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Cost of Crime: A Systematic Review

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Abstract

Purpose: This study aims to systematically search and review all the relevant studies that have estimated the cost of crime of adult offenders.

Methods: Fifteen databases were searched for published studies and grey literature. We included studies that estimated the cost of crime of adult offenders. Due to high heterogeneity results were synthesised descriptively.

Results: Twenty-one studies estimated the cost of crime. There was considerable variance in the estimated total costs of crime and studies from the United States consistently reported the highest total costs. All the studies consistently included robbery and burglary in the total cost estimate. Homicide was ranked as the most costly offence and accounted on average for 31% of the total cost of crime, followed by drug offence (21%) and fraud (17%). Crime categories that involved violence to a person were associated with large intangible costs.

Conclusions: While it is difficult to precisely determine what caused the large variance in the total cost estimates, we think that it could be due to changes in unit costs, changes in crime trends, and variations in the methods used to estimate costs. The findings from this systematic review highlight the need for more up-to-date studies with better reporting standards.

Key Words: cost of crime, monetization estimates, offenders, victimization

Introduction

Crime imposes significant costs and negative consequences to people globally. In 2013, the police recorded approximately 3.7 million crimes in England and Wales (Ministry of Justice, 2014a). In addition, re-conviction rates have also continued to be high. According to the Ministry of Justice, approximately half of all crimes committed in the United Kingdom were perpetrated by adults who have already been convicted by the Criminal Justice System (Ministry of Justice, 2010). Higher prevalence of crime imposes huge costs to society with serious negative long-term consequences to victims, households, and businesses (Brand & Price, 2000; Macmillan, 2001).

For the purpose of this review, cost of crime is defined as “all costs that would not exist in the absence of illegal behaviour” (Anderson, 2012, p. 5). Calculating accurate estimates for the full societal cost of crime is challenging because of limited availability of data, difficulty of measuring the actual rate of crime and the unknown long-term consequences of crime. Nevertheless, several studies have estimated the cost of crime in the United Kingdom and other developed countries. The objective of conducting this review is to systematically search the literature to identify all published studies that estimated the cost of crime imposed by adult offenders.

Estimating the cost of crime is important for several reasons. First, there is a financial imperative to target resources to the most cost-effective crime prevention interventions. Since crime imposes huge costs on society, effective crime prevention interventions can provide considerable cost savings to society (Cohen, Piquero, & Jennings, 2010). Cost of crime data can be utilized by policymakers to prioritize crime prevention efforts relative to the severity of the crime type (Cohen, 2000). For instance, if violent crime imposes a heavy burden to society, more resources can be utilized to reduce such crimes. Therefore, compiling cost of crime estimates has important policy implications.

Second, cost of crime studies can be utilised to conduct economic evaluations (i.e. cost-effectiveness studies or cost-benefit studies) of existing programs (Ludwig, 2010). These studies can not only be important for resource allocation, but also important to determine if the benefits of crime prevention programs outweigh the costs. For example, we intend to use the results of this systematic review to assess the cost-effectiveness of care farms compared to community orders in improving health and wellbeing and reducing reconvictions of adult offenders.

Finally, to address the problem of high reoffending, the government is introducing the transforming rehabilitation reform where payment incentives will be given to market providers for real reductions in reoffending (Ministry of Justice, 2014b). The payment by performance model would require valuation of reoffending outcomes that are being evaluated for investors to determine the rate of return on their investment (Fox & Albertson, 2011). This highlights the importance of gathering accurate cost of crime estimates that are comprehensive and up-to-date.

Estimating the cost of crime is complex, as a result authors have used a number of different methods to measure the cost of crime. For example, some classify cost of crime into different crime categories which vary from assault to serious traffic offenses and within these categories costs can be subdivided into direct, indirect and intangible costs. Direct costs can be distinguished from indirect and intangible costs as there is a monetary exchange involved. For example, if car owners repair their vehicle as a result of criminal damage, the cost of the repair is a direct cost, and is straightforward to measure as there is a market value for repairs. Indirect costs refer to the economic value of consequences of crime that do not involve a direct monetary exchange. These include lost productivity of both offenders and/or victims, and the value of volunteer time. Often lost productivity is estimated by calculating the forgone productivity as a result of the offence. For example, lost productivity can be

determined by multiplying hourly average income with the number of hours a victim has spent out of work as a consequence of a crime. Intangible costs are costs incurred by victims, potential victims and society which include fear, pain, suffering, and lost quality of life. These costs are the most difficult to quantify as there is no market value or monetary exchange. As a result, intangible costs are usually inferred by revealed or stated preference-based methods such as willingness-to-pay (WTP) or contingent valuation.

The cost imposed by crime can be measured from different cost perspectives and depending on the chosen cost perspective authors can include or exclude certain types of costs as the perspective determines who bears the cost. Costs could be calculated according to victim's perspective, government perspective and societal perspective. Victims' perspective consists of costs incurred by the victim such as out of pocket medical costs, lost productivity, pain and suffering. Government perspective includes costs incurred by the Criminal Justice System. Societal perspective is comprised of both victims and government perspective costs and includes costs to tax payers and offenders. Out of the different perspectives that can be used to calculate cost of crime, the societal perspective is the most comprehensive as it includes all possible costs hence, it is the category least likely to underestimate the overall costs of crime.

To the best of our knowledge, a systematic review of the cost of crime has never been conducted. Several authors have conducted reviews of the cost of crime (Albertson & Fox, 2008; Ludwig, 2010; O'Brien, 2010; Webber, 2010) but they all focused on analysing a couple of recent articles that estimated the cost of crime. The aim of this review is to systematically search the literature to select and review all existing and relevant studies that estimate the cost of crime.

Methods

Search strategy

The literature search aimed to identify studies on the health and societal costs of offending. Health, social science, criminal justice, published and grey literature sources¹ were selected to provide representative set of studies.

