DOI: 10.1111/1745-9133.12449

CRIMINOLOGY
& Public Policy

RESEARCH ARTICLE
CLEARING HOMICIDES

Clearing homicides

Role of organizational, case, and investigative dimensions

Charles F. Wellford[1] | Cynthia Lum[2] | Thomas Scott[1] | Heather Vovak[2] | J. Amber Scherer[2]

[1]University of Maryland—College Park
[2]George Mason University

Correspondence
Charles F. Wellford, University of Maryland—College Park, 2220 LeFrak Hall, College Park, MD 20742-8235.
Email: wellford@umd.edu

This article is based on work supported by the Laura and John Arnold Foundation (LJAF). We thank them for the support and note that LJAF is not responsible for any of the content or conclusions herein.

Research Summary: Since the RAND Corporation studies on investigations were published, there has been a widely held belief among scholars that police agencies and investigative effort matter little to solving crimes. A few researchers have recently challenged this belief, however, producing results that show that investigative effort does play a role in clearing crimes. In this study, we replicate the methodological approach of the RAND studies and use multiagency, multimethod, detailed case files, as well as organizational analysis, to examine the association among investigative effort, case features, organizational factors, and the clearance of homicide cases. The results show that variation between the homicide clearances in agencies can be explained by case attributes, investigative practices, and organizational differences. Future research should be aimed at building on these results using a similar design with a larger number of agencies.

Policy Implications: An agency's ability to clear homicides is a function of the resources it applies to conduct investigations and how it organizes its effort. Agencies seeking to increase their ability to clear homicides should focus on increasing investigative efforts for cases (i.e., thoroughness of the initial investigative response) and

prioritize oversight, management, and evaluation of investigation work. The results of our study show that providing justice to the family, friends, and communities of homicide victims is an achievable goal for law enforcement agencies when they attend to investigative efforts.

KEYWORDS
evidence-based policing, homicide clearances, investigations, role of police

In 1975, Greenwood, Petersilia, Chaiken, and colleagues, in a series of reports for the RAND Corporation (see Chaiken, 1975; Chaiken, Greenwood, & Petersilia, 1977; Greenwood & Petersilia, 1975; Greenwood et al., 1975), came to a surprising conclusion about law enforcement criminal investigations. After examining investigative practices in multiple agencies, they concluded that investigators spent only a small amount of time on activities related to solving crimes. Most of their efforts were focused on postarrest case processing. Often these activities were not helpful to the prosecution of those crimes. Many crimes were never investigated, and those that were had been solved quickly as a result of circumstances about the case or because of efforts of uniformed patrol officers. They also found that evidence collected at crime scenes only helps to solve crimes when that evidence is processed well. Greenwood and colleagues asserted that "arrest and clearance rates reflect activities of patrol officers and members of the public more than they reflect activities of investigators" (1975, p. 192). In the end, they concluded that there is "enough information about the effectiveness of each [investigative] function to begin asking whether the function should be performed at all and, if so, who should do it" (Chaiken et al., 1977, p. 209). Even though they acknowledged that their research findings led to the implication that resources should be shifted away from investigative units to other units, they also advocated for more evaluation of their recommendations before such a fundamental change in policing was undertaken.

For many years, the conclusions from the RAND research remained widely believed (see Bayley, 1994; see also discussion by Eck, 1992). Although Eck (1983) presented more optimistic findings of the role investigations could play in case clearance, the belief that investigations did not matter as much as other factors in case clearance persisted among the research community. This was certainly the case with homicides investigations, and studies on homicide clearance since the RAND report have been focused more on crime-related factors and have generally ignored the role of investigative effort.

At the same time, interest about homicides and what police can do about them has grown. As the most serious crime, the public often judges the performance of the police by the resolution of homicide cases. There has been increasing public concern about the dramatic declines in recent years in homicide clearance in cities such as Baltimore, Chicago, and New Orleans (see Madhani, 2018; Valcourt, 2015). The notable and steady decline in homicide clearances since 1970 and the popular press coverage of the problem of low clearances and its concentration in economically disadvantaged communities (see Leovy, 2015; *The Murder Accountability Project*[1]) has resulted in a renewed focus by policy makers on what can be done to improve homicide clearance rates.

In a small body of research that has emerged since the RAND research was published, scholars have challenged the notion that investigators (and police agencies more generally) do not matter in solving crimes. In this article, we review the research on criminal investigations—focusing specifically on

homicide investigations—to assess the role that investigators play in solving homicides. Unfortunately, in much of the existing research, scholars failed to meet the holistic approach set forth by Chaiken et al. (1977) who devised what is still today the most complete conceptual design to test what factors, both police and nonpolice related, contribute to clearing a crime. They observed that to understand the role of police in crime clearances, researchers needed to study the investigative activities of the police directly. That is, researchers needed access to the investigative files to understand aspects of the crime itself (i.e., participants and modus operandi) and to determine what investigative effort was undertaken. Researchers also needed to understand that investigations occurred within organizations that could influence how they are conducted (a point also made by Eck, 1983, 1992). In sum, all three sources of information—investigative actions, organizational context, and aspects of the crime itself—were needed to understand why any given crime would be resolved and cleared. Estimating such a model also requires examining multiple organizations selected by variations in their clearance rates.

In this article, we analyze homicide clearances within the holistic conceptual model developed by Greenwood et al. (1975) by analyzing specific clearance patterns across case files nested in different agencies, taking into account information about the case, investigative effort, and organizational context.

1 | LITERATURE REVIEW

We begin by reviewing 46 research studies (shown in Table 1) in which aspects of homicide cases or agencies and their contributions to homicide clearances were examined. Table 1 shows information from each of these studies, including the unit of analysis, how the sample and agency were chosen, and the dependent variable used. We also recorded whether the authors collected information about the three types of factors that might influence case clearances—crime event information, investigative effort, and organizational context—and whether the analysis specifically showed that investigative or agency factors mattered in the clearance of homicides.[2]

After a review of the literature on criminal investigations, we found that in none of the research projects was the full conceptual model envisioned by Greenwood and colleagues (1975) in the RAND studies for homicide examined. In other words, case-level information about homicides, the investigative effort from those cases, and organizational data for multiple agencies represented by those cases has not been linked in any of these studies to determine how aspects of the crime, investigative effort, and agency contextual factors collectively matter in homicide clearance. Without a full model of clearance that reflects Greenwood et al.'s initial call for research, it is hard to assert with any degree of confidence that investigative efforts do not matter to case clearance.

