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Abstract | Police use a variety of techniques in their investigation of serious violent crimes, such as homicide, robbery, assault and sexual assault. This paper systematically reviews experimental and quasi-experimental research on the effectiveness of these investigative techniques. Meta-analysis was used to combine effect sizes across multiple studies examining the same technique, crime and outcome.

Eighteen studies on 10 broad categories of investigative techniques were identified, with the largest number of studies examining specialised investigative techniques for sexual assault and the collection or testing of DNA and other physical evidence. While there were some promising findings, findings were mixed and, in some areas, there is limited evidence on which to draw strong conclusions. Given the significant investment of police resources in the investigation of serious violent crime, the results highlight the need for more methodologically rigorous empirical research on both new and established investigative techniques available to law enforcement.

Police techniques for investigating serious violent crime: A systematic review

Angela Higginson, Elizabeth Eggins and Lorraine Mazerolle

Serious violent crime is a persistent and significant criminal justice issue and contributes significantly to the costs of crime in Australia (Rollings 2008). Police are at the front line of controlling and responding to serious violent crime, and investigation is a major part of their role (Newburn 2007; Palmiotto 2004; Roberts 2007; Stelfox 2013). The techniques police use to investigate serious violent crime play a large role in determining whether an offender is identified, arrested and/or makes a confession, which can affect whether cases are cleared or convictions secured.

Although investigating and responding to serious violent crime is a core component of police work, clearance rates have either stagnated or declined in recent decades (Horvath et al. 2001; Litwin & Xu 2007; Mustaine et al. 2012; Riedel 2008; Worrall 2016). Ineffective investigations and unsolved serious violent crimes can have ramifications on many levels for victims, the general public, the police and the criminal justice system. When serious violent offenders are not apprehended or cases are not investigated effectively, victims may experience additional trauma (Riedel & Jarvis 1998). There is a risk that additional serious violent crimes may be committed and victims may be reluctant to report serious violent crimes in the future (Cole 2007; Cronin et al. 2007, Turner & Kosa 2003). These issues have important implications for the criminal justice system. For example, the



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deterrent effect of apprehending, prosecuting and convicting serious violent offenders may be diminished, and citizens may lose confidence in the police (Curry et al. 2013; Regoeczi et al. 2000).

Although criminal investigation is a substantial component of police work, and although solving and dealing with serious violent crime is critically important, the evidence base around police techniques for investigating serious violent crime lacks the level of synthesis seen in other fields of policing and in general crime and disorder.

Specifically, this study systematically evaluates the impact of police investigative techniques on key police outcomes related to serious violent crime:

- identifying offenders;
- arrests;
- eliciting confessions;
- convictions; and
- closing cases.

Defining serious violent crime and police investigative techniques

Serious violent crime is defined in various ways in the literature and the distinction between violent crime and serious violent crime, in particular, varies. This research takes the most common approach (see, for example, Day et al. 2012; Kramer & Ulmer 2002; Truman et al. 2013) and defines the following offences as serious violent crime:

- murder;
- manslaughter;
- rape or other sexual assault;
- aggravated assault; and
- robbery.

Defining techniques for investigating serious violent crime is more straightforward. A police investigative technique is any activity or strategy used by police to gather evidence to identify and arrest offenders, elicit confessions, close cases or secure convictions (Newburn 2007; Palmiotto 2004; Stelfox 2013). Examples include but are not limited to:

- collecting or testing DNA;
- line-ups;
- interrogation;
- profiling; and
- surveillance.

Method

Systematic review is at the forefront of evidence-based policy and practice. Systematic reviews use search, screening and analytic techniques to summarise quantitative research evidence concisely, robustly and comprehensively (Welsh & Farrington 2006).

Inclusion criteria

Any research that used an experimental, or quasi-experimental, research design with a valid comparison group to examine the impact of a police investigative technique on an eligible outcome in a case of serious violent crime was eligible for inclusion in the review. To be included, a study had to report on one of the following outcomes (or an equivalent):

- offender identification;
- arrest;
- confession;
- case closure; or
- conviction.