We searched the following databases in December 2013 from their inception dates to present: Embase, Health Management and Information Consortium, Medline, Medline-in-Process, PsycInfo (all Ovid); ASSIA, National Criminal Justice Reference Service Abstracts, Sociological Abstracts, Social Services Abstracts (all ProQuest); CINAHL, Criminal Justice Abstracts (all EbscoHost); The Campbell Library; NHSEED (Cochrane Library, Wiley); RePeC Ideas; and Conference Proceedings Citation Indexes- Science, Social Science and Humanities (Web of Science, Thomson Reuters). Searches were designed to identify studies of the health and societal costs of offending by combining the search concept ‘offending’ with the concepts ‘health costs’ or ‘societal costs’. Where possible studies of juvenile offending were identified and removed from the search results. Full details of the search strategy for Medline database is presented in Appendix A and full search strategies for all databases are available from the author on request. Searches of NHSEED contained the ‘offending’ search terms only since this database only contains studies related to health care costs. Test searches of Green file (EbscoHost) were run however no relevant hits were seen on title screening of these search results and the database was then deemed inappropriate for this search question. In addition, grey literature was sought by scanning the UK government website (<https://www.gov.uk/>) and by screening bibliographies of included studies or literature reviews.

¹ Grey literature sources are research conducted by Governments, industry or NGOs but not published in academic journals.

Inclusion or exclusions criteria

To be eligible for inclusion we considered studies that quantified the cost of crime. We excluded studies that primarily reported qualitative data, literature reviews, policy papers and studies that only discussed methodology of costing crime. In addition, economic evaluations of crime prevention interventions were excluded. Moreover, studies that only reported costs for juvenile offenders were excluded as the focus of our review was to assess costs imposed by adult offenders. The literature suggests that the costs imposed by adult offenders differ considerably compared to juvenile offenders, for example, the types of crimes juveniles commit generally tend to be less serious compared to adult offenders, thus juveniles may not receive a prison sentence (Richards, 2011). In addition, the interventions delivered to adults and juveniles tend to vary considerably, for instance the juvenile correction system is generally focused on rehabilitation whereas the adult system is typically focused on punishment and the costs of delivery of these different interventions vary considerably (Richards, 2011). Consequently, we decided to focus on the costs of adult offenders. Furthermore, included studies for this systematic review were searched spanning 17 years (1996-2013) because we found that older studies presented cost data that were outdated. Only studies published in English were included in the systematic review due to limited capacity. Studies not conducted in high-income countries were also excluded as our aim was to identify results relevant to the United Kingdom.

Data collection and analysis

Titles and abstracts were screened based on the inclusion criteria to select studies for the review and Endnote software was utilised to manage references. When the decision to include

or exclude a study was not straightforward, a second reviewer was consulted to resolve uncertainty. The detailed process of articles selection was presented in a PRISMA chart (see Appendix A). Once the included studies were identified, data were extracted using a data extraction form developed for this purpose. For each study we extracted the following: cost perspective, cost category, study population, country, source of cost data, currency, cost year, discounting, estimated direct, indirect, intangible, and total costs and limitations. As studies varied considerably when estimating the cost of crime, results were synthesised descriptively and presented according to crime category. Cost data were not adjusted for the current year instead it was presented with cost year and currency.

Results

The literature search yielded 8520 potentially relevant studies. After removal of duplicates 6265 were identified for screening. In addition, five studies were identified from scanning reference lists of included studies and seven from searching grey literature. In total 6277 titles and abstracts were screened of which 6211 studies were excluded and sixty-six possibly relevant studies were retrieved for full-text assessment. During full-text review, 21 studies were included in the analysis and 45 studies were excluded. Studies were excluded for the following reasons: literature reviews of other cost studies, economic evaluations, focus on juvenile offenders, report of qualitative data, and absence of cost estimates. A PRISMA chart describing the inclusion and exclusion processes can be found in Figure 1.

Insert Figure 1 here

Description of included studies

Of the 21 studies included in the review, seven studies were from the United States, six studies were from the United Kingdom, five studies were from Australia and one each from Poland, Canada and New Zealand. Fourteen studies calculated broader societal costs (Anderson, 2012; Brand & Price, 2000; Czabanski, 2009; DeLisi & Gatling, 2003; DeLisi, et al., 2010; Dubourg, Hamed, & Thorns, 2005; Mayhew, 2003; McCollister, French, & Fang, 2010; Rollings, 2008; Roman, 2010; Roper & Thompson, 2006; Russell, 2011; Walker, 1997); six studies focused specifically on victim costs (Ambrey, Fleming, & Manning, 2013; Atkinson, Healey, & Mourato, 2005; Cohen & Miller, 1998; Dolan, Loomes, Peasgood, & Tsuchiya, 2005; Dolan & Peasgood, 2007; Leung, 2004; Miller, Cohen, & Wiersema, 1996); and one study calculated the costs imposed by ‘career’ offenders defined as people that commit offences frequently as juveniles who then go on to committing more serious offenses as adults (Piquero, Jennings, & Farrington, 2013). Majority of the studies utilised the whole population of the country to estimate the cost of crime but, seven studies (33%) used sub-samples of victims, of mental health care providers, or of offenders as their study cohort. Studies taking a societal perspective relied on a combination of national databases, interview data, previous study data, jury award data and survey data to estimate the cost of crime. Conversely, the majority of studies that exclusively focused on victims’ perspectives mainly used interview and survey data to calculate costs.

Insert Table 1 here

The fourteen studies that measured the societal cost of crime included various crime categories to calculate the total cost. Crime categories ranged from victimization against individuals and households (i.e. homicide, sexual assault) to crimes against commercial and public sector (i.e. theft from a shop, vandalism). For each crime category most authors estimated direct, indirect and intangible costs to derive the total cost per category. However,

most studies did not present these cost classifications separately instead the authors presented an aggregate total cost per each crime category. Only one study disaggregated these cost types in the original article (McCollister, et al., 2010). Nevertheless, from the information provided in the original article we were able to disaggregate tangible, intangible and indirect costs for five additional studies. The most commonly reported category of direct costs was medical costs, this included victims' costs of hospitalization and other medical treatment costs, however mental health treatment costs were not included. Other direct costs included property loss, costs associated with criminal justice system, costs associated with victim assistance (i.e. child protection), security industry, and insurance administration costs. Studies that focused on a broader societal perspective additionally included indirect costs such as lost productivity and the value of volunteer time, as well as intangible costs.