There are many reasons for this current state of research. Perhaps the main reason for the dearth of studies in which investigative effort on case clearance is examined is that a large proportion—almost half (21 studies)—of studies on homicide clearance has not been focused on investigative effort at all (as indicated by "Not Measured" in the last column of Table 1). Instead, many researchers have used a more limited model of homicide clearance in which the role that aspects of the crime itself play in homicide case clearance is primarily explored (this could be the result of persistent beliefs about the nature of homicide clearances, as discussed earlier). Almost all of these were studies in which electronic data sets of homicide cases were employed rather than detailed case files (except Regoeczi & Jarvis, 2011). The focus of these studies was primarily on specific aspects of the crime, such as where the homicide occurred, the circumstances or motives of the crime, or the characteristics of the people

TABLE 1 Research studies of factors contributing to homicide clearance

Citation	Sample size (cases = homicide)	How was sample and agency selected	Time period studied	Research method	Outcome being explained	Case-level crime event data analyzed	Source of case-level data	Investigative effort analyzed	Agency data analyzed	Does the study find overall that investigative or organizational efforts matter?
Greenwood et al. RAND studies	153 agencies surveyed; 25 agency case studies; 264 cases	Surveyed agencies met population threshold; agencies for interviews purposefully and conveniently selected; agencies for case and investigative information by convenience	1973	Multi-method	Arrest and clearance rates, departmental characteristics, investigative effort and organization	YES	Agency case files	YES	YES	NO (as measured by investigative processes and organizational aspects)
Cloniger and Sartorius (1979)	16 agency years	Data available for selected years; agency selected by convenience	1960-1976	Regression	Percentage of case clearance, defined as cleared by arrest	NO	N/A	NO	YES	NO (using proxy measures of expenditures and number of officers)

(Continues)

TABLE 1 (Continued)

Citation	Sample size (cases = homicide)	How was sample and agency selected	Time period studied	Research method	Outcome being explained	Case-level crime event data analyzed	Source of case-level data	Investigative effort analyzed	Agency data analyzed	Does the study find overall that investigative or organizational efforts matter?
Gilbert (1983)	111 cases	Only criminal homicides in San Diego, CA, in which the suspects were charged by prosecution officials; agency selected by convenience	1970, 1980	Descriptive	Increase in criminal homicide cases between 1970 and 1980	YES	Unclear	NO	NO	NOT MEASURED
Cordner (1989)	84 agencies	All municipal and county police or sheriff departments in Maryland	1986	Correlation and regression	Percentage of case clearance, defined as cleared by arrest or exception	NO	N/A	NO	YES	NO (using proxy measure of size and officer workload)
Keppel and Weis (1994)	967 cases	Only single victim-single offender homicide cases that occurred in the state of Washington during the dates examined	1981-1986	Correlation analysis	Percentage of case clearance, defined as cleared by arrest, exception, or when warrant was issued	YES	Electronic data derived from investigative case files	NO	NO	NOT MEASURED

(Continues)

TABLE 1 (Continued)

Citation	Sample size (cases = homicide)	How was sample and agency selected	Time period studied	Research method	Outcome being explained	Case-level crime event data analyzed	Source of case-level data	Investigative effort analyzed	Agency data analyzed	Does the study find overall that investigative or organizational efforts matter?
Marché (1994)	18,673 cases	All homicides recorded in the FBI's Supplemental Homicide Reports (SHR) in 1983, excluding justifiable homicide and manslaughter by negligent circumstances, for all agencies within year	1983	Logistic regression	A proxy for case clearance was estimated as when an offender is reported as known in the SHR	YES	National homicide database (SHR)	NO	YES	MAYBE (some evidence using proxy measures for workload and experience)
Decker (1995)	792 cases	All homicides from the city of St. Louis for the dates examined; agency selected by convenience	1985-1989	Descriptive and qualitative	Witnesses and third parties at homicides	YES	Agency case files	NO	NO	N/A

(Continues)

TABLE 1 (Continued)

Citation	Sample size (cases = homicide)	How was sample and agency selected	Time period studied	Research method	Outcome being explained	Case-level crime event data analyzed	Source of case-level data	Investigative effort analyzed	Agency data analyzed	Does the study find overall that investigative or organizational efforts matter?
Wellford and Cronin (1999)	798 cases	Random sample of homicide incidents within each city; proportion of open and closed homicide cases in the sample matched that of the entire homicide caseload for those years for that city; four agencies selected purposefully	1994-1995	Logistic regression	Case clearance as defined by cleared by arrest but excluding exceptional clearance	YES	Agency case files	YES	NO	YES (as measured by investigative effort for cases)

(Continues)

TABLE 1 (Continued)

Citation	Sample size (cases = homicide)	How was sample and agency selected	Time period studied	Research method	Outcome being explained	Case-level crime event data analyzed	Source of case-level data	Investigative effort analyzed	Agency data analyzed	Does the study find overall that investigative or organizational efforts matter?
Regoeczi, Kennedy, and Silverman (2000)	7,917 Canada, 2,215 Ontario, 305,482 U.S., 20,779 New York cases	All homicide cases contained in the Canadian Center for Justice Statistics (CCJS) and the SHR (United States) for the years examined included, broken down further by cities identified	1961-1983 (Canada) 1976-1992 (U.S.)	Logistic regression	A proxy for case clearance was estimated using when offender is reported as known in the SHR or identified in CCJS-CHS	YES	National homicide database (SHR and CCJS-CHS)	NO	NO	NOT MEASURED

(Continues)

TABLE 1 (Continued)

Citation	Sample size (cases = homicide)	How was sample and agency selected	Time period studied	Research method	Outcome being explained	Case-level crime event data analyzed	Source of case-level data	Investigative effort analyzed	Agency data analyzed	Does the study find overall that investigative or organizational efforts matter?
Mouzos and Muller (2001)	3,722 cases; 11 investigators	All homicide cases in the National Homicide Monitoring Program for Australia were selected; Questionnaire sent to each homicide squad in Victoria, South Australia, Western Australia and Queensland	1989-1990, 2001	Correlational and qualitative analysis	Case clearance, defined as cleared by arrest, charged, or deceased	YES	National homicide database (NHMP)	YES	NO	NO (when measured with case-level information) but YES (when asking investigators)
Puckett and Lundman (2003)	802 cases	All homicides selected, but dropped 14 cases with Asian American male victims, 187 easily solved cases, and 171 solved the same day	1984-1992	Logistic regression	Case clearance, as defined by cleared by arrest and/or exception	YES	Agency homicide data (not full case files)	MAYBE (implied with proxy)	NO	NO (using workload and experience at the case level)

(Continues)

TABLE 1 (Continued)

Citation	Sample size (cases = homicide)	How was sample and agency selected	Time period studied	Research method	Outcome being explained	Case-level crime event data analyzed	Source of case-level data	Investigative effort analyzed	Agency data analyzed	Does the study find overall that investigative or organizational efforts matter?
Borg and Parker (2001)	157 cities	Cities in the US with population of 100,000 or more in 1990; pulled from U.S. Bureau of the Census 1990	1989-1991	OLS regression	Clearance rate of each city, calculated as percentage of total homicides that were cleared by arrest, averaged across 3 years	NO	N/A	NO	NO	NOT MEASURED
Litwin (2004)	2,224 cases in 72 communities	Entire population of homicides for one agency; agency selected by convenience	1989-1991	Hierarchical linear modeling	Case clearance as defined by cleared by arrest but excluding exceptional clearance	YES	Agency homicide data (not full case files)	NO	NO	NOT MEASURED
Lee (2005)	9,442 cases	Entire population of homicides for Los Angeles; agency selected by convenience	1990-1994	Logistic regression, survival analysis	Case clearance, defined as cleared by arrest or exception, as well as time to clearance in days	YES	State-level computerized homicide data (not full case files)	NO	YES	NOT MEASURED

(Continues)

TABLE 1 (Continued)