Exclusion criteria

Studies were excluded if they evaluated only the *presence* of evidence rather than the police process of collecting or testing that evidence. Studies were also excluded if they examined techniques for *detecting* serious violent crime. Also excluded were studies where the intervention was not specified (eg the use of ‘analytic methods’) or where data were insufficient to calculate an effect size.

Search strategy

The literature for this review was drawn from two English-language systematic searches. The first was a systematic search of the literature on the investigation of serious violent crime between 1970 and 2009, funded by the UK National Policing Improvement Agency (NPIA; Denning et al. 2009). The second extracts literature published between 2009 and 2014 from a search conducted for the Global Policing Database (GPD), a database designed to capture all published and unpublished experimental and quasi-experimental evaluations of policing interventions since 1950 (Higginson et al. 2015). Together, these searches offer access to the equivalent of over 48 academic search locations.

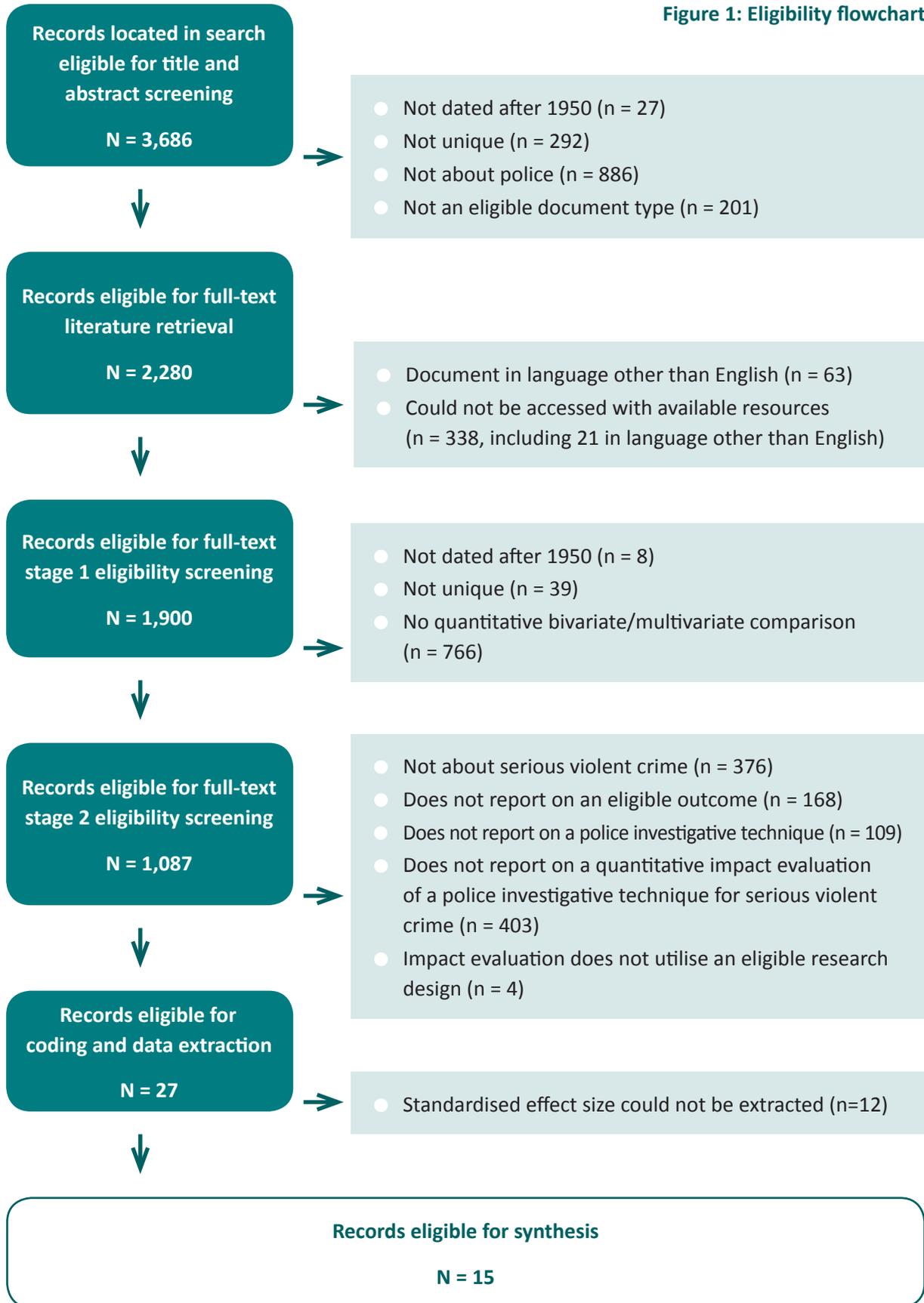
Search terms

The search conducted by Denning et al. (2009) included documents that contained a research term, a police term, and an investigation term. As the GPD is based on both police and research terms, documents were extracted from the GPD search if they included a violence term, an investigative term and an outcome term. This yielded a total of 3,686 potentially eligible documents.

Eligibility screening

Figure 1 illustrates how documents were screened for eligibility. First, the title and abstract of the document were screened, leaving 2,280 documents eligible for further screening. Of these, the full text of 1,900 documents was obtainable. After screening on research design, research focus and whether effect sizes could be extracted, a total of 15 documents met all eligibility criteria.

Figure 1: Eligibility flowchart



Analysis and a note on odds ratios

The impact of the various interventions across the range of crimes and outcomes are presented using odds ratios (OR) and 95 percent confidence intervals (CI). Where more than one study evaluated the same intervention, crime and outcome, an inverse variance weighted random-effects meta-analysis was used to combine the effect sizes.