Insert Table 3 here

Authors used several methods to establish intangible costs. Some used jury awards to determine the proportion of compensation allocated for pain, suffering and lost quality of life (McCollister, et al., 2010; Miller, et al., 1996). Others used willingness-to-pay or contingent valuation methods to deduce intangible costs (Ambrey, et al., 2013; Mayhew, 2003). These stated preference-based methods ask individuals to estimate the amount of money they would be willing to pay to reduce crime; they are useful to value non market goods such as pain and suffering. For example, some used survey data collected by the Department of the Environment, Transport and the Regions (DETR) where respondents were asked their willingness-to-pay for a 10% risk reduction in fatal road accidents (Brand & Price, 2000). Other methods such as the quality-adjusted life years (QALY) approach were also used to measure intangible costs. The authors measured the QALY loss associated to fear of crime and how long the individual was in that health state (Dolan, et al., 2005; Dolan & Peasgood, 2007; Dubourg, et al., 2005).

Crime categories

Homicide

Overall, twelve studies (86%) estimated the cost of homicide. The cost estimate included manslaughter both wilful and negligent, and deaths caused by driving accidents. On average 31% (SD=39) of the total cost was accounted by homicide. However, as reflected by the large standard deviation, the proportion of the total cost attributed to homicide largely varied from one study to another; in McCollister et al. (2010) it accounted for 95% of the total cost of crime whereas it was 2% in Brand and Price (2000). The largest amount of costs in this crime category was allocated to indirect and intangible costs. For example, Duborgh and colleagues (2005) found that intangible costs were approximately six times the value of direct cost.

Assault

Assault was defined as the “the direct (and immediate/ confrontational) infliction of force, injury or violence upon a person or persons, or the direct (and immediate/ confrontational) threat of force, injury or violence where there is an apprehension that the threat could be enacted” (Australian Bureau of Statistics, 2006, p. 40). Some also included attempted murder and attempted attack with or without a weapon. Thirteen studies (93%) measured the cost of assault. On average 9% (SD=9) of the total cost of crime was accounted to assault but this percentage varied considerably, for example, the total cost of crime in Roper and Thompson (2006) accounted 30% to assault whereas it was 1% in DeLisi et al. (2010). Intangible costs represented the largest cost component for this crime category, with the exception of Brand and Price (2000) who found that the direct costs associated to assault were higher than the intangible costs.

Sexual Assault

Sexual assault was defined as forced sexual intercourse which included vaginal, anal or oral penetration, either by psychological coercion or physical force (McCollister, et al., 2010). The costs associated to sexual assault crime were difficult to define as some authors disaggregated rape and sexual assault crime costs whereas others did not. For example, DeLisi and colleagues (2010) only reported the cost of rape whereas McCollister et al. (2010) provided an overall figure which included both rape and sexual assault. Nine studies (64%) reported cost estimates for sexual assault and on average 9% (SD=10) of the total cost of crime was assigned to sexual assault. Miller (1996) reported the highest percentage for sexual assault at 28% and the lowest figure was reported by Mayhew (2003) at 1%. Similarly to the costs of homicide and of assault, the intangible costs of sexual assault appeared to be higher than both direct and indirect costs.

Robbery

Robbery is one of the two crime categories for which all 14 articles which estimated the broader societal costs included a cost estimate. Robbery was defined as “completed or attempted theft, directly from an individual, of property or cash by force or threat of force, with or without a weapon, and with or without injury” (McCollister, et al., 2010). Most of the studies also included attempted robbery in this crime category. On average 2% (SD=2) of the total cost of crime was accounted for robbery but the proportion of the cost of crime allocated to robbery varied from one study to the another; for instance, it represented 7% in Dubourg et al. (2005) and 0.02% in Anderson (2012).

Burglary

Burglary was defined as the “unlawful entry of a structure with the intent to commit an offence where the entry is either forced or unforced” (Australian Bureau of Statistics, 2006, p. 42). This is the other cost category where all fourteen studies reported a cost estimate. On average 5% (SD=5) of the total cost of crime was attributed to burglary. The proportion allocated to burglary varied from 19% (Walker, 1997) to 0.06% (McCollister, et al., 2010). In addition, three studies additionally calculated the cost of burglary not in a dwelling, the proportions ranged from 4% (Brand & Price, 2000) to 0.03% (Anderson, 2012). With the exception of Russell (2011) and Rolling (2008), all studies found that the direct costs associated to burglary were higher than the indirect and intangible costs.

Theft

Several authors separated the theft category into four subcategories such as theft of motor vehicle, theft from motor vehicle, theft from a shop and other theft. Theft of motor vehicle refers to an occurrence where “the vehicle is driven away illegally, whether or not it is recovered” (Office for National Statistics, 2014, p. 37). Theft from a vehicle includes attempts where property within a vehicle is stolen. Theft from a shop refers to incidents of shoplifting by customers and sales personnel. All remaining types of theft fall under the category of other theft; these include for example, theft of personal property, theft of cycles, and theft in a dwelling. Of the total cost of crime, on average 2% (SD=2) was allocated to theft of motor vehicle, 4% (SD=4) to theft from motor vehicle, 3% (SD=2) to theft from a shop and 5% (SD=6) to other theft. Considerable variability was found among the cost estimates reported by the authors, for example, Brand and Price (2000) estimated that theft of motor vehicle represented 6% of the total cost of crime whereas and McCollister and colleagues (2010) estimated it at 0.11%. The highest proportion for theft from motor vehicles was estimated at 10% by Walker (1997) and the lowest proportion was estimated by Rollings

(2008) at 1%. The proportion for the cost associated to theft from a shop subcategory ranged from 0.38% (Anderson, 2012) to 38% (Walker, 1997) and the proportion for other theft was between 19% (Walker, 1997) and 0.04% (McCollister, et al., 2010). Overall 13 studies estimated the cost of theft, of which 5 studies (36%) estimated the cost of theft from a motor vehicle, 10 studies (71%) estimated the cost of theft of motor vehicle, 5 studies (36%) estimated the cost of theft from a shop and 12 studies (86%) estimated other theft costs. Direct costs formed the largest proportion of the total cost of theft followed by intangible costs and indirect costs.

Criminal damage or vandalism

Criminal damage is defined as “the intentional and malicious damage to the home, other property or vehicles” (Office for National Statistics, 2014, p. 39). Eight authors (57%) included this crime cost category when calculating the total cost of crime; on average vandalism accounted for about 5% (SD=2) of the total cost of crime.

Arson

Arson is defined as “[the] unlawful and intentional damage, or attempt to damage, any personal property by fire or incendiary device” (McCollister, et al., 2010, p. 101). Seven studies (50%) included arson as a crime cost category; it represented on average 3% (SD=4) of the total cost of crime. The highest percentage was estimated by Russell (2011) at 11% and the lowest by Roman (2010) at 0.2%.