Citation	Sample size (cases = homicide)	How was sample and agency selected	Time period studied	Research method	Outcome being explained	Case-level crime event data analyzed	Source of case-level data	Investigative effort analyzed	Agency data analyzed	Does the study find overall that investigative or organizational efforts matter?
Alderden and Lavery (2007)	7,470 cases	Entire population of homicides from Chicago Police Department's electronic database where circumstances were determined; Chicago selected by convenience	1991-2002	Logistic regression	Case clearance as measured by when offender is arrested, charged, and prosecuted or cleared by exception or there is enough to charged offender;	YES	Agency homicide data (not full case files)	NO	NO	NOT MEASURED
Litwin and Xu (2007)	23,184 cases in 77 communities	All homicides in Victim-Level Chicago Homicide Dataset for the dates examined; Chicago selected by convenience	1966-1995	Hierarchical generalized linear modeling	Case clearance, defined as cleared by arrest or exception	YES	Agency homicide data (not full case files)	NO	NO	NOT MEASURED

(Continues)

TABLE 1 (Continued)

Citation	Sample size (cases = homicide)	How was sample and agency selected	Time period studied	Research method	Outcome being explained	Case-level crime event data analyzed	Source of case-level data	Investigative effort analyzed	Agency data analyzed	Does the study find overall that investigative or organizational efforts matter?
Riedel and Boulahanis (2007)	452 cases barred from prosecution; 700 cases cleared by arrest	All cases exceptionally cleared due to barred from prosecution for the dates examined; cleared by arrest homicides randomly sampled; agency selected by convenience	1988-1995	Chi-square analysis and logistic regression	Case clearance (specifically comparing cleared by exception via barred from prosecution and cleared by arrest)	YES	Agency homicide data (not full case files)	NO	NO	NOT MEASURED
Davies (2007)	60 cities	59 largest U.S. cities selected; one agency case study selected by convenience	1970-1999	Time-series cross-sectional analysis, qualitative case study	Homicide clearance rate (not clear how defined)	NO	N/A	NO	YES	NOT MEASURED

(Continues)

TABLE 1 (Continued)

Citation	Sample size (cases = homicide)	How was sample and agency selected	Time period studied	Research method	Outcome being explained	Case-level crime event data analyzed	Source of case-level data	Investigative effort analyzed	Agency data analyzed	Does the study find overall that investigative or organizational efforts matter?
Hsu (2007)	100 agencies	100 largest agencies from UCR from 1970–2002	1987, 1990, 1993, 1997, 2000	Regression	Percentage of case clearance, defined as cleared by arrest or exception	NO	N/A	NO	YES	MAYBE (some indication that resources are important for agencies with lower clearance rates)
Addington (2007)	5,706 cases	Cases from National Incident-Based Reporting System (NIBRS) participating agencies. The cases analyzed are all murders and nonnegligent manslaughters for the dates examined	2000 - 2002	Contingency tables, ordered logistic regression	Time to clearance (clearance defined by cleared by arrest or exception)	YES	National homicide database (NIBRS)	NO	NO	NOT MEASURED

(Continues)

TABLE 1 (Continued)

Citation	Sample size (cases = homicide)	How was sample and agency selected	Time period studied	Research method	Outcome being explained	Case-level crime event data analyzed	Source of case-level data	Investigative effort analyzed	Agency data analyzed	Does the study find overall that investigative or organizational efforts matter?
Roberts (2007)	1,579 cases	All murder and non-negligent manslaughter incidents from NIBRS participating agencies for the dates examined	2002	Survival analysis	Time to clearance for homicides cleared by arrest only (exceptional clearances excluded from this study)	YES	National homicide database (NIBRS)	NO	NO	NOT MEASURED

(Continues)

TABLE 1 (Continued)

Citation	Sample size (cases = homicide)	How was sample and agency selected	Time period studied	Research method	Outcome being explained	Case-level crime event data analyzed	Source of case-level data	Investigative effort analyzed	Agency data analyzed	Does the study find overall that investigative or organizational efforts matter?
Regoeczi, Jarvis, and Riedel (2008)	5,680 cases	All murder and non-negligent manslaughter offenses in NIBRS participating agencies for the dates examined; study limited to cases involving single victims due to the overlap of information on incident characteristics for homicides with multiple victims	1996-2002	Logistic regression, survival analysis	Case clearance, defined as cleared by arrest or exception, as well as time to clearance in days	YES	National homicide database (NIBRS)	NO	NO	NOT MEASURED

(Continues)

TABLE 1 (Continued)

Citation	Sample size (cases = homicide)	How was sample and agency selected	Time period studied	Research method	Outcome being explained	Case-level crime event data analyzed	Source of case-level data	Investigative effort analyzed	Agency data analyzed	Does the study find overall that investigative or organizational efforts matter?
Schroeder and White (2009)	593 cases	All located homicide cases in the borough of Manhattan (354 files could not be located, and 90 more excluded from study for the dates examined; agency selected by convenience	1996-2003	Logistic regression, survival analysis, case study	Case clearance, defined as cleared by arrest	YES	Agency case files	YES	NO	YES (follow up on leads, running checks); NO (DNA testing, use, existence)
Keel, Jarvis, and Muirhead (2009)	55 agencies	Agencies with 25 or more homicides per year and that report to UCR	unclear	Linear regression	Homicide clearance rate as reported in the survey by responding agency	NO	N/A	NO	YES	YES (agency indicators such as formal training, use of investigative tools)

(Continues)

TABLE 1 (Continued)

Citation	Sample size (cases = homicide)	How was sample and agency selected	Time period studied	Research method	Outcome being explained	Case-level crime event data analyzed	Source of case-level data	Investigative effort analyzed	Agency data analyzed	Does the study find overall that investigative or organizational efforts matter?
Jarvis and Regoeczi (2009)	3,372 cases	All incidents of murder and nonnegligent manslaughter reported by NIBRS participating agencies for the dates examined; study limited to single victims and single offenders; eliminated 242 cases when unable to assign population data	1996-2002	Logistic regression	Case clearance, comparing those cleared by arrest and by exception	YES	National homicide database (NIBRS)	NO	NO	NOT MEASURED

(Continues)

TABLE 1 (Continued)

Citation	Sample size (cases = homicide)	How was sample and agency selected	Time period studied	Research method	Outcome being explained	Case-level crime event data analyzed	Source of case-level data	Investigative effort analyzed	Agency data analyzed	Does the study find overall that investigative or organizational efforts matter?
Roberts and Lyons (2009)	2,798 homicides 44,667 assaults	All homicides (cleared or not cleared by arrest) from NIBRS participating agencies, and all aggravated assaults from NIBRS for the dates examined	2000-2005	Survival analysis	Time to case clearance as defined by cleared by arrest (excludes exceptional clearance)	YES	National homicide database (NIBRS)	NO	NO	NOT MEASURED
Maguire, King, Johnson, and Katz (2010)	242 interviews, agency information	One agency selected by convenience	2004-2006	Descriptive and qualitative	Homicide clearance rate trend	NO	Aggregated agency homicide statistics	YES	YES	YES (when examining investigative and agency aspects generally)

(Continues)

TABLE 1 (Continued)

