rightarrow 1= x(0.7866 + .7150) \rightarrow 1=x(1.5016) \rightarrow x = 1/1.5016 \rightarrow x = .6659563133 \\
\rightarrow (.6659563133)(2.76)(.2850) + (.6659563133)(1)(.7150) = .5238 + .4762

11% = 8.25
1 = x(2.76)(.0825) + x(1)(.9175) \rightarrow 1= x(0.2277 + .9175) \rightarrow 1=x(1.1452) \rightarrow x = 1/1.1452 \rightarrow x = .8732091997 \\
\rightarrow (.8732091997)(2.76)(.0825) + (.8732091997)(1)(.9175) = .1988 + .8012

17% = 12.75
1 = x(2.76)(.1275) + x(1)(.8725) \rightarrow 1= x(0.3519 + .8725) \rightarrow 1=x(1.2244) \rightarrow x = 1/1.2244 \rightarrow x = .8167265599 \\
\rightarrow (.8167265599)(2.76)(.1275) + (.8167265599)(1)(.8725) = .2874 + .7126

OR 2.48
15% = 11.25
1 = x(2.48)(.1125) + x(1)(.8875) \rightarrow 1= x(0.279 + .8875) \rightarrow 1=x(1.1665) \rightarrow x = 1/1.1665 \rightarrow x = .8572653236 \\
\rightarrow (.8572653236)(2.48)(.1125) + (.8572653236)(1)(.8875) = .2392 + .7608

32% = 24
1 = x(2.48)(.2400) + x(1)(.7600) \rightarrow 1= x(0.5952 + .7600) \rightarrow 1=x(1.3552) \rightarrow x = 1/1.3552 \rightarrow x = .7378984652 \\
\rightarrow (.7378984652)(2.48)(.2400) + (.7378984652)(1)(.7600) = .4392 + .5608

17% = 12.75
1 = x(2.48)(.1275) + x(1)(.8725) \rightarrow 1= x(0.3162 + .8725) \rightarrow 1=x(1.1887) \rightarrow x = 1/1.1887 \rightarrow x = .8412551527
\[(.8412551527)(2.48)(.1275) + (.8412551527)(1)(.8725) = .2660 + .7340\]

12% = 9
1 = x(2.48)(.9000) + x(1)(.9100) → 1= x(0.2232 + .9100) → 1=x(1.1332) → x = 1/1.1332 → x = .8824567596
\[(.8824567596)(2.48)(.9000) + (.8824567596)(1)(.9100) = .1970 + .8030\]

35% = 26.25
1 = x(2.48)(.2625) + x(1)(.7375) → 1= x(0.651 + .7375) → 1=x(1.3885) → x = 1/1.3885 → x = .7202016565
\[(.7202016565)(2.48)(.2625) + (.7202016565)(1)(.7375) = .4689 + .5311\]

18% = 13.5
1 = x(2.48)(.1350) + x(1)(.8650) → 1= x(0.3348 + .8650) → 1=x(1.1998) → x = 1/1.1998 → x = .834722454
\[(.834722454)(2.48)(.1350) + (.834722454)(1)(.8650) = .2790 + .7210\]

34% = 25.5
1 = x(2.48)(.2550) + x(1)(.7450) → 1= x(0.6324 + .7450) → 1=x(1.3774) → x = 1/1.3774 → x = .7260055176
\[(.7260055176)(2.48)(.2550) + (.7260055176)(1)(.7450) = .4591 + .5409\]

38% = 28.5
1 = x(2.48)(.2850) + x(1)(.7150) → 1= x(0.7068 + .7150) → 1=x(1.4218) → x = 1/1.4218 → x = .703338022
\[(.703338022)(2.48)(.2850) + (.703338022)(1)(.7150) = .4971 + .5029\]

11% = 8.25
1 = x(2.48)(.0825) + x(1)(.9175) → 1= x(0.2046 + .9175) → 1=x(1.1221) → x = 1/1.1221 → x = .8911861688
\[(.8911861688)(2.48)(.0825) + (.8911861688)(1)(.9175) = .1823 + .8277\]