The odds ratio is a measure of association between exposure to an intervention and an outcome. Where the odds ratio equals one (OR=1), the intervention is not associated with a change in the odds of the outcome occurring. An OR of less than one (OR<1) means that exposure to the intervention is associated with lower odds of the outcome, and an odds ratio greater than one (OR>1) means the intervention is associated with increased odds of the outcome occurring. Confidence intervals that span 1 indicate the association is not statistically significant.

Results

Characteristics of eligible studies

The documents were primarily from the United States (n=10), but were also drawn from Australia (n=1), Norway (n=1), South Africa (n=1) and the United Kingdom (n=2). From the 15 eligible documents, data for 18 studies and 111 standardised effect sizes was extracted, relating to six broad crime categories (homicide, robbery, carjacking, serious assault, sexual assault, and an aggregate measure of serious violent crime), 13 intervention categories and 17 outcome categories. The results are presented below by intervention category, in descending order of the weight of evidence contributing to the results.

Specialised sexual offence interventions

Eight studies examined the impact of specialised sexual offence interventions, including: sexual assault examinations (Alderden 2008; Alderden & Ullman 2012; Bouffard 2000; Heenan & Murray 2007; Kelly 2008); the Sexual Assault Nurse Examiner program (SANE; Kelly 2008; Toon & Gurusamy 2014—data from Kelly, 2004 & Campbell 2012); and specialist police sex offence units (LaFree 1981).

Sexual assault examination refers broadly to post-assault forensic data collection, otherwise referred to as a rape kit or sexual assault screening. The effects from studies that examined the impact of sexual assault examinations on case outcomes were highly heterogeneous across, and at times within, outcomes.

Sexual assault examinations were not significantly associated with the police decision to drop or unfound a sexual assault case (OR: 0.75; CI: 0.25–2.22), or with case clearance or closure (OR: 1.04; CI: 0.35–3.10). Sexual assault screening exams did significantly increase the odds of arrest (OR: 2.55; CI: 1.78–3.65) and the laying of charges (OR: 1.96; CI: 1.38–2.78), and marginally significantly increased the likelihood of cases being presented to prosecution (OR: 4.45; CI: 0.11: 1.00–19.88), but had no significant impact on prosecution (OR: 1.14; CI: 0.71–1.83), conviction (OR: 0.97; CI: 0.46–2.02), or exceptional closure (OR: 0.51; CI: 0.09–2.93).

Finally, while overall there was no significant effect on whether victims withdrew from sexual assault cases, there is evidence to suggest that standard forensic examinations produce a higher rate of victim withdrawal (OR: 5.24; CI: 3.07–8.94) than that seen in specialised SANE exams (OR: 0.37; CI: 0.13–1.07).