Citation	Sample size (cases = homicide)	How was sample and agency selected	Time period studied	Research method	Outcome being explained	Case-level crime event data analyzed	Source of case-level data	Investigative effort analyzed	Agency data analyzed	Does the study find overall that investigative or organizational efforts matter?
Ousey and Lee (2010)	409 (157 places × 3 time periods)	U.S. cities and places with population threshold	1980, 1990, 2000	Fixed-effects regression	Homicide clearance rate defined by ratio of cleared homicides to homicides known to the police	NO	N/A	NO	YES	NO (as measured by number of officers or workload)
Trussler (2010)	11,348 cases	All homicide cases from Canadian Center for Justice Statistics for the dates examined	1991-2006	Logistic regression, nested models	Homicide clearance, as defined by cleared by arrest, suicide, or other unspecified means	YES	National homicide database (CCJS-CHS)	NO	NO	NOT MEASURED
Regoeczi and Jarvis (2011)	495 offender cases	All suspected homicide offenders of homicides for the dates examined, excluding police-related justifiable homicides; agency selected by convenience	1998-2002	Multilevel analysis	Case clearance, defined as cleared by arrest or exception, and whether suspect convicted	YES	Agency case files	NO	NO	NOT MEASURED

(Continues)

TABLE 1 (Continued)

Citation	Sample size (cases = homicide)	How was sample and agency selected	Time period studied	Research method	Outcome being explained	Case-level crime event data analyzed	Source of case-level data	Investigative effort analyzed	Agency data analyzed	Does the study find overall that investigative or organizational efforts matter?
Roberts and Lyons (2011)	9,929 cases	All homicide data from NIBRS participating agencies for the dates examined, excluding incidents in which no ethnicity was reported or with multiple victims	2000-2007	Survival analysis	Time to case clearance as defined by cleared by arrest (excludes exceptional clearance)	YES	National homicide database (NIBRS)	NO	NO	NOT MEASURED
Abrahams, Jewkes, Martin, and Mathews (2011)	1,052 cases	all homicides in 1999 of women 14 years and older selected from 25 mortuaries selected by stratified random sampling	1999	Multinomial logistic regression	Whether suspect charged, and if charged, whether convicted	YES	Various computerized and non-computerized agency data sources	YES	NO	YES (for when investigator goes to the scene); NO (forensic medical activities)

(Continues)

TABLE 1 (Continued)

Citation	Sample size (cases = homicide)	How was sample and agency selected	Time period studied	Research method	Outcome being explained	Case-level crime event data analyzed	Source of case-level data	Investigative effort analyzed	Agency data analyzed	Does the study find overall that investigative or organizational efforts matter?
Alexander (2012)	798 cases	Random sample of homicide incidents within each city; proportion of open and closed homicide cases in the sample matched that of the entire homicide caseload for those years for that city; four agencies selected purposefully	1994-1995	Bivariate analysis, logistic regression, correlational analysis	Case clearance as defined by cleared by arrest but excluding exceptional clearance	YES	Agency case files	YES	NO	YES (specifically for effort related to requesting warrants)
Lundman and Myers (2012)	816 cases	All homicides occurring in Columbus, Ohio for the dates examined; agency selected by convenience	1984-1992	Logistic regression	Case clearance, comparing cleared by arrest, exceptionally cleared, or no arrest/no clearance	YES	Agency homicide data (not full case files)	NO	NO	NOT MEASURED

(Continues)

TABLE 1 (Continued)

Citation	Sample size (cases = homicide)	How was sample and agency selected	Time period studied	Research method	Outcome being explained	Case-level crime event data analyzed	Source of case-level data	Investigative effort analyzed	Agency data analyzed	Does the study find overall that investigative or organizational efforts matter?
Riedel and Rinehart (Kochel) (2012)	3,066 cases	All homicide cases that occurred for the dates examined; agency selected by convenience	1987-1991	Correlation analysis	Case clearance; uncleared cases defined as when offender is not known; other cases estimated as cleared	YES	National homicide database (derived from SHR)	NO	NO	NOT MEASURED
Armstrong, Plecas, and Cohen (2013)	140 cases	Homicide cases from a specific team of investigators who often examine gang-related homicides; agency selected by convenience	2003-2010	Descriptive	Descriptive interest of gang versus non-gang homicides and unit's clearance rates	YES	Agency case files	YES	NO	HYPOTHESIZED (not analyzed) that more resources needed to resolve gang homicides

(Continues)

TABLE 1 (Continued)

Citation	Sample size (cases = homicide)	How was sample and agency selected	Time period studied	Research method	Outcome being explained	Case-level crime event data analyzed	Source of case-level data	Investigative effort analyzed	Agency data analyzed	Does the study find overall that investigative or organizational efforts matter?
Rydberg and Pizarro (2014)	718 cases	All homicides reported in Newark, NJ for the dates examined; excluded cases that were exceptionally cleared or that were missing information on time to clearance; agency selected by convenience	1997-2007	Survival analysis	Case clearance as defined by cleared by arrest but excluding exceptional clearance, as well as time to clearance in days	YES	Agency case files; arrest and correctional computerized records from the state and NCIC	MAYBE (implied with proxy)	NO	MAYBE (as implied by officer workload)
Quinet and Nunn (2014)	829 cases	Solved and unsolved homicides that occurred in Indianapolis, IN for the dates examined; agency selected by convenience	2004-2011	Descriptive temporal study	Whether case was solved	YES	Agency homicide data (not full case files) and reports	NO	NO	MAYBE (as implied by findings that focusing on acquaintances may matter)

(Continues)

TABLE 1 (Continued)

Citation	Sample size (cases = homicide)	How was sample and agency selected	Time period studied	Research method	Outcome being explained	Case-level crime event data analyzed	Source of case-level data	Investigative effort analyzed	Agency data analyzed	Does the study find overall that investigative or organizational efforts matter?
Roberts (2014)	7,927 cases	Homicides from NIBRS participating agencies of specific population and homicide thresholds, nested inside of agencies (only 85 agencies in 23 states of the total 157 agencies in NIBRS were used) for the dates examined	2005-2009	Multi-level logistic regression	Case clearance as defined by cleared by arrest but excluding exceptional clearance	YES	National homicide database (NIBRS)	NO	YES	NOT MEASURED
McEwen and Regoeczi (2015)	294 cases	Homicide cases in Cleveland, Ohio, for the dates examined; agency selected by convenience	2008-2011	Logistic regression	Case clearance and conviction	YES	Agency case files	YES	NO	YES (regarding number of witnesses interviewed and forensic efforts)

(Continues)

TABLE 1 (Continued)

Citation	Sample size (cases = homicide)	How was sample and agency selected	Time period studied	Research method	Outcome being explained	Case-level crime event data analyzed	Source of case-level data	Investigative effort analyzed	Agency data analyzed	Does the study find overall that investigative or organizational efforts matter?
Hawk (2015)	252 cases	All homicides cases that occurred for the dates examined; agency selected by convenience	2009-2011	Logistic regression	Case clearance, defined as cleared by arrest or exception	YES	Agency case files	YES	NO	YES (as measured by workload at the investigator-case level)
Worrall (2016)	570 agencies	All agencies that appear in both UCR clearance data and LEMAS data for the dates examined	2000-2012	Trajectory analysis, multinomial logistic regression	Violent and property crime clearance rates (including cleared by arrest and exceptionally)	NO	N/A	NO	YES	NO (as implied by resources spent on investigators)