17% = 12.75
1 = x(2.48)(.1275) + x(1)(.8725) → 1= x(0.3162 + .8725) → 1=x(1.1887) → x = 1/1.1887 → x = .8412551527
\[(.8412551527)(2.48)(.1275) + (.8412551527)(1)(.8725) = .2660 + .7340\]

OR 2.58 ([1.72 + 3.43]/2)
15% = 11.25
1 = x(2.58)(.1125) + x(1)(.8875) → 1= x(0.29025 + .8875) → 1=x(1.17775) → x = 1/1.17775 → x = .8490766292
\[(.8490766292)(2.58)(.1125) + (.8490766292)(1)(.8875) = .2464 + .7536\]

32% = 24
1 = x(2.58)(.2400) + x(1)(.7600) → 1= x(0.6192 + .7600) → 1=x(1.3792) → x = 1/1.3792 → x = .7250580046
\[(.7250580046)(2.58)(.2400) + (.7250580046)(1)(.7600) = .4490 + .5510\]

17% = 12.75
1 = x(2.58)(.1275) + x(1)(.8725) \rightarrow 1 = x(0.32895 + .8725) \rightarrow 1 = x(1.20145) \rightarrow x = 1/1.20145 \rightarrow x = .83233276041
\rightarrow (.83233276041)(2.58)(.1275) + (.83233276041)(1)(.8725) = .2738 + .7262

12\% = 9
1 = x(2.58)(.0900) + x(1)(.9100) \rightarrow 1 = x(0.2322 + .9100) \rightarrow 1 = x(1.1422) \rightarrow x = 1/1.1422 \rightarrow x = .8755034145
\rightarrow (.8755034145)(2.58)(.0900) + (.8755034145)(1)(.9100) = .2033 + .7967

35\% = 26.25
1 = x(2.58)(.2625) + x(1)(.7375) \rightarrow 1 = x(0.67725 + .7375) \rightarrow 1 = x(1.41475) \rightarrow x = 1/1.41475 \rightarrow x = .7068386641
\rightarrow (.7068386641)(2.58)(.2625) + (.7068386641)(1)(.7375) = .4787 + .5213

18\% = 13.5
1 = x(2.58)(.1350) + x(1)(.8650) \rightarrow 1 = x(0.3483 + .8650) \rightarrow 1 = x(1.2133) \rightarrow x = 1/1.2133 \rightarrow x = .824198467
\rightarrow (.824198467)(2.58)(.1350) + (.824198467)(1)(.8650) = .2871 + .7129

34\% = 25.5
1 = x(2.58)(.2550) + x(1)(.7450) \rightarrow 1 = x(0.6579 + .7450) \rightarrow 1 = x(1.4124) \rightarrow x = 1/1.4124 \rightarrow x = .7080147627
\rightarrow (.7080147627)(2.58)(.2550) + (.7080147627)(1)(.7450) = .4658 + .5342

38\% = 28.5
1 = x(2.58)(.2850) + x(1)(.7150) \rightarrow 1 = x(0.7353 + .7150) \rightarrow 1 = x(1.4503) \rightarrow x = 1/1.4503 \rightarrow x = .6895125147
\rightarrow (.6895125147)(2.58)(.2850) + (.6895125147)(1)(.7150) = .5070 + .4930

11\% = 8.25
1 = x(2.58)(.0825) + x(1)(.9175) \rightarrow 1 = x(0.21285 + .9175) \rightarrow 1 = x(1.13035) \rightarrow x = 1/1.13035 \rightarrow x = .8846817357
\rightarrow (.8846817357)(2.58)(.0825) + (.8846817357)(1)(.9175) = .1883 + .8117

17\% = 12.75
1 = x(2.58)(.1275) + x(1)(.8725) \rightarrow 1 = x(0.32895 + .8725) \rightarrow 1 = x(1.20145) \rightarrow x = 1/1.20145 \rightarrow x = .8323276041
\rightarrow (.8323276041)(2.58)(.1275) + (.8323276041)(1)(.8725) = .2738 + .7268

OR 3.00
15\% = 11.25
1 = x(3.00)(.1125) + x(1)(.8875) \rightarrow 1 = x(0.3375 + .8875) \rightarrow 1 = x(1.225) \rightarrow x = 1/1.225 \rightarrow x = .8163265306
\rightarrow (.8163265306)(3.00)(.1125) + (.8163265306)(1)(.8875) = .2755 + .7245