The SANE program is an American and Canadian program established in the 1970s where specialist nurses, rather than forensic doctors, gather forensic evidence in sexual assault cases (Toon & Gurusamy 2014). The trained nurse examiners 'are responsible for conducting forensic examinations, collecting and documenting findings, preparing statements for court...and giving evidence in court' (Toon & Gurusamy 2014: 9). Kelley (2008) examined the impact of police involvement in the SANE program and on the use of SANE-trained detectives. There was no significant impact on a decision by police to drop or unfound a case (OR: 1.03; CI: 0.63–1.70), or to present a case for prosecution (OR: 0.80; CI: 0.56–1.15), or on victims' decision to withdraw (OR: 1.30; CI: 0.89–1.91).

One study (LaFree 1981) found that deploying specialist sex offence units had no significant impact on arrests (OR: 1.00; CI: 0.75–1.32) or whether felony charges were laid in sexual assault cases (OR: 1.39; CI: 0.88–2.19).

Collection or testing of DNA

Three documents reported on five studies that evaluated the impact of collection or testing of DNA evidence on homicide, sexual assault and serious assault cases (Abrahams et al. 2011; Hagemann et al. 2011; Wilson et al. 2011). Overall, the collection or testing of DNA was associated with a significant increase in convictions (OR: 3.24; CI: 1.50–6.98). Charges laid (OR: 1.08; CI: 0.16–7.43), prosecution (OR: 4.27; CI: 0.68–26.78), plea bargains and sentence length (OR: 1.87; CI: 0.81–5.74) were not significantly impacted by the collection or testing of DNA, but this was associated with a significant decrease in case clearances in homicide cases (OR: 0.100; CI: 0.060–0.167).

Collecting or testing of physical evidence

Three studies provided effect sizes of the impact of collecting or testing physical evidence in homicide, robbery and sexual assault cases.

If crime technicians were present at a robbery crime scene, this was associated with three times the odds of clearance in robbery cases (OR: 3.10; CI: 2.29–4.20), and almost double the odds of arrest (OR: 1.90; CI: 1.42–2.56). Arrest was more likely in robbery cases where fingerprints were taken (OR: 1.46; CI: 1.09–1.95).

Findings on the impact of collecting or testing physical evidence in homicide cases were mixed. Three of the 11 types of evidence analysed were significantly associated with higher odds of charges being laid: crime scene photos (OR: 1.24, CI: 1.06–1.45); forensic photos during autopsies (OR: 1.53; CI: 1.22–1.92); and victim blood alcohol levels (OR: 1.56; CI: 1.34–1.82).

Five types of evidence were associated with a significant reduction in the odds of homicide charges being laid: toxicology collection (OR: 0.16; CI: 0.07–0.37); collection of genital swabs (OR: 0.41; CI: 0.33–0.51); collection of head hair (OR: 0.60; CI: 0.43–0.82); collection of nail scrapings (OR: 0.73; CI: 0.53–0.996); and having an autopsy done at an academic centre (OR: 0.76; CI: 0.63–0.91).

Three interventions made no significant impact on charges in homicide cases: histology specimen collection (OR: 0.94; CI: 0.49–1.79); the collection of clothing specimens (OR: 1.32; CI: 0.79–2.21); and the performance of a full autopsy (OR: 0.88; CI: 0.74–1.03).

In cases of sexual assault (Hagemann et al. 2011), there was a strong positive relationship between the odds of charges being laid and the analysis of trace evidence (OR: 9.71; CI: 2.37–39.79). Six of the 11 types of evidence analysed were significantly associated with higher odds of conviction: crime scene photos (OR: 1.32; CI: 1.03–1.70); forensic photos taken during autopsies (OR: 1.42; CI: 1.01–2.00); victim blood alcohol collected (OR: 1.37; CI: 1.08–1.72); collection of genital swabs (OR: 2.15; CI: 1.36–3.41); collection of head hair (OR: 2.83; CI: 1.43–5.61); and collection of nail scrapings (OR: 4.15; CI: 1.88–9.18).