(Continues)

TABLE 1 (Continued)

Citation	Sample size (cases = homicide)	How was sample and agency selected	Time period studied	Research method	Outcome being explained	Case-level crime event data analyzed	Source of case-level data	Investigative effort analyzed	Agency data analyzed	Does the study find overall that investigative or organizational efforts matter?
Carter and Carter (2016)	7 agencies	Seven agencies with at least 24 homicides in 2011 and clearance rates of 80% or higher	2011	Case study	High clearance rate	NO	N/A	YES	YES	YES (as measured by agency's community partnerships, reliance on crime analysis, organizational cooperation, staffing, training, expertise)

(Continues)

TABLE 1 (Continued)

Citation	Sample size (cases = homicide)	How was sample and agency selected	Time period studied	Research method	Outcome being explained	Case-level crime event data analyzed	Source of case-level data	Investigative effort analyzed	Agency data analyzed	Does the study find overall that investigative or organizational efforts matter?
Roberts and Roberts (2016)	122,734 violent crimes; 107 agencies	All serious violent crime (homicide, forcible sexual offense, robbery, and aggravated assault) incidents in NIBRS participating agencies in 2007 with populations greater than 50,000	2007	multilevel survival analysis	Time to case clearance as defined by cleared by arrest or exception	YES	National homicide database (NIBRS)	MAYBE (implied with proxy)	YES	IMPLIED (as measured by workload)
Fallik (2017)	184 investigators; 564 index crimes	Detectives volunteered to participate; agency selected by convenience	2013	Logistic regression	Suspect arrest	YES	Agency case files	YES	NO	YES (but investigative effort matters more for known suspects); NO (time performing activities)

(Continues)

TABLE 1 (Continued)

Citation	Sample size (cases = homicide)	How was sample and agency selected	Time period studied	Research method	Outcome being explained	Case-level crime event data analyzed	Source of case-level data	Investigative effort analyzed	Agency data analyzed	Does the study find overall that investigative or organizational efforts matter?
Braga and Dusseault (2018)	465 cases	All homicides cases (victimizations) that occurred for the dates examined; agency selected by convenience	2007-2014	Quasi-experimental evaluation,	Case clearance, defined as cleared by arrest or exception	YES	Agency case files and data	YES	NO	YES (as measured by investigative improvements for cases)

involved. In these studies, with important temporal and environmental caveats, researchers mostly found that the probability of clearing homicide cases tends to be higher for female and very young victims, as well as in cases in which a firearm is *not* used. Furthermore, cases are more likely to be cleared when circumstances and motives are expressive and domestic related rather than gang or drug related; when victims and offenders know each other; when the homicide occurs indoors; when the homicide occurs with concomitant crime circumstances; or when the circumstances of the homicide are known. Examples of contrary findings were reported by Roberts (2007) and, to some extent, by Regoeczi et al. (2008). The evidence is mixed as to the impact that the race of the victim has on case clearance, which like gender and age may be moderated by many factors.

Second, when investigative effort and processes associated with specific homicide cases were collected (13 of the 46 studies, and maybe three additional studies if we allow for proxy measures of investigative effort), only three (Carter & Carter, 2016; Keel et al., 2009; Maguire et al., 2010) also included agency characteristics from the jurisdictions where cases occurred. In a more holistic model, linking agency characteristics related to investigation efforts that are present in specific cases provides a more complete understanding of the role of organizational factors in investigations. Carter and Carter (2016), for example, pooled together findings from qualitative studies of seven agencies with high clearance rates. They concluded that agencies with high clearance rates also seemed to have solid community relationships; used crime and intelligence analysis; had an organizational ethos of collaboration and cooperation (especially with patrol officers); and had good staffing, training, and expertise. Keel et al. (2009), in a survey of 81 agencies, concluded that formal training and general investigative effectiveness across crime types were positively associated with higher case closures of agencies, whereas lack of witness protection programs and the lack of a necessity to consult with prosecutors before executing searches were associated with lower homicide clearance rates. Although not a comparison with other agencies, Maguire et al. (2010), in their case study of investigations in Trinidad and Tobago, seemed to indicate that both external and internal organizational problems limited investigative effectiveness in solving homicides. Even though these study findings provide a framework for a more complete understanding of the determinants of homicide clearance from an organizational standpoint, however, they do not include information on homicide cases themselves, so it is unclear whether organizational factors matter above and beyond case-level factors.

Although the results of these studies indicate that investigative efforts may matter as much as the attributes of the crime in case clearance, few scholars have identified specific attributes of investigations and have tended to rely on proxies measured by aggregate features of agencies. For example, Cloniger and Sartorius (1979) concluded that small increases in enforcement efforts, as measured by expenditures and number of officers, did not affect clearance rates. More recently, Worrall (2016), using group-based trajectory analysis, found a strong relationship between changes in agency spending per investigator and the long-term clearance rate trends of an agency. Some researchers have estimated the "workload" of officers (and investigators) of agencies as a proxy measure for investigative effort (i.e., the greater the workload per officer, the less time spent on any given case). Cordner (1989) and Ousey and Lee (2010) have also argued that workload or number of officers in an agency is not associated with clearance. Furthermore, Marché (1994) has asserted that proxy measures of workload and experience do matter to cases being resolved. On the other hand, Roberts and Roberts (2016) have found that higher long- and short-term workloads are associated with the reduced chance of a case being cleared. The use of proxy measures for investigative efforts, however, weakens the ability for these study findings to demonstrate the role that investigative efforts have on the clearance of specific cases, and it is overshadowed by the stronger evidence from research on case files that seem to indicate that investigator efforts may matter after all.

Another reason for the absence of a fuller model of the determinants of homicide case clearance has to do with the source of data used for research studies. Understanding the influence of investigator efforts on case clearance requires more than just agency-level proxy measures of investigator efforts. Actual case files are needed to determine what types of activities and actions investigators took in relation to elements of the crime (we note that even case files may not provide all information on investigator actions). Although seemingly many of these studies (37) seem to collect information at the homicide case level, only 12 of these studies (Armstrong et al., 2013; Braga & Dusseault, 2018; Decker, 1995; Fallik, 2017; Greenwood et al., 1975; Hawk, 2015; McEwen & Regoeczi, 2015; Regoeczi & Jarvis, 2011; Rydberg & Pizarro, 2014; Schroeder & White, 2009; Wellford & Cronin, 1999 [see also Alexander, 2012, using Wellford and Cronin's data]) seem to have had access to actual homicide case files to be able discern investigative effort and event information more precisely. Investigative case files are distinguished from electronic or standardized databases such as the Federal Bureau of Investigation's Supplemental Homicide Reports (SHR) or the National Incident-Based Reporting System (NIBRS), or agency-specific computerized data such as the Chicago Homicide data, which includes limited information about homicide events. Researchers who can access actual homicide case files are more likely to be able to measure investigator effort or investigative process information.