32\% = 24
1 = x(3.00)(.2400) + x(1)(.7600) \rightarrow 1 = x(0.7200 + .7600) \rightarrow 1 = x(1.4800) \rightarrow x = 1/1.4800 \rightarrow x = .6756756757
\rightarrow (.6756756757)(3.00)(.2400) + (.6756756757)(1)(.7600) = .4865 + .5135
17% = 12.75
1 = x(3.00)(.1275) + x(1)(.8725) → 1 = x(0.3825 + .8725) → 1 = x(1.255) → x = 1/1.255 →
x = .796812749
→ (.796812749)(3.00)(.1275) + (.796812749)(1)(.8725) = .3048 + .6952

12% = 9
1 = x(3.00)(.0900) + x(1)(.9100) → 1 = x(0.2700 + .9100) → 1 = x(1.18) → x = 1/1.18 →
x = .8474576271
→ (.8474576271)(3.00)(.0900) + (.8474576271)(1)(.9100) = .2288 + .7712

35% = 26.25
1 = x(3.00)(.2625) + x(1)(.7375) → 1 = x(0.7875 + .7375) → 1 = x(1.525) → x = 1/1.525 →
x = .6557377049
→ (.6557377049)(3.00)(.2625) + (.6557377049)(1)(.7375) = .5164 + .4836

18% = 13.5
1 = x(3.00)(.1350) + x(1)(.8650) → 1 = x(0.2475 + .8650) → 1 = x(1.165) → x = 1/1.165 →
x = .8583690987
→ (.8583690987)(3.00)(.1350) + (.8583690987)(1)(.8650) = .2124 + .7876

34% = 25.5
1 = x(3.00)(.2550) + x(1)(.7450) → 1 = x(0.7392 + .7600) → 1 = x(1.4992) →
x = 1/1.4992 → x = .667022412
→ (.667022412)(3.08)(.2550) + (.667022412)(1)(.7450) = .5066 + .4934

38% = 28.5
1 = x(3.00)(.2850) + x(1)(.7150) → 1 = x(0.855 + .7150) → 1 = x(1.57) → x = 1/1.57 →
x = .6369426752
→ (.6369426752)(3.00)(.2850) + (.6369426752)(1)(.7150) = .5449 + .4351

11% = 8.25
1 = x(3.00)(.0825) + x(1)(.9175) → 1 = x(0.2475 + .9175) → 1 = x(1.165) → x = 1/1.165 →
x = .8583690987
→ (.8583690987)(3.00)(.0825) + (.8583690987)(1)(.9175) = .2124 + .7876

17% = 12.75
1 = x(3.00)(.1275) + x(1)(.8725) → 1 = x(0.3825 + .8725) → 1 = x(1.255) → x = 1/1.255 →
x = .796812749
→ (.796812749)(3.00)(.1275) + (.796812749)(1)(.8725) = .3048 + .6952

OR 3.08
15% = 11.25
1 = x(3.08)(.1125) + x(1)(.8875) → 1 = x(0.3465 + .8875) → 1 = x(1.234) → x = 1/1.234 →
x = .8103727715
→ (.8103727715)(3.08)(.1125) + (.8103727715)(1)(.8875) = .2808 + .7192

32% = 24
1 = x(3.08)(.2400) + x(1)(.7600) → 1 = x(0.7392 + .7600) → 1 = x(1.4992) → x = 1/1.4992 →
x = .667022412
→ (.667022412)(3.08)(.2400) + (.667022412)(1)(.7600) = .4931 + .5069

173
17% = 12.75
1 = x(3.08)(.1275) + x(1)(.8725) → 1 = x(0.3927 + .8725) → 1 = x(1.2652) → x = 1/1.2652 → x = .7903888713 → (.7903888713)(3.08)(.1275) + (.7903888713)(1)(.8725) = .3104 + .6896

12% = 9
1 = x(3.08)(.0900) + x(1)(.9100) → 1 = x(0.2772 + .9100) → 1 = x(1.1872) → x = 1/1.1872 → x = .8423180593 → (.8423180593)(3.08)(.0900) + (.8423180593)(1)(.9100) = .2335 + .7665