Drug Offence

Drug offences can be subdivided into three categories: trafficking in controlled drugs, possession of controlled drugs and other drug offences. Six studies (43%) estimated the cost

of drug offence. On average, drug offences accounted for 21% (SD=29) of the total cost of crime however, the proportion of the total cost attributed to drug offence varied considerably as illustrated with the large standard errors. In DeLisi and Gatlin (2003) it accounted for 76% of the total cost of crime while Roper and Thompson (2006) evaluated the cost of drug offence to represent 1%.

Fraud

Fraud is conceptualised as the deception of an individual to take their property. This category was broadly defined and could include different types of fraud. For example, when estimating the cost of fraud Anderson (2012) included occupational fraud, health insurance fraud, retail fraud, telemarketing fraud, mail fraud, non-health insurance fraud, and coupon fraud whereas Mayhew (2003) considered credit card fraud, employee fraud, forgery, welfare benefit frauds, identity fraud, custom and excise fraud, tax fraud, insurance fraud, and computer and telecommunications fraud. Overall, eight studies (57%) estimated the cost of fraud. On average it accounted for 17% (SD=13) of the total cost of crime however, there were large discrepancies in the estimates as the proportions ranged from 0.1% (Roman, 2010) to 38% (Anderson, 2012).

Serious Traffic Offence

Serious traffic offences refer to accidents that occur on the road due to the influence of alcohol or drugs, or reckless driving above the speed limit. Four studies (29%) estimated the cost of serious traffic offence and on average it contributed to 9% (SD=2) of the total cost of crime.

Total cost of crime

Out of the 21 studies that were included in this review, 10 studies calculated the total cost of crime. The highest cost of crime was consistently reported from the studies conducted in the United States. The total cost estimates varied considerably within each country. For example, four studies that estimated the cost of crime from Australia reported estimates ranging from AUD 9 billion to 35 billion; two studies from the United Kingdom found cost estimates from £36 billion to £60 billion; and the total cost estimates for the United States ranged from \$3200 billion to \$450 billion.

Insert Table 2 here

Other studies estimating the cost of crime to victims and offenders

Apart from the studies that estimated the overall societal cost of crime, we found several studies that solely focused on victims or offenders. It is acknowledged in the literature that intangible costs are the most challenging to estimate and contains a lot of uncertainty around the estimate so several techniques have been developed to estimate the intangible cost of crime. Four studies estimated intangible costs of crime using willingness-to-pay and QALY approaches. Atkinson and colleagues (2005) conducted interviews with 807 individuals to measure their willingness-to-pay to reduce their chances of being a victim of assault, other wounding and serious wounding. The findings suggested that the average individual would be willing to pay £5,828 for a 2% reduction in common assault, £30,908 for a 0.5% risk reduction in other wounding and £35,844 for a 0.5% risk reduction in serious wounding. Ambrey et al. (2013) assessed the intangible cost of crime also using the willingness-to-pay approach. The results indicated that on average, an individual was willing to pay \$3,213 to reduce property crime by one offence per 1000 residents in their local government area.

Alternatively, Dolan et al. (2005) used quality adjusted life years to calculate intangible costs to victims. The authors first estimated the number of quality-adjusted-life-years victims

of crime lose, and then this was converted to a monetary figure using a rate of exchange (i.e. the NICE threshold of £30,000). The results indicated that overall victims' quality of life loss was approximately £4 billion and the findings also showed that the crime category that resulted in the biggest QALY loss was rape. Dolan and Peasgood (2007) also used the QALY approach to estimate the cost of fear of crime, put another way it is the intangible costs associated with anticipating possible victimization. Survey data were used to determine the degree to which people were fearful of being a victim of crime which were then matched to a score on the EQ-5D to calculate a QALY. Similar to the previous study a rate of exchange was used to translate QALYs into a monetary figure to determine the costs associated with fear of crime. The authors found that the total annual monetary loss attributed to QALY loss from fear of crime for England and Wales was £776.5 million.

In addition to these four studies, Cohen and Miller (1998) estimated mental health care costs to victims. The survey results indicated that 3.1 to 4.7 million people used mental health services such as counselling and therapy due to crime, which on average costs \$9.7 billion to victims. Moreover, Leung (2004) also conducted a study in Canada to estimate the cost of pain and suffering due to crime. The author found that overall cost of pain and suffering from all non-fatal crimes accounted for CAD 35.83 billion. Furthermore, Piquero and colleagues (2013) conducted a study to examine the cost per offender for distinct offender trajectories (i.e. high-rate chronic offender or low-rate chronic offender). The authors used data from a longitudinal survey following 411 males for 50 years to determine their offending frequency. Then they estimated the mean and total costs associated with specific types of offenses the offenders committed and conducted a bivariate comparison to determine how these costs are distributed across distinct offender trajectories. The results found that high-rate chronic offenders imposed the highest financial burden; the results also showed that on average a

male high-rate chronic offender costs a UK citizen £742 over the lifetime of their criminal career.

Discussion

Overall, 21 studies reported estimates of the costs of crime, of which 14 estimated the cost of crime to society and victims, six focused only on the cost of crime to victims and one study measured the costs to society of career offenders. The findings show that the total costs of crime varied considerably between studies. Furthermore, each offence category also provided substantially different cost estimates. This is reflected in the large standard deviations estimated for each category with the exception of serious traffic offence, criminal damage, and fraud. Additionally, homicide ranked as the most costly offence followed by drug offence, fraud, sexual assault, assault, and serious traffic offence all accounting for more than 9% of the total cost of crime. Crime categories that involved violence to a person such as homicide, assault and sexual assault were all associated with higher intangible costs.

There are several possible reasons that could explain the variations in the cost estimates. The dispersion may be due to the differences in the year when the study was conducted, due to inflation, changes in unit costs, underreporting of crime or changes in crime trends. For example, the total cost of theft of motor vehicle per year was reported to be £3.4 billion by Brand and Price in 2000 and £951 million by Dubourg and colleagues in 2005. Dubourg and colleagues interpreted that this reduction in cost was due to a fall in incidence of vehicle theft and a fall in the estimated unit cost of theft of motor vehicles (Dubourg, et al., 2005). In addition, official recorded crime statistics may underestimate the actual incidence of crime because of victims underreporting incidents of crime and police not recording reported crime (MacDonald, 2002; Mirrlees-Black, Budd, Partridge, & Mayhew, 1998). As a result, studies that calculated costs based only on recorded crimes provided a conservative estimate of the

total cost of crime. To address this problem, authors used multipliers to calculate the actual crime rate. Multipliers were calculated by computing the ratio of the actual estimated number of crimes to the number of crimes recorded. However, due to lack of data availability some authors also used proxy multipliers from different studies. For example, Russell (2011) calculated the cost of crime in Victoria, Australia and when Australian estimates were not available Russell used proxy data from the UK study conducted by Dubourg et al. (2005), in such instances it is important to interpret the data with caution, as UK data may not be generalizable to Australia.