The findings from the 11 studies in which actual case files were examined and in which information about investigative effort or processes were collected[3] indicate that police do matter to case clearance. Abrahams et al. (2011) and Wellford and Cronin (1999) both found that investigator response and securing that initial crime scene are important factors in homicide clearance. Research results produced by Alexander (2012), Braga and Dusseault (2018), Hawk (2015), Wellford and Cronin (1999), and to some extent Schroeder and White (2009) and Mouzos and Muller (2001) indicate that specific investigative efforts related to seeking search warrants, collecting more evidence, developing cooperative witnesses, better documentation, or accessing information, as well as investigator competency and workload, may increase the likelihood of case clearance. In other studies, scholars found that investigative effort can be especially useful in certain types of cases. For example, Fallik (2017) reported that the influence of investigative efforts can vary by whether suspects are known, with efforts spent on known suspects producing more positive clearance results. Schroeder and White (2009) determined that some investigative activities can be fruitful to case clearances such as following up on leads or running computer checks, although they and Abrahams et al. (2011) were more skeptical about the role that forensics analysis efforts play on case clearance. Hsu (2007), in a purely agency-level analysis, discovered that an agency's proportion of investigators and computer use is associated with homicide clearance rates generally, but this is contingent on whether an agency has high, medium, or low clearance rates. In sum, in the existing research in which aspects of police investigative efforts are directly measured, researchers have found significant impacts of those efforts on homicide clearances. One limitation of these studies, however, is that they are not designed to examine whether such factors may be dependent on particular agency policies and practices. Nonetheless, their findings do indicate that factors beyond aspects of homicide cases themselves contribute to case clearance. Cautious but optimistic findings were also discovered in a systematic review of the broader investigative literature by Higginson, Eggins, and Mazerolle (2017).

Finally, in only four other studies besides Greenwood et al. (1975) were homicide case file data from multiple agencies analyzed within the context of agency-level information. Of the four studies in which both case-level and agency level information were collected (see Lee, 2005; Marché, 1994; Roberts, 2014; Roberts & Roberts, 2016), in none of these studies was information on investigative effort or processes related to the cases collected. Roberts and Roberts (2016) could be considered an exception, as they included a proxy measure—the ratio of cases to sworn officers—to estimate within-agency

daily estimates of investigative workload. They did not, however, directly examine the contribution of specific investigative efforts to individual cases.

In sum, although aspects of a homicide will always matter to its solvability, the totality of the research seems to indicate that investigative effort and to some extent organizational best practices can also make a difference in whether a homicide is resolved. Without research in which all three potential factors of homicide clearance—case elements, investigative effort, and process, and organizational context that may shape those efforts—are simultaneously examined, we are limited in understanding the role that police agencies have on homicide clearances. In this study, we use the fuller model of case clearance suggested by Greenwood et al. (1975) in their original RAND study to explore these issues.

2 | DATA AND METHOD

To remedy this research gap, we collectively examine how attributes of homicide cases, investigative effort within those cases, and agency characteristics related to those investigations contribute to homicide clearance. Achieving this analysis requires sampling homicide case files to collect specific information about the crime, as well as about the investigative effort devoted to solving that crime. Those cases would also need to come from multiple agencies in which organizational information specific to investigations would have to be collected and then incorporated into the analytic model. Thus, we conducted our study in three phases. The first phase involved systematically understanding and identifying long-term clearance rate "trajectories" of the largest 100 agencies in the United States. In the second phase of our study, we systematically selected a sample of agencies based on that trajectory analysis for in-depth case studies. The final stage of our project involved randomly sampling open and closed cases from those selected agencies to understand the crime-related and investigative processes for each case and its relationship to broader organizational factors.

In the first phase of our analysis, we carried out a trajectory analysis of case clearances for homicide, robbery, aggravated assault, and burglary to understand the long-term clearance rate trends of large U.S. agencies. We report the findings from that analysis in Scott, Wellford, Lum, and Vovak (2019; see also Lum, Wellford, Scott, & Vovak, 2016). Using data derived from the "Offenses Known and Clearances by Arrest" summary data as reported to the Federal Bureau of Investigation (FBI) Uniform Crime Reports (UCR) program, we created yearly clearance rate trends from 1981 to 2013 for the 100 largest agencies in the United States for homicide, robbery, aggravated assault, and burglary. We employed a common definition of "clearance" used in the literature reviewed earlier because our data came from the UCR—cleared by arrest and exception.[4] During this period, the average homicide clearance rate trends for this group of agencies declined slightly over time, from approximately 75% to 80% clearance in the 1980s to slightly less than 70% in the 2000s. Similarly, clearance rates for aggravated assaults declined from 60% to 50% during this period, while clearance rates for robbery and burglary remained stable over time, at 30% and 10% to 15%, respectively.

Using a trajectory analysis (see Nagin, 2005; Nagin & Land, 1993), we found that for the largest 92 agencies with available data, the slightly declining national clearance rate trends over time masked significant between-agency variations. Figure 1 shows the trajectory results for homicide clearance rates[5] and indicates that approximately 21% of these agencies seem to have consistently high and increasing homicide clearance rates ("high increasers"); 40% show declines from 80% to 60% during this time period ("high decreasers"); 21% of these agencies had already low clearance rates in 1981 and who got worse over time ("low decreasers"); and 19% of initially low-performing agencies seemed to increase their ability to clear homicides over time ("low increasers").

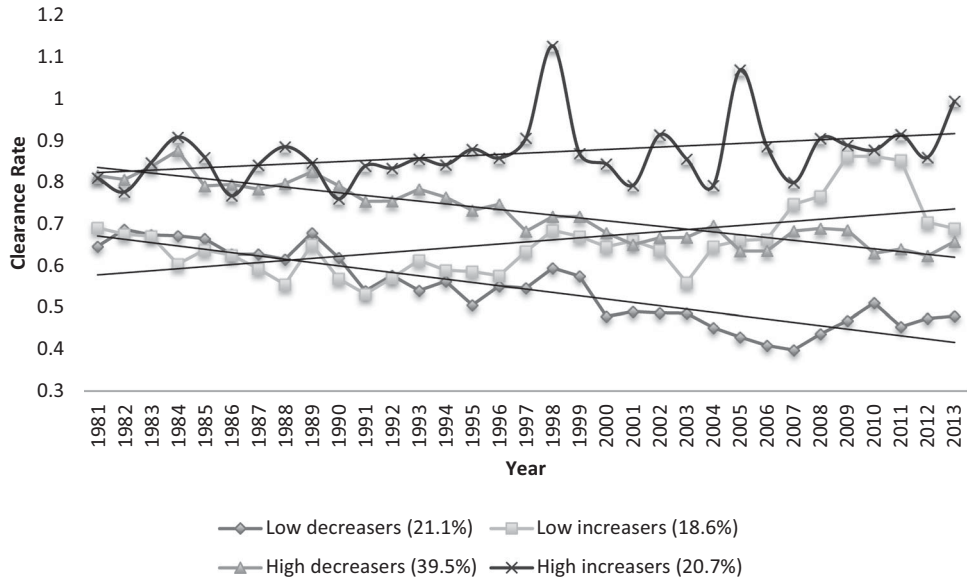

FIGURE 1 Trajectories of homicide clearances ($N = 92$) (as reported in Scott et al., 2019)

Why do some agencies have very high crime clearance rates over time while others are consistently low? To explore this question, we used the trajectory analysis to select eight agencies[6] for in-depth case studies during the second phase of our study. Specifically, we took a "most-different" case study approach (see Przeworski & Teune, 1970) by identifying four agencies that consistently performed much higher than national averages with regard to their long-term clearance rates for homicide, robbery, aggravated assault, and burglary, and four agencies who performed much lower than national averages. Doing so across all crime types (rather than just for homicide) was purposeful. To measure agency-level effects, we were interested in finding agencies that showed consistent achievement in crime clearance, not just in a crime like homicide in which a great amount of resources is normally spent. To achieve this selection, we used three different approaches[7] to rank-order all of the agencies from our original large agency sample based on their trajectory groupings across the four crimes examined. Our results across these three different approaches were highly consistent and provided us with confidence in demonstrating which agencies fell into low and high clearances rate trends across the four crime types for each agency.