35% = 26.25
1 = x(3.08)(.2625) + x(1)(.7375) → 1 = x(0.8085 + .7375) → 1 = x(1.546) → x = 1/1.546 → x = .6468305304 → (.6468305304)(3.08)(.2625) + (.6468305304)(1)(.7375) = .5223 + .4777

18% = 13.5
1 = x(3.08)(.1350) + x(1)(.8650) → 1 = x(0.4158 + .8650) → 1 = x(1.2808) → x = 1/1.2808 → x = .7807620237 → (.7807620237)(3.08)(.1350) + (.7807620237)(1)(.8650) = .3246 + .6754

34% = 25.5
1 = x(3.08)(.2550) + x(1)(.7450) → 1 = x(0.7854 + .7450) → 1 = x(1.5304) → x = 1/1.5304 → x = .6534239415 → (.6534239415)(3.08)(.2550) + (.6534239415)(1)(.7450) = .5132 + .4868

38% = 28.5
1 = x(3.08)(.2850) + x(1)(.7150) → 1 = x(0.855 + .7150) → 1 = x(1.57) → x = 1/1.57 → x = .6369426752 → (.6369426752)(3.08)(.2850) + (.6369426752)(1)(.7150) = .5449 + .4551

11% = 8.25
1 = x(3.08)(.0825) + x(1)(.9175) → 1 = x(0.2541 + .9175) → 1 = x(1.1716) → x = 1/1.1716 → x = .8535363292 → (.8535363292)(3.08)(.0825) + (.8535363292)(1)(.9175) = .2169 + .7831

17% = 12.75
1 = x(3.08)(.1275) + x(1)(.8725) → 1 = x(0.3927 + .8725) → 1 = x(1.2652) → x = 1/1.2652 → x = .7903888713 → (.7903888713)(3.08)(.1275) + (.7903888713)(1)(.8725) = .3104 + .6896

OR 3.19

15% = 11.25
1 = x(3.19)(.1125) + x(1)(.8875) → 1 = x(0.358875 + .8875) → 1 = x(1.246375) → x = 1/1.246375 → x = .8023267476 → (.8023267476)(3.19)(.1125) + (.8023267476)(1)(.8875) = .2879 + .7121

32% = 24
1 = x(3.19)(.2400) + x(1)(.7600) → 1= x(0.7656 + .7600) → 1=x(1.5256) → x =
1/1.5256→ x = .6554798112
→ (.6554798112)(3.19)(.2400) + (.6554798112)(1)(.7600) = .5018 + .4982

17% = 12.75
1 = x(3.19)(1.275) + x(1)(.8725) → 1= x(0.406725 + .8725) → 1=x(1.279225) → x =
1/1.279225→ x = .78172309
→ (.78172309)(3.19)(1.275) + (.78172309)(1)(.8725) = .3179 + .6821

12% = 12
1 = x(3.19)(.0900) + x(1)(.9100) → 1= x(0.2871 + .9100) → 1=x(1.1971) → x =
1/1.1971→ x = .835321009
→ (.835321009)(3.19)(.0900) + (.835321009)(1)(.9100) = .2398 + .7602

35% = 26.25
1 = x(3.19)(.2625) + x(1)(.7375) → 1= x(0.837375 + .7375) → 1=x(1.574875) → x =
1/1.574875→ x = .6349710294
→ (.6349710294)(3.19)(.2625) + (.6349710294)(1)(.7375) = .5317 + .4683

18% = 13.5
1 = x(3.19)(.1350) + x(1)(.8650) → 1= x(0.43065 + .8650) → 1=x(1.29565) → x =
1/1.29565→ x = .771813755
→ (.771813755)(3.19)(.1350) + (.771813755)(1)(.8650) = .3324 + .6676

34% = 25.5
1 = x(3.19)(.2550) + x(1)(.7450) → 1= x(0.81345 + .7450) → 1=x(1.55845) → x =
1/1.55845→ x = .641663191
→ (.641663191)(3.19)(.2550) + (.641663191)(1)(.7450) = .5220 + .4780