Having a full autopsy performed was associated with a significant reduction in the odds of homicide charges being laid (OR: 0.64; CI: 0.49–0.83).

Four interventions had no significant impact on charges in homicide cases: toxicology collection (OR: 0.19; CI: 0.04–1.00); histology specimen collection (OR: 0.48; CI: 0.18–1.29); collection of clothing specimens (OR: 1.11; CI: 0.45–2.72); and having an autopsy done at an academic centre (OR: 1.27; CI: 0.94–1.71).

Computer or file checks

Two studies examined the impact of performing computer or file checks on persons, vehicles, decedents, witnesses or suspects (Greenberg et al. 1977; Schroeder & White 2009). On average, running computer checks on the deceased, witnesses or suspects in homicide cases was associated with more than three times the odds of case clearance (OR: 3.68; CI: 1.76–7.69), while in robbery cases running file checks on people, vehicles or vehicle registrations was not significantly associated with arrest (OR: 0.91; CI: 0.43–1.90).

Interviews conducted

Two studies examined the impact of conducting interviews on case outcomes. Schroeder and White (2009) demonstrated that interviewing family members or attending physicians more than doubled the odds of homicide case clearance (OR: 2.30; CI: 1.58–3.37).

Kelley (2008) reported effect sizes that showed interviewing suspects in sexual assault cases was associated with:

- a borderline statistically significant reduction in the odds of police dropping a case (OR: 0.51; CI: 0.26–1.00);
- a fourfold increase in the odds of police presenting a case to prosecution (OR: 3.97; CI: 2.36–6.70); and
- a 65 percent reduction in the odds of victims withdrawing from a sexual assault case (OR: 0.35; CI: 0.21–0.58).

Line-ups

Two studies examined the impact of police line-up techniques on the identification of suspects. Clarke and Tunnicliff's (2001) study compared two different line-up compositions for suspect identification line-ups in carjacking cases.

They examined whether the way non-suspects (or foils) are chosen for an identification line-up influences whether an innocent suspect is falsely identified as the perpetrator. In both conditions, the perpetrator was absent but the line-ups included an innocent suspect. The two conditions were perpetrator-matched line-up (where the line-up included foils who were matched to the description of the perpetrator), and suspect-matched line-up (where the line-up included foils who were matched to the innocent suspect). The study demonstrated that a perpetrator-matched line-up achieves a lower false positive suspect identification than a suspect-matched line-up (OR: 0.15; CI: 0.04–0.54). In other words, fewer innocent suspects would be falsely identified if police try to find foils who fit the description of the perpetrator, rather than finding foils who look like the suspect.

Davis et al. (2014) examined three different ways of using police data on robbery cases to identify suspects—video line-ups, mugshots and street identifications. Davis et al. showed that video line-ups (where the suspect and foils were filmed rather than simply photographed) were more effective than either street identification (where the witness is asked to scan the vicinity of the crime scene to identify suspects) or mugshots (OR: 8.21; CI: 3.16–21.33), and that street identification was more effective than mugshot viewing (OR: 2.67; CI: 1.11–6.38). They further demonstrated that video line-ups were more successful where the witness had previously performed a street identification (OR: 4.65; CI: 1.88–11.50), and that there was no significant difference in suspect identification where the identification occurred more than a week after the offence, compared to identifications that happened less than a week after (OR: 4.50; CI: 0.97–20.83).

Crime scene visits by detectives or medical practitioners

One study (Abrahams et al. 2011) examined the impact of crime scene visits by detectives or medical examiners on the outcomes of homicide cases. They found that, while detective visits to the crime scene increased the odds of charges (OR: 1.84; CI: 1.39–2.42) and conviction (OR: 4.92; CI: 2.83–8.57), having medical practitioners attend the crime scene had no significant effect on charges (OR: 1.69; CI: 0.70–4.06) or conviction (OR: 0.48; CI: 0.14–1.68).

Detective present at post-mortem

One study (Schroeder & White 2009) examined the impact of having a detective attend a post-mortem exam on homicide case clearances and found a 75 percent increase in the odds of a homicide case being cleared (OR: 1.75; CI: 1.03–2.98).