The lack of a standardized approach to measure cost of crime was also problematic. When calculating the total cost of crime, it was clear that the authors did not all consider the same types of offences. For example, the fourteen studies that calculated the total cost of crime all included the cost associated to robbery and to burglary in their cost estimate, whereas serious traffic offences and burglary not in a dwelling were occasionally included because of data unavailability or costing impossibility (Mayhew, 2003). The exclusion of some crime categories in the overall cost calculations could therefore underestimate the overall cost of crime.

Inconsistency in definitions of crime categories was also observed. For example, McCollister and colleagues defined rape/sexual assault as “forced sexual intercourse (vaginal, anal, or oral penetration) involving psychological coercion and physical force, as well as attacks or attempted attacks generally involving unwanted sexual contact between victim and offender” (McCollister, et al., 2010, p. 101) while Roman (2010) included forcible rape, forcible sodomy, sexual assault with object and forcible fondling but does not mention whether attempted attacks were included. Similarly, we found that some authors aggregated two similar crime categories such as criminal damage and arson, whereas others disaggregated crime categories and presented cost estimates for sexual assault and rape

separately. These inconsistencies in definitions are problematic as it can increase the variability in the cost estimates when comparing studies in the review and interpreting the findings.

While direct costs were relatively straightforward to calculate, intangible costs such as fear, pain and suffering required a more intricate approach. Diverse methods were used such as jury awards approach, willingness-to-pay approach and QALY approach for this purpose. These different methods introduced considerable heterogeneity to the estimated results. For example, the cost of homicide doubled when estimated using WTP method (DeLisi, et al., 2010) compared to jury awards approach (McCollister, et al., 2010; Roman, 2010). However, all of these methods have their own limitations. For example, some authors criticized jury awards method as it would inflate the value of pain and suffering, hence overestimate the cost of intangible crime (Zimring & Hawkins, 1995). In addition, jury awards might not capture all of the crime cases, especially because the most damaging cases are settled out of court. On the other hand, some criticised the willingness-to-pay approach because the stated preferences would heavily depend on the chosen sample of participants and the manner in which questions were formulated (Dolan, et al., 2005). For instance, Brand and Price (2002) used WTP estimates to measure the emotional and physical cost of crime from a proxy study on road traffic accidents. However, because of the differences in context, these WTP estimates might not generalize well to predict emotional and physical cost of crime. Furthermore, the accuracy of the QALY approach was also questioned because the accuracy of this approach is largely based on the reliability of the assumptions authors made about people's health state. For example, if a respondent stated that they were a 'little bit afraid' of becoming a victim of crime, then Dolan and Peasgood (2007) assumed that the respondent would fall under the "moderately anxious" health state for an hour. Since the health loss estimates heavily depended on the accuracy of the authors' assumptions, these

assumptions need to be tested to assess for reliability (Farrall & Gadd, 2004). These diverse techniques with varying degrees of strengths and limitations produce heterogeneous cost estimates and could explain some variation in the overall cost estimate between studies.

The strengths of this review include conducting a comprehensive search to identify all published and unpublished studies estimating the cost of crime in developed countries. In addition, to the best of our knowledge this is the first systematic review conducted to estimate the cost of crime, consequently, we were able to assess similarities and differences of the methodologies used to estimate the cost of crime. We find that our research is timely as cost of crime data will be utilized more frequently by both investors and decision-makers. While we tried to minimize biases during the systematic review, we found that due to high heterogeneity and the absence of a comparison group in several studies of interest it was not appropriate to conduct a meta-analysis. In addition, due to limited capacity we were unable to include non-English-language studies. While every effort was made to identify all relevant articles, it is possible that we may have missed some unpublished grey literature.

Several factors limit the generalizability of the findings of this review. The aim of this review was to find studies that estimated the societal cost of crime for adult offenders. The literature indicates that there are significant differences between adult and juvenile offenders (Richards, 2011) consequently, the finding of this review may not be generalizable to juvenile offenders. However, several studies have estimated the cost of juvenile crime (Cohen, 1998; Cohen & Piquero, 2009; Miller, Fisher & Cohen, 2001; Welsh, et al., 2008). Consequently, there is scope to conduct future reviews focused on the cost of juvenile crime. In addition, the literature also highlights that a small number of career criminals could account for a large proportion of the crimes committed in a particular country (DeLisi, 2005; Vaughn, et al., 2011). To account for this skewness in costs some authors specifically

estimated the cost of crime for different subgroups of criminals such as high-rate chronic offenders or low-rate chronic offenders (Piquero, et al., 2013) while others did not. Piquero and colleagues found that high-rate chronic offenders produced the greatest costs to society compared to low-rate chronic offenders. As a result, it is possible that the findings may not be generalizable to high-rate chronic offenders.

Conclusion

This systematic review found several studies that estimated the cost of crime spread across different developed countries. However, we found a large variance in the total cost estimate between studies. While it is difficult to precisely determine what caused this variance, we think that it could be due to changes in unit costs, underreporting of crime, changes in crime trends, inconsistent definitions of crime categories, and variations in the methods used to estimate costs.

The results of this review will be applied to conduct a cost-benefit analysis of care farms compared to community orders for adult offenders in the UK (Elsley, et al., 2014). The results of Dubourg et al. (2005) and Brand and Price (2000) will particularly be useful for this economic evaluation as they provided the most comprehensive results based on the United Kingdom. However, the findings of this review also highlight that studies estimating the societal cost of crime are not up to date. For instance, the most recent UK study that evaluated the societal cost of crime in the UK was published in 2005. It is not clear the degree to which these cost figures have significantly changed overtime, so even if results were appropriately adjusted for present values it is unclear whether this is sufficient. This highlights the need for more studies to provide regular updates of the cost estimates.