38% = 28.5
1 = x(3.19)(.2850) + x(1)(.7150) → 1= x(0.90915 + .7150) → 1=x(1.62415) → x =
1/1.62415→ x = .6157066773
→ (.6157066773)(3.19)(.2850) + (.6157066773)(1)(.7150) = .5598 + .4402

11% = 8.25
1 = x(3.19)(.0825) + x(1)(.9175) → 1= x(0.263175 + .9175) → 1=x(1.180675) → x =
1/1.180675→ x = .8460731298
→ (.8460731298)(3.19)(.0825) + (.8460731298)(1)(.9175) = .2229 + .7771

17% = 12.75
1 = x(3.19)(1.275) + x(1)(.8725) → 1= x(0.406725 + .8725) → 1=x(1.279225) → x =
1/1.279225→ x = .78172309
→ (.78172309)(3.19)(1.275) + (.78172309)(1)(.8725) = .3179 + .6821

OR 3.97
15% = 11.25
1 = x(3.97)(.1125) + x(1)(.8875) → 1= x(0.446625 + .8875) → 1=x(1.334125) → x =
1/1.334125→ x = .7495549517
→ (.7495549517)(3.97)(.1125) + (.7495549517)(1)(.8875) = .3348 + .6652

175
32% = 24
\[ 1 = x(3.97)(.2400) + x(1)(.7600) \rightarrow 1 = x(0.9528 + .7600) \rightarrow 1 = x(1.7128) \rightarrow x = \frac{1}{1.7128} \rightarrow x = .5562821112 \rightarrow (.5562821112)(3.97)(.2400) + (.5562821112)(1)(.7600) = .5300 + .4700 \]

17% = 12.75
\[ 1 = x(3.97)(.1275) + x(1)(.8725) \rightarrow 1 = x(0.506175 + .8725) \rightarrow 1 = x(1.378675) \rightarrow x = \frac{1}{1.378675} \rightarrow x = .725334107 \rightarrow (.725334107)(3.97)(.1275) + (.725334107)(1)(.8725) = .3671 + .6329 \]

12% = 9
\[ 1 = x(3.97)(.0900) + x(1)(.9100) \rightarrow 1 = x(0.3573 + .9100) \rightarrow 1 = x(1.2673) \rightarrow x = \frac{1}{1.2673} \rightarrow x = .7890791446 \rightarrow (.7890791446)(3.97)(.0900) + (.7890791446)(1)(.9100) = .2819 + .7181 \]

35% = 26.25
\[ 1 = x(3.97)(.2625) + x(1)(.7375) \rightarrow 1 = x(0.1.042125 + .7375) \rightarrow 1 = x(1.779625) \rightarrow x = \frac{1}{1.779625} \rightarrow x = .561916134 \rightarrow (.561916134)(3.97)(.2625) + (.561916134)(1)(.7375) = .5859 + .4131 \]

18% = 13.5
\[ 1 = x(3.97)(.1350) + x(1)(.8650) \rightarrow 1 = x(0.53595 + .8650) \rightarrow 1 = x(1.40095) \rightarrow x = \frac{1}{1.40095} \rightarrow x = .7138013491 \rightarrow (.7138013491)(3.97)(.1350) + (.7138013491)(1)(.8650) = .3826 + .6174 \]

34% = 25.5
\[ 1 = x(3.97)(.2550) + x(1)(.7450) \rightarrow 1 = x(1.01235 + .7450) \rightarrow 1 = x(1.75735) \rightarrow x = \frac{1}{1.75735} \rightarrow x = .5690386093 \rightarrow (.5690386093)(3.97)(.2550) + (.5690386093)(1)(.7450) = .5761 + .4239 \]

38% = 28.5
\[ 1 = x(3.97)(.2850) + x(1)(.7150) \rightarrow 1 = x(0.1.13145 + .7150) \rightarrow 1 = x(1.84645) \rightarrow x = \frac{1}{1.84645} \rightarrow x = .5415797882 \rightarrow (.5415797882)(3.97)(.2850) + (.5415797882)(1)(.7150) = .6128 + .3872 \]