Once these rankings were created, we then began contacting the agencies at the extreme ends of our list.[8] These were agencies that had the highest clearance rate trajectories over long periods of time across our four crime types, as well as those with the lowest long-term clearance rate trajectories (in each case, the homicide clearances for these agencies mirrored their placement based on all four offenses). If agencies were tied with each other as to their rankings, the principal investigators reached out to the agencies in which they had a contact. After this process, we were able to secure cooperation from the three agencies tied at the lowest performing agency rank, and a fourth at the second lowest rank (among 92 agencies). We were also able to secure two of the highest performing agencies (six agencies were tied at the first rank) and two agencies in the second highest ranking (four agencies were tied in this second rank).

The eight agencies selected come from large agencies with between an estimated 500 and 3,000 officers. They are geographically dispersed and do not cluster in any particular region in the United States. The populations of these eight cities range from approximately 250,000 to 1 million and are

often diverse, some with proportions of non-White populations of greater than 50%. Although all of the agencies have hierarchical ranks and structures, they vary regarding where investigative units are located within the organization. These agencies also have varying rates of serious crime.

After receiving cooperation from each of the eight selected agencies, we then carried out 2- to 3-day site visits with each agency. During each site visit, we interviewed multiple people and groups involved in investigations in the agency to understand agency investigative practices better. These individuals included high-ranking commanders overseeing investigations generally; commanding officers of investigative units, overseeing the investigation of homicide, robbery, aggravated assaults, and burglary; shift commanders or supervisors involved in the direct supervision of investigators for each of our crime types; detectives who investigate homicide, robbery, aggravated assaults, and burglaries; patrol supervisors who would understand the relationship and requirements of patrol for investigations of homicide, robbery, burglary, and aggravated assaults; and individuals from investigative support services such as crime scene investigators, crime analysts, forensics officers, and other personnel from units that provide regular investigative support services.

The interview instruments we used are available online.[9] To create these instruments, the research team relied heavily on both prior literature on investigations and clearances as well as on team member experience in investigative research and practice. The research team also included three subject matter experts who have extensive law enforcement and investigative experience to develop and review the interview and focus group instruments, and who sometimes helped to conduct the interviews.[10] The interview instruments were specific to the rank, role, and unit of the interviewees, and the questions could be generally grouped into five themes. These themes are frequently used in the analysis of police agencies, especially of their investigative functions (e.g., Carter, 2013; Police Executive Research Forum, 2018). We suggest using them in the analysis of any of the trajectories or patterns of clearance for any offense.

1. *Organizational Structures:* This includes the overall structure of the organization and where detective units are positioned in that structure; the division of labor; the connectivity of detectives to other units; the infrastructure for information sharing with other units and with patrol; and the resources given to investigations.
2. *Leadership and Resources:* This theme includes the leadership, supervision, and accountability of investigators; the performance measures and expectations set for detectives and how they are used; and how detective resources are deployed and prioritized.
3. *Selection, Training, and Performance Review:* This theme includes questions about how investigators and their supervisors are selected and trained (including requirements to become a detective); whether they receive special pay and incentives to be a detective; and how investigators and supervisors are evaluated and reviewed (and whether they can be removed for poor performance).
4. *Case Assignment and the Investigative Process:* We also asked detailed questions about investigative processes including how cases are initially assigned to investigations; whether agencies have formal processes for investigations; the activities at the initial crime scene; the initial response of investigators; their subsequent investigative process including interviews; support from other units (e.g., forensics and intelligence); technologies or other innovative tools used in investigations; the relationship with the state's attorney/prosecutor's office; and whether victim and witness services are available. For homicide specifically, questions about handling cold cases were asked.
5. *Community Interaction:* We also probed agencies about the extent to which investigative units engaged with the community in any way. This could include the use of social media to provide

information on cases; engaging with community groups to strengthen cooperation or involvement in investigations; or other specific initiatives.

In total, we interviewed 155 individuals across the eight departments during our visits (the specific breakdown of these interviews for each agency is provided in Appendix A). For each visit, interviews were conducted by a principal investigator and at least one research assistant. In some cases, a subject matter expert was also present, which allowed for all interviews to be conducted and detailed notes to be typed simultaneously in most cases. The usually hour-long interviews were conducted in semi-structured style. Once all of the interviews (and any necessary follow-ups) were completed, we then took the detailed written notes from the interviews and numerically coded findings according to our themes.[11] This coding was done by senior members of the research team who have had extensive involvement in agency studies and police research.

The findings from our analysis of our interview coding revealed qualitative differences between high- and low-performing agencies with regard to their investigative practices. Higher performing agencies tended to have more structured oversight between units; stronger management and leadership practices; better relationships between investigative units and between those units and patrol; greater likelihood of responding to cases quickly, conducting follow-ups, and having standard operating procedures for their investigations; investigators with more specialized experience, training, and positive attitudes toward their jobs; more support for investigative units; and better relationships with the community. We then used the coded data from these interviews to build an organizational "best practices" scale into our clearance models.

Following the conceptual model of Greenwood and colleagues (1975), we then examined individual investigative case files within high- and low-performing agencies to determine whether differences between high and low performers might be revealed in the processes of specific investigations for each agency. Toward this goal, for the third phase of our project, we obtained permission from seven of the eight agencies we visited to randomly sample and examine open and closed homicide case files from 2014 cases.[12] Four of these agencies were high performing and three were low performing. We choose the year 2014 to ensure that most cases either had enough time to be resolved or that they were no longer being investigated. Our sampling framework was specific to each crime type. Because homicides are rarer compared with robberies, assaults, and burglaries, we sampled all homicides in the provided year if the agency had 50 or fewer homicides. For agencies with more than 50 homicides, a random sample of 50 homicides was taken. One agency had slightly more than 50 homicide cases in 2014; in which case, we examined all homicides for that agency. This resulted in a total of 242 homicide cases sampled from the seven cities.

Coding was carried out by senior members of the research project along with trained advanced graduate students. All coding was done in a group setting to encourage discussion of ambiguous and missing elements. Multiple elements of each case were coded, including aspects of the crime as well as information about investigative effort and processes undertaken for each homicide.[13] As with the interview instruments, the selection of these variables was heavily influenced by previous case analysis research as described in Table 1, specifically the work of Wellford and Cronin (1999) and Carter (2013), as well as by subject matter expertise. Specific variables selected for inclusion in the analysis were those identified in this research as potentially impacting clearance. Unfortunately, we were not able to interview specific detectives about their efforts on each homicide case we collected. This limited our ability to refine certain measures of investigative efforts. Often, cases were also missing various elements, and not all elements were used in the analysis that follows. The assumptions we made based on what we were able to collect are discussed in the presentation of the results. Our analysis and interpretation seek to provide the best estimation given these limitations.