The findings from this systematic review highlight the need for uniform definitions of crime categories in order to increase transparency so that readers are clearly informed on what was included to derive the estimated costs. Moreover, all the studies included in this review only calculated point estimates and did not present any error terms, it would be extremely useful to provide confidence intervals or standard errors to permit users accounting for uncertainty around the estimate and interpreting the results more carefully.

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Tables and figures

Figure 1: Flow diagram of excluded and included studies

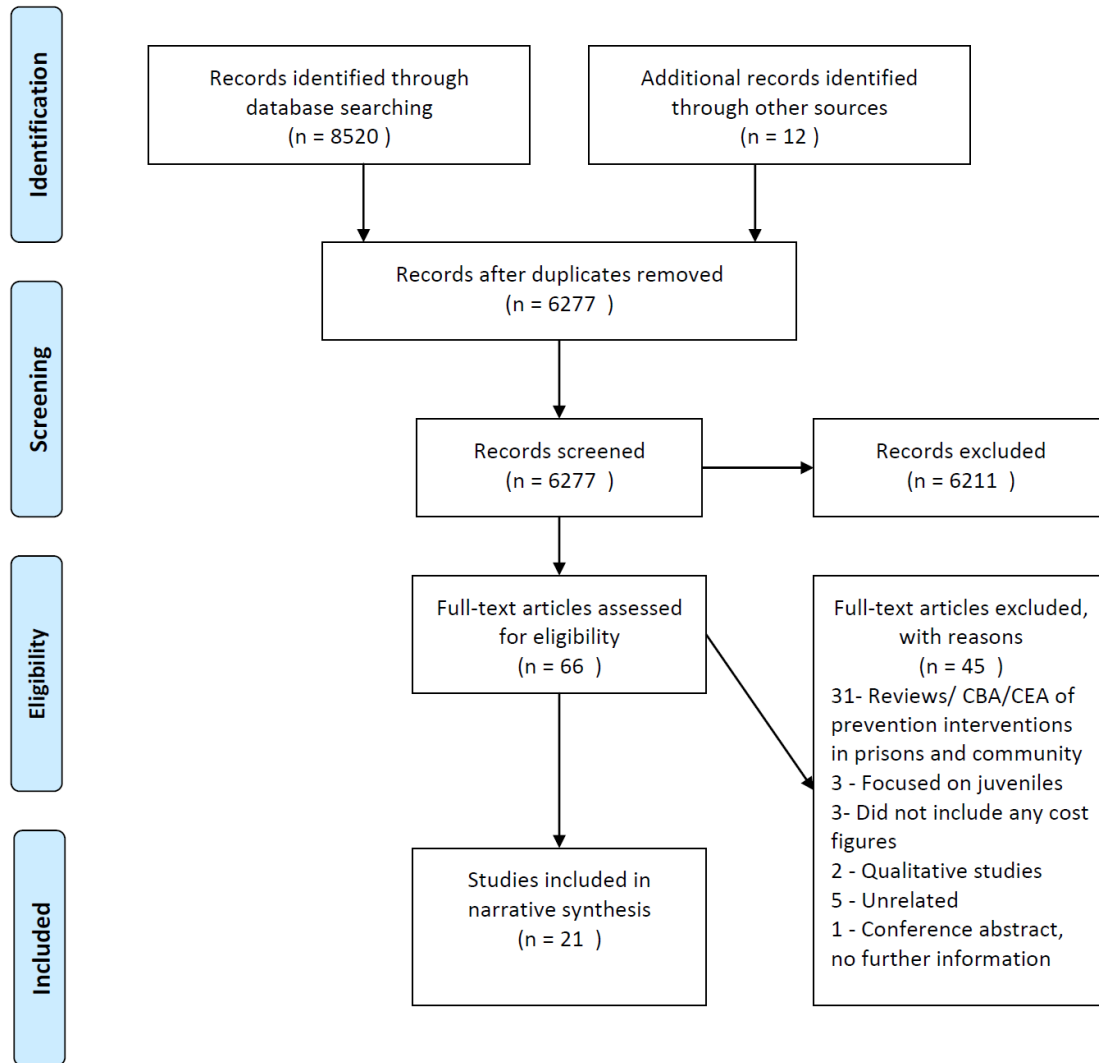


Table 1: Methodology of Included Studies

	Study	Country	Year of data	Cost perspective	Study population	Study design and data sources
1	Ambrey et al., 2013	Australia	-	Victim	National	Willingness to pay approach - Household survey
2	Russell, 2011	Australia	2010	Societal	National	Bottom-up approach - National database
3	Rollings, 2008	Australia	2005	Societal	National	National database
4	Mayhew, 2003	Australia	2001-2002	Societal	National	National database, Medical costs from Monash University Accident Research Centre
5	Walker, 1997	Australia	1996	Societal	National	National database
6	Leung, 2004	Canada	1999	Victim	25,876 People	National database and survey
7	Roper & Thompson, 2006	New Zealand	2004	Societal	National	National database
8	Czabanski, 2009	Poland	2003	Societal	National	QALY approach - International crime victim survey
9	Piquero et al., 2013	United Kingdom	-	Societal (only career offenders)	411 Males	National database and previous study
10	Dolan & Peasgood, 2007	United Kingdom	-	Victim	977 People	Willingness to pay approach - survey
11	Dubourg et al., 2005	United Kingdom	2003	Societal	National	National database
12	Dolan et al., 2005	United Kingdom	2001	Victim	National	QALY approach - National database, jury award, previous studies
13	Atkinson et al., 2005	United Kingdom	-	Victim	807 People	Willingness to pay approach - survey
14	Brand & Prices, 2000	United Kingdom	1999	Societal	National	National database
15	Anderson, 2012	United States	2012	Societal	National	Bottom-up approach - National database
16	Roman, 2010	United States	2008	Societal/victim	12,918 People	Jury award data and previous studies
17	McCollister et al., 2010	United States	2008	Societal	National	Two-pronged approach (cost-of-illness and jury compensation method) - National database
18	DeLisi et al., 2010	United States	2008	Societal	654 Offenders	National database and previous study
19	DeLisi & Gatling, 2003	United States	2002	Societal	500 Offenders	National database & interview data
20	Cohen & Miller, 1998	United States	1991	Victim	339 Mental Health Care Providers	Interview data
21	Miller et al., 1996	United States	1993	Victim	National	National database