11% = 8.25
\[ 1 = x(3.97)(.0825) + x(1)(.9175) \rightarrow 1 = x(0.327525 + .9175) \rightarrow 1 = x(1.245025) \rightarrow x = \frac{1}{1.245025} \rightarrow x = .803196723 \rightarrow (.803196723)(3.97)(.0825) + (.803196723)(1)(.9175) = .2631 + .7369 \]

17% = 12.75
\[ 1 = x(3.97)(.1275) + x(1)(.8725) \rightarrow 1 = x(0.506175 + .8725) \rightarrow 1 = x(1.378675) \rightarrow x = \frac{1}{1.378675} \rightarrow x = .725334107 \rightarrow (.725334107)(3.97)(.1275) + (.725334107)(1)(.8725) = .3671 + .6329 \]
All UK PPD Proportions of Crime

2.2%

4.0%

**OR 2.71**

2.2%

1 = x(2.71)(.0220) + x(1)(.9788) → 1 = x(0.05962 + .9780) → 1 = x(1.03762) → x = 1/1.03762 → x = .9637439525

\[ \rightarrow (.9637439525)(2.71)(.0220) + (.9637439525)(1)(.9780) = .0575 \ + .9425 \]

4.0%

1 = x(2.71)(.04) + x(1)(96) → 1 = x(0.1084 + .96) → 1 = x(1.0684) → x = 1/1.0684 → x = .9359790341

\[ \rightarrow (.9359790341)(2.71)(.04) + (.9359790341)(1)(.96) = .1015 \ + .8985 \]

**OR 2.76**

2.2%

1 = x(2.76)(.0220) + x(1)(.9788) → 1 = x(0.06072 + .9780) → 1 = x(1.03872) → x = 1/1.03872 → x = .9627233518

\[ \rightarrow (.9627233518)(2.76)(.0220) + (.9627233518)(1)(.9780) = .0585 \ + .9415 \]

4.0%

1 = x(2.76)(.04) + x(1)(.96) → 1 = x(0.1104 + .96) → 1 = x(1.0704) → x = 1/1.0704 → x = .9342301943

\[ \rightarrow (.9342301943)(2.76)(.04) + (.9342301943)(1)(.96) = .1031 \ + .8969 \]

**OR 2.48**

2.2%

1 = x(2.48)(.0220) + x(1)(.9788) → 1 = x(0.05456 + .9780) → 1 = x(1.03256) → x = 1/1.03256 → x = .9684667235

\[ \rightarrow (.9684667235)(2.48)(.0220) + (.9684667235)(1)(.9780) = .0528 \ + .9472 \]

4.0%

1 = x(2.48)(.04) + x(1)(.96) → 1 = x(0.0992 + .96) → 1 = x(1.0592) → x = 1/1.0592 → x = .9441087613

\[ \rightarrow (.9441087613)(2.48)(.04) + (.9441087613)(1)(.96) = .0937 \ + .9063 \]

**OR 2.58 ([1.72 + 3.43]/2)**

2.2%

1 = x(2.58)(.0220) + x(1)(.9788) → 1 = x(0.05676 + .9780) → 1 = x(1.03476) → x = 1/1.03476 → x = .9664076694

\[ \rightarrow (.9664076694)(2.58)(.0220) + (.9664076694)(1)(.9780) = .0549 \ + .9451 \]

4.0%

1 = x(2.58)(.04) + x(1)(.96) → 1 = x(0.1032 + .96) → 1 = x(1.0632) → x = 1/1.0632 → x = .9405568096

\[ \rightarrow (.9405568096)(2.58)(.04) + (.9405568096)(1)(.96) = .0971 \ + .9029 \]

**OR 3.00**

2.2%
\[1 = x(3)(.0220) + x(1)(.9788) \rightarrow 1 = x(0.066 + .9780) \rightarrow 1 = x(1.044) \rightarrow x = 1/1.044 \rightarrow x = .9578544061 \rightarrow (.9578544061)(3)(.0220) + (.9578544061)(1)(.9780) = .0632 + .9368
\]