Interview recording

One study (Knight 2009) examined the effect of video or voice recording of investigative interviews on serious violent crime case outcomes. The recording of interviews was not significantly associated with any of the following outcomes:

- admission or confession (OR: 1.40; CI: 0.31–6.24);
- prosecution (OR: 3.44; CI: 0.87–13.52);
- dismissal (OR: 0.30; CI: 0.04–2.14);
- guilty pleas (OR: 2.78; CI: 0.52–14.80);
- plea bargains (OR: 0.26; CI: 0.04–1.82);

- hung juries (OR: 1.02; CI: 0.05–23.04); or
- conviction (OR: 4.36; CI: 0.22–86.59).

Medical examiner qualifications

One study (Abrahams et al. 2011) examined the impact of a medical examiner's qualifications on homicide case outcomes in South Africa. The study found that although specialist qualifications (compared with 'some training') are associated with increased odds of charges being laid (OR: 1.31; CI: 1.02–1.69), they were conversely also associated with a lower likelihood of conviction (OR: 0.62; CI: 0.41–0.95). While having some training (versus no training) had no impact on the laying of charges (OR: 0.89; CI: 0.73–1.10), it was associated with significantly higher odds of conviction (OR: 1.50; CI: 1.04–2.16).

Discussion

This systematic review found evidence of the effectiveness of 10 broad categories of techniques for investigating serious violent crime. In descending order of the weight of evidence contributing to this review, the intervention categories were:

- specialised sexual offence interventions (n=8);
- collection or testing of DNA (n=5);
- collection or testing of physical evidence (n=3);
- computer or file checks (n=2);
- interview (n=2);
- line-ups (n=2);
- crime scene visits by detectives or medical practitioners (n=1);
- detective presence at post-mortem (n=1);
- recording interviews (n=1); and
- medical examiner qualifications (n=1).

The level of research synthesis seen for street-level policing approaches and general crime and disorder far outweighs the research synthesis for police investigative techniques, particularly in relation to serious violent crime. This systematic review highlights how little primary research is available that empirically evaluates, in a way that can be synthesised by meta-analysis, how serious violent crime is investigated.

This systematic review identified 3,686 studies for screening and examined the full text of 1,900 documents, but yielded only 15 documents (outlining 18 eligible studies) from which standardised effect sizes could be calculated. Each of these studies examined the impact of a particular police investigative technique on the outcomes of cases of serious violent crime including homicide, robbery, carjacking, serious assault and sexual assault, and an aggregate measure of serious violent crime. The results of 13 intervention types, in 10 broad categories, on 17 case outcomes were synthesised. While the eligible studies yielded 111 standardised effect sizes for synthesis, there were often few studies examining the same issue; there was therefore insufficient power to perform moderator analyses by crime type to determine if certain interventions work best for certain crime types. These results

should be seen as a preliminary exploration of how effective various techniques are in investigating serious violent crime.

It is important to recognise that there can be issues of selection bias even in a small set of quantitative evaluations. Only one study used a randomised control experiment design, and only three studies controlled for victim, case or organisational characteristics. The remaining 14 included studies matched the control and treatment conditions by crime type. It is therefore possible that the characteristics of the crime or the victim may have led to the allocation of treatment, and also to the results seen. It is important to recognise that, in most cases, there is the possibility of confounded effects; these results indicate an association only, rather than causation.

During the course of the search much empirical research evaluating investigative police techniques was identified but, as the study has shown, there is a much smaller corpus of work that evaluates them in the context of serious violent crime. Further research exploring the differential and combined impact of various techniques for investigating certain crime types would be useful, particularly (where appropriate and ethical) randomised control experiments or well-balanced quasi-experiments that control for selection assignment factors.

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Dr Angela Higginson is a Lecturer in Criminology at the School of Justice at Queensland University of Technology.

Ms Elizabeth Eggins is a Research Fellow at the School of Social Science at The University of Queensland.

Professor Lorraine Mazerolle is a Professor of Criminology at the School of Social Science at The University of Queensland.

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GPO Box 1936
Canberra ACT 2601, Australia
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