Table 2: Total Costs Estimates

Total Costs	Anderson (2012) USA (\$)	Russell, (2011) Australia (AUD)	Rollings (2008) Australia (AUD)	Mayhew (2003) Australia (AUD)	Walker (1997) Australia (AUD)	Roper & Thompson (2006) New Zealand (NZD)	Czabanski (2009) Poland (PLN)	Dubourg et al. (2005) UK (£)	Brand & Prices (2000) UK (£)	Anderson (2012) USA (\$)	Roman (2010) USA (\$)	McCollister et al. (2010) USA (\$)	DeLisi et al. (2010) USA (\$)	et Miller et al. (1996) USA (\$)	
	Millions	Millions	Millions	Millions	Millions	Millions	Millions	Millions	Billions	Millions	Average in 000's	Cost Offense 000's	Per- In 000's	Average in 000's	Millions
Homicide/Murder	-	397.6	950	930	323	-	8,195	1,997	1.2	-	6,900,000	8,982,907	17,252,656	93,000	
Assault	-	204	1,411	1,440	979"	2,771	6,233	2,666	1.7	-	134,770	107,020	145,379	93,000	
Sexual assault	-	73.4	720	230	-	1,192	2,334	8,464	2.5	-	-	-	-	127,000	
Rape	-	-	-	-	-	-	-	-	-	-	272,121	240,776	448,532	-	
Robbery	-	82	225	600	37	157	1,433	2,436	2.4	727	279,085	42,310	335,733	11,000	
Burglary	-	364.8	2,229	1,650	1,193	942	1,331	2,877	2.7	5,173	4,444	6,462	41,288	9,000	
Burglary not in a dwelling	-	-	-	790	-	-	-	-	2.6	1,052	-	-	-	-	
Theft/larceny	-	64.4	282	640	1,204	1,233	2,732	2,001	1.3	6,819	-	3,532	-	9,000	
Theft of motor vehicle	-	133.5	597	880	-	-	-	951	3.4	5,096	15,175	10,772	-	7,000	
Thefts from a motor vehicle	-	149.1	529	530	654	-	-	1,071	-	-	-	-	-	-	
Theft from a shop	-	287.9	861	810	1,020- 2,460	-	-	-	3.1	12,380	-	-	-	-	
Arson	-	1,090.60	1,624	1,350	-	-	-	-	-	-	16,979	21,103	-	5,000	
Drug offence	-	468.8	1,816	1,960	2,000	129	-	-	-	-	-	-	-	-	
Fraud	-	2,143.50	8,516	5,880	3,000- 3,500	1,170	-	-	13.8	1,235,845	4,389	10,512	-	-	
Criminal damage	-	365.6	1,582	1,340	510	-	-	2,242	4.1	-	-	4,860	-	-	
Serious traffic offence	-	-	-	-	-	988	-	-	4.8	-	-	-	-	41,000	
TOTAL COST OF CRIME	-	9.8 billion	35,802 million	31,780 million	11-13 billion	9,136 million	42,886 million	36,166 million	59.9 billion	3.2 trillion	-	-	-	450 billion	

" the primary authors combined assault and sexual assault

Table 3: Direct, Indirect, Intangible and Total Costs Estimates

	Anderson (2012) USA (\$) Millions	Russell, (2011) Australia (AUD) Millions	Roman (2010) USA (\$) Average in 000's	McCollister et al. (2010) USA (\$) Cost Per- Offense In 000's	DeLisi et al. (2010) USA (\$) Average in 000's	et Czabanski (2009) Poland (PLN) Millions	Rollings (2008) Australia (AUD) Millions	Roper & Thompson (2006) New Zealand (NZD) Millions	Dubourg et al. (2005) UK (£) Millions	Mayhew (2003) Australia (AUD) Millions	DeLisi & Gatlin (2003) USA (\$) Average in 000's	& Brand & Prices (2000) UK (£) Total In Billions	Walker (1997) Australia (AUD) Millions	Miller et al. (1996) USA (\$) Millions
Homicide/Murder														
Direct costs	-	1.9	-	1,285,146	-	-	8.6	-	201	4.5	16,811	27,330~	-	-
Indirect costs	-	299.8	-	-	-	-	719	-	618	700	-	370,000~	-	-
Intangible costs	-	95.9	-	8,442,000	-	-	230	-	1,178	225	425,768	700,000~	-	60,000
Total costs	-	397.6	6,900,000	8,982,907	17,252,656	8,195	950	-	1,997	930	-	1.2	323	93,000
Assault														
Direct costs	-	15.2	-	19,472	-	-	258	-	709	170	11,413	276~	-	-
Indirect costs	-	67.1	-	-	-	-	495	-	498	600	-	20~	-	-
Intangible costs	-	121.7	-	95,023	-	-	658	-	1,458	670	100,700	240~	-	77,000
Total costs	-	204	134,770	107,020	145,379	6,233	1,411	2,771	2,666	1,440	-	1.7	979"	93,000
Sexual assault														
Direct costs	-	4.8	-	-	-	-	36	-	1,146	20	-	5,082~	-	-
Indirect costs	-	23.8	-	-	-	-	259	-	1,193	100	-	2,000~	-	-
Intangible costs	-	44.8	-	-	-	-	424	-	6,126	110	-	12,000~	-	119,000
Total costs	-	73.4	-	-	-	2,334	720	1,192	8,464	230	-	2.5	-	127,000
Rape														
Direct costs	-	-	-	41,252	-	-	-	-	-	-	1,284	-	-	-
Indirect costs	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Intangible costs	-	-	-	199,642	-	-	-	-	-	-	46,524	-	-	-
Total costs	-	-	272,121	240,776	448,532	-	-	-	-	-	-	-	-	-
Robbery														
Direct costs	-	7	-	21,373	-	-	85	-	1,079	180	6,231	-	-	-