4.0%
\[1 = x(3)(.04) + x(1)(.96) \rightarrow 1 = x(.12 + .96) \rightarrow 1 = x(1.08) \rightarrow x = 1/1.08 \rightarrow x = .9259259259 \rightarrow (.9259259259)(3)(.04) + (.9259259259)(1)(.96) = .1111 + .8889
\]

OR 3.08
2.2%
\[1 = x(3.08)(.0220) + x(1)(.9788) \rightarrow 1 = x(0.06776 + .9780) \rightarrow 1 = x(1.04576) \rightarrow x = 1/1.04576 \rightarrow x = .9562423501 \rightarrow (.9562423501)(3.08)(.0220) + (.9562423501)(1)(.9780) = .0648 + .9352
\]

4.0%
\[1 = x(3.08)(.04) + x(1)(.96) \rightarrow 1 = x(.1232 + .96) \rightarrow 1 = x(1.0832) \rightarrow x = 1/1.0832 \rightarrow x = .9231905465 \rightarrow (.9231905465)(3.08)(.04) + (.9231905465)(1)(.96) = .1137 + .8863
\]

OR 3.19
2.2%
\[1 = x(3.19)(.0220) + x(1)(.9788) \rightarrow 1 = x(0.07018 + .9780) \rightarrow 1 = x(1.04818) \rightarrow x = 1/1.04818 \rightarrow x = .9540346124 \rightarrow (.9540346124)(3.19)(.0220) + (.9540346124)(1)(.9780) = .0670 + .9330
\]

4.0%
\[1 = x(3.19)(.04) + x(1)(.96) \rightarrow 1 = x(.1276 + .96) \rightarrow 1 = x(1.0876) \rightarrow x = 1/1.0876 \rightarrow x = .9194556822 \rightarrow (.9194556822)(3.19)(.04) + (.9194556822)(1)(.96) = .1173 + .8827
\]

OR 3.97
2.2%
\[1 = x(3.97)(.0220) + x(1)(.9788) \rightarrow 1 = x(0.08734 + .9780) \rightarrow 1 = x(1.06534) \rightarrow x = 1/1.06534 \rightarrow x = .9386674677 \rightarrow (.9386674677)(3.97)(.0220) + (.9386674677)(1)(.9780) = .0820 + .9180
\]

4.0%
\[1 = x(3.97)(.04) + x(1)(.96) \rightarrow 1 = x(.1588 + .96) \rightarrow 1 = x(1.1188) \rightarrow x = 1/1.1188 \rightarrow x = .8938148016 \rightarrow (.8938148016)(3.97)(.04) + (.8938148016)(1)(.96) = .1419 + .8581
\]
Appendix B.
Calculations for Per Unit Costs for Specific Crimes

Other crime → According to Easton et al., (2014), 15% of crime in 2012 fell in the “Other” category

- Other = 1 – violent crime, property crime, drug crime, traffic crime, federal statute violations (i.e., everything but these listed crimes)
- In 2012 → 984 “Other” crimes per 100,000 people
- 15% of all crime in 2012 of 20.8 billion CAD = 3.12 billion (** This is only 20.8 and not the total non-pain and suffering costs, i.e., 39.1 million, because these other costs are not theoretically related to these extra costs; e.g., medical losses, business losses. These are normally calculated based on victimization)
- Population in Canada in 2012 According to Stats Canada (2016 http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/demo02a-eng.htm) is 34.75 million dollars.
- 34 750 000/100, 000 = 347.5
- 347.5 x 984 other crimes = 341 940
- 3 120 000 000/ 341 940 = $9,124 per individual Other crime
- Note: This value is already a total estimation. Multiplication was not needed (e.g., multiplied by factors of 1.33 and 1.29, as per below) to account for additional indirect costs.

Drug Costs: Same approach as Other crimes, but it accounts for 5% instead of 15% of total crimes. Thus 1/3 of the value, or $9124/3 = 3038.3.

Theft: In the Easton and colleagues work (2014), in footnote 35, four different types of theft were included in the top 10 crimes that account for 70% of victim pain and suffering. Fraud, Credit Card Use, Theft under, Theft over, Motor Vehicle Theft, and Shoplifting make up 58% of Property Crime which makes up 53% of total crime = 30.74% of all crime.