Indirect costs	-	24.7	-	-	-	-	63	-	338	170	-	-	-	-
Intangible costs	-	30.7	-	22,575	-	-	77	-	1,020	250	14,198	-	-	8,000
Total costs	727	82	279,085	42,310	335,733	1,433	225	157	2,436	600		2.4	37	11,000
Burglary														
Direct costs	-	152	-	6,169	-	-	962	-	2,253	-	10,802	1,754~	-	-
Indirect costs	-	21.7	-	-	-	-	124	-	56	-	-	40~	-	-
Intangible costs	-	191.1	-	321	-	-	1,143	-	569	-	7,486	550~	-	1,800
Total costs	5,173	364.8	4,444	6,462	41,288	1,331	2,229	942	2,877	1,650		2.7	1193	9,000
Burglary not in a dwelling														
Direct costs	-	-	-	-	-	-	-	-	-	-	-	2,640~	-	-
Indirect costs	-	-	-	-	-	-	-	-	-	-	-	40~	-	-
Intangible costs	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total costs	1,052	-	-	-	-	-	-	-	-	790	-	2.6	-	-
Theft/larceny														
Direct costs	-	35.5	-	3,523	-	-	157	-	1,619	350	11,313	240~	-	-
Indirect costs	-	1.9	-	-	-	-	8	-	9	-	-	4~	-	-
Intangible costs	-	27	-	10	-	-	118	-	372	270	3,674	100~	-	-
Total costs	6,819	64.4	-	3,532	-	2,732	282	1,233	2,001	640		1.3	1,204	9,000
Theft of motor vehicle														
Direct costs	-	88.2	-	10,534	-	-	430	-	755	590	5,563	10,220~	-	-
Indirect costs	-	13.6	-	-	-	-	11	-	11	100	-	80~	-	-
Intangible costs	-	31.7	-	262	-	-	155	-	184	190	8,110	200~	-	500
Total costs	5,096	133.5	15,175	10,772	-	-	597	-	951	880		3.4	-	7,000
Thefts from a motor vehicle														
Direct costs	-	52.4	-	-	-	-	184	-	715	260	-	-	-	-
Indirect costs	-	7.6	-	-	-	-	25	-	24	20	-	-	-	-
Intangible costs	-	89.1	-	-	-	-	319	-	332	250	-	-	-	-
Total costs	-	149.1	-	-	-	-	529	-	1,071	530	-	-	654	-
Theft from a shop														
Direct costs	-	245.2	-	-	-	-	756	-	-	-	-	100~	-	-
Indirect costs	-	42.7	-	-	-	-	105	-	-	-	-	-	-	-
Intangible costs	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Total costs	12,380	287.9	-	-	-	-	861	-	-	810	-	3.1	1,020-2,460	-	
Arson															
Direct costs	-	488.6	-	16,429	-	-	1,357	-	-	-	-	-	-	-	
Indirect costs	-	602	-	-	-	-	267	-	-	-	-	-	-	-	
Intangible costs	-	-	-	5,133	-	-	-	-	-	-	4,307	-	-	2,400	
Total costs	-	1,090.60	16,979	21,103	-	-	1,624	-	-	1,350	-	-	-	5,000	
Drug offence															
Direct costs	-	434.7	-	-	-	-	1,600	-	-	-	208,153	-	-	-	
Indirect costs	-	34.1	-	-	-	-	216	-	-	-	-	-	-	-	
Intangible costs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total costs	-	468.8	-	-	-	-	1,816	129	-	1,960	-	-	2,000	-	
Fraud (swindle/deception/embezzlement)															
Direct costs	-	1,286.10	-	10,512	-	-	5,110	-	-	-	-	12 [~]	-	-	
Indirect costs	-	857.4	-	-	-	-	-	-	-	-	-	-	-	-	
Intangible costs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total costs	1,235,845	2,143.50	4,389	10,512	-	-	8,516	1,170	-	5,880	-	13.8	3,000-3,500	-	
Criminal damage/Property damage															
Direct costs	-	146.7	-	4,860	-	-	633	-	1,007	670	-	-	-	-	
Indirect costs	-	14.8	-	-	-	-	63	-	15	-	-	-	-	-	
Intangible costs	-	204.1	-	-	-	-	886	-	1,222	536	-	-	-	-	
Total costs	-	365.6	-	4,860	-	-	1,582	-	2,242	1,340	-	4.1	510	-	
Serious traffic offence															
Direct costs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Indirect costs	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	
Intangible costs	-	-	-	-	-	-	-	-	-	-	52,674	0.7	-	27,000	
Total costs	-	-	-	-	-	-	-	988	-	-	-	4.8	-	41,000	
TOTAL COST OF CRIME	3.2	9.8	-	-	-	-	42,886	35,802	9,136	36,166	31,780	-	59.9	11-13	450
	trillion	billion					million	million	million	million	million		billion	billion	billion

[~] the primary authors combined assault and sexual assault

[~] cost per-offence in 000s

Appendix A

Search Strategy Ovid MEDLINE(R) <1946 to November Week 3 2013>

- 1 (convict or convicts or convicted or offender* or reoffend* or criminal* or prisoner* or inmate* or detainee* or cellmate* or incarcerated* or felon* or probation or probationer* or "ex offender*" or parole or recidiv*).tw. (32721)
- 2 correctional.tw. (2123)
- 3 prisoners/ or criminals/ (13458)
- 4 exp prisons/ (7791)
- 5 or/1-4 [Offenders] (41967)
- 6 exp *economics/ (261559)
- 7 exp *socioeconomic factors/ (121894)
- 8 6 and 7 (20744)
- 9 exp public assistance/ (59349)
- 10 employment, supported/ or return to work/ (1110)
- 11 Vocational Education/ (1774)
- 12 exp Health Care Costs/ (47394)
- 13 exp *"Costs and Cost Analysis"/ (46412)
- 14 or/8-13 [Societal and Health Costs MeSH] (143762)
- 15 (cost or costs or economic*).ti. (96282)
- 16 ((societ* or "social care" or communit*) adj5 (cost or costs)).tw. (5651)
- 17 (("criminal activit*" or crime or violence or polic* or correctional) adj5 (cost or costs)).tw. (2441)
- 18 ((unemploy* or "vocational training" or employment or "job seeker*") adj5 (cost or costs)).tw.
- 19 ((housing or welfare or state or "low income" or "job seeker*" or family or child or entitle*) adj2 (support or benefit* or allowance*)).tw. (7643)
- 20 (health adj3 (cost or costs)).tw. (18802)
- 21 or/15-20 [Societal and Health Costs Textwords] (117824)
- 22 14 or 21 (223617)
- 23 (adolescent/ or exp child/ or exp infant/) not (exp adult/ and (adolescent/ or exp adult/ or exp child/ or exp infant/)) (1525970)
- 24 (5 and 22) not 23 [Health and society offenders costs, children excluded] (773)