Using the different theft-based crimes (see http://www.statcan.gc.ca/pub/85-002-x/2013001/article/11854/tbl/tbl06-eng.htm), 223 per 100,000 MV theft, Theft under 1424/100,000, Theft over is 44/100,000, Fraud (including identity theft) is 262/100,000. Thus, there are 1,953/100,000 in 2012. Total cost of crime is 81.5 (30.74%) = $34.83 billion and the Canadian population is 34.75 million.

- 34 750 000/100, 000 = 347.5
- 347.5 x 1,953 theft crimes = 678,667.5
- 34 830 000 000/ 678,667.5 = $51,321 per individual Theft crime
Although this appears quite high, Easton and colleagues note: “These include, in order: break and enter, robbery, mischief, fraud, theft under $5000, theft of a motor vehicle, sexual assault level 1, common assault 1, common assault 2, and shoplifting under $5,000.”

Kidnapping and Forcible Confinement: From the same table used in the Easton article (2014), Total cost of crime is $81.5 billion (0.20%) = $.163 billion. Based on Stats Canada (http://www.statcan.gc.ca/pub/85-002-x/2013001/article/11854/tbl/tbl06-eng.htm), 10/1190 violent crimes per 100 000 = 0.84% of violent crime which makes up 19% of total crimes = 0.2% of all crimes. Therefore, 163 000 000/3475 = $46,906 per individual Kidnap crime.

The following are victim pain and suffering in 2012 (Easton et al., 2014). They do not include direct or institutional costs.

Assault 1 = 6,789
Assault 2 = $19,173
Assault 3 = $187,718
Sex Assault 1 = $14,493
Sex Assault 2 = $81,449
Sex Assault 3 = $95,865
Attempted Murder = $307,996
Robbery = $84,931
Break & Enter = $35,191

From Table 37 of Easton and colleagues (2014), In 2009 (but in 2012 CAN dollars), the pain and suffering was = $47 billion and the total victim costs (so this also adds productivity, prevention, goods lost, medical, personal security, homicide, business losses) was 18.9 +47 = $65.9 billion (2012 CAN dollars). Homicide being counted under murder and other deaths, so the $3.35 billion of related costs were removed, resulting in $62.55 billion (2012 CAN dollars). As such, pain suffering/total victim excluding homicide = 47/62.55 = 0.751 \times .722 \times x = 1.00 \rightarrow 1.331. In turn, to estimate pain and suffering costs needed to be multiplied by 1.331 to achieve total Victim costs.
In addition to this multiplicative of 1.331 for the costs above, these costs do not include institutional costs. As a result, from Easton and colleagues' Table 37, 2009 Total Justice costs were an additional 19.3 billion (2012 CAN $). To add this cost to victim costs, 65.9/85.2 = .773, and therefore, costs also needed to be multiplied by 1.294.

Thus, based on the costs above, the following estimates were used after multiplying by 1.294 and then multiplying by 1.331:

- Assault 1 = 6,789 = \textbf{11,693}
- Assault 2 = $19,173 = \textbf{33,022}
- Assault 3 = $187,718 = \textbf{323,309}
- Sex Assault 1 = $14,493 = \textbf{24,961}
- Sex Assault 2 = $81,449 = \textbf{140,280}
- Sex Assault 3 = $95,865 = \textbf{165,110}
- Sex Assault broad category = 24461+ 1402 + 1651 = \textbf{27,266} $ (98% Assault 1, 1% assault 2& 3, respectively; see below)
- Attempted Murder = $307,996 = \textbf{530,466}
- Robbery = $84,931 = \textbf{146, 228}
- Break & Enter = $35, 191 = \textbf{60,610}
- Murder = $5, 589, 934

\textbf{Assault as broad category:} In Canada total number of assaults in 2014 = 20,1382
1 = 153,352 = 76%
2 = 44,788 22%
3 = 3,242 = 2%

Based on these percentages (.76)( 11,693) + (.22)( 33,022) + (.02)(323,309)= 6753.88 + 7264.84 + 6466.18 = \textbf{20,484.90 per assault unspecified (Can dollars)}

- Sex Assault as broad category = 20,735
1 = 20,311 = 98%
2 = 319 = 1%
3 = 105 = 1%