3 | RESULTS

Of the 242 homicide cases collected, 238 had enough data to be included in the analysis. The descriptive statistics for all of these covariates are presented in Table 2. We collected 13 variables from each case including whether:

- A gun was used (GUN USED)
- A weapon was recovered (WEAPON RECOVERED)
- Whether law enforcement knew the mode of entry (ENTRY MODE KNOWN)
- The offender was identified at the time of the response (OFFENDER IDENTIFIED)
- The suspect knew the victim (SUSPECT KNOWS VICTIM)
- The victim cooperated (VICTIM COOPERATED)
- The witness(es) had a relationship with the victim (WITNESS RELATED TO VICTIM)
- The witness(es) had a relationship with the suspect (WITNESS RELATED TO SUSPECT)
- The witness(es) cooperated (WITNESS COOPERATED)
- There was identifying information on a suspect's vehicle (SUSPECT VEHICLE IDENTIFIED)
- The crime occurred at a residence (OCCURRED INSIDE RESIDENCE)
- The motive was known to law enforcement (MOTIVE KNOWN)
- There were initial leads regarding a motive (HOMICIDE LEADS)

All of these covariates are binary, and most are self-explanatory.[14] The motive variables (e.g., whether the motive was known or whether initial leads existed), however, deserve further explanation. Although we attempted to collect specific motives for each homicide (i.e., drug, gang, retaliation, or domestic related), our inability to interview detectives who worked on each case and to examine extensive interview materials for each case led us to the conclusion that we did not have enough motive-based information to include a more specific covariate into our model.[15]

We collected an additional 15 factors that described specific activities investigators engaged in during the investigation, such as whether:

- Medical treatment was provided to the victim (VICTIM TREATED)
- Confidential informants came forward with information (CONFIDENTIAL INFORMANTS)
- A large number of police employees, as determined via a median split, responded to the scene (MANY EMPLOYEES RESPONDED)
- A large number of detectives, as determined via a median split, responded to the scene (MANY INVESTIGATORS RESPONDED)
- Physical evidence was collected (PHYSICAL EVIDENCE COLLECTED)
- A victim's statement was obtained (VICTIM STATEMENT OBTAINED)
- An investigative supervisor was present at the initial response (INVESTIGATIVE SUPERVISOR PRESENT)
- A crime scene log was collected (CRIME SCENE LOG)
- A large number of detectives, as determined via a median split, were assigned to a follow-up investigation (MANY INVESTIGATORS FOLLOWUP)
- Investigators followed up with the victim (VICTIM FOLLOWUP)

TABLE 2 Descriptive statistics and logistic regression model results

	Mean (SD)	(a) Model 1 *Case information only* Odds Ratio (RSE)	(b) Model 2 *Case information, and organizational best practices scale* Odds Ratio (RSE)	(c) Model 3 *Case information, organizational scale, and interaction terms* Odds Ratio (RSE)
Information about the Homicide				
GUN USED	0.80 (0.40)	1.626 (0.583)	1.329 (0.465)	1.171 (0.47)
WEAPON RECOVERED	0.34 (0.48)	14.685 (11.311)***	18.110 (17.038)**	19.378 (18.234)**
ENTRY MODE KNOWN	0.68 (0.47)	0.873 (0.475)	1.191 (1.054)	1.492 (1.149)
OFFENDER IDENTIFIED	0.34 (0.47)	8.035 (3.694)***	8.945 (4.573)***	18.039 (14.827)***
SUSPECT KNOWS VICTIM	0.51 (0.50)	24.558 (15.59)***	40.214 (29.481)***	46.123 (30.937)***
VICTIM COOP-ERATED	0.06 (0.24)	0.016 (0.021)**	0.002 (0.003)***	0.001 (0.01)***
WITNESS RELATED TO VICTIM	0.59 (0.49)	0.371 (0.267)	0.265 (0.239)	0.255 (0.263)
WITNESS RELATED TO SUSPECT	0.34 (0.48)	1.062 (0.612)	0.875 (0.653)	0.785 (0.633)
WITNESS COOPER-ATED	0.81 (0.40)	5.793 (3.021)**	8.552 (6.453)**	11.567 (11.663)*
SUSPECT VEHICLE IDENTIFIED	0.38 (0.49)	0.291 (0.255)	0.412 (0.442)	0.4 (0.42)
OCCURRED INSIDE RESIDENCE	0.33 (0.47)	0.809 (0.362)	1.009 (0.463)	1.039 (0.549)
MOTIVE KNOWN	0.57 (0.50)	1.030 (0.766)	1.184 (0.789)	1.172 (0.833)
HOMICIDE LEADS	0.51 (0.50)	6.151 (3.427)**	7.61 (4.347)***	9.186 (4.57)***
Information about the Investigation				
VICTIM TREATED	0.49 (0.50)	0.608 (0.311)	0.297 (0.19)*	0.257 (0.159)*
CONFIDENTIAL INFOR-MANTS	0.11 (0.31)	2.240 (2.00)	2.390 (2.086)	2.198 (2.033)

(Continues)

TABLE 2 (Continued)

	Mean (SD)	(a) Model 1 *Case information only* Odds Ratio (RSE)	(b) Model 2 *Case information, and organizational best practices scale* Odds Ratio (RSE)	(c) Model 3 *Case information, organizational scale, and interaction terms* Odds Ratio (RSE)
MANY EMPLOYEES RESPONDED	0.46 (0.50)	2.242 (1.211)*	2.650 (1.178)*	1.902 (1.865)
MANY INVESTIGATORS RESPONDED	0.43 (0.50)	3.395 (1.914)*	6.996 (4.032)**	71.723 (97.823)**
PHYSICAL EVIDENCE COLLECTED	0.90 (0.30)	0.694 (0.782)	1.062 (0.977)	0.794 (0.892)
VICTIM STATEMENT OBTAINED	0.08 (0.28)	3.103 (3.511)	3.421 (3.246)	3.398 (2.8)
INVESTIGATIVE SUPERVISOR PRESENT	0.71 (0.45)	0.475 (0.273)	0.205 (0.137)*	0.134 (0.078)**
CRIME SCENE LOG	0.59 (0.49)	0.764 (0.454)	0.105 (0.035)***	0.109 (0.027)***
MANY INVESTIGATORS FOLLOWUP	0.25 (0.44)	0.666 (0.38)	0.174 (0.114)**	0.228 (0.156)*
VICTIM FOLLOWUP	0.06 (0.24)	3.966 (7.272)	20.143 (45.798)	23.91 (50.233)
WITNESS FOLLOWUP	0.70 (0.46)	0.285 (0.096)***	0.146 (0.085)**	0.197 (0.163)*
ADDITIONAL EVIDENCE AND TECH	0.42 (0.49)	1.092 (0.634)	2.889 (1.661)*	2.943 (1.592)*
SPECIALIZED UNIT ASSISTED	0.63 (0.48)	1.734 (1.01)	2.589 (1.484)*	2.204 (1.097)
SOCIAL MEDIA USED	0.26 (0.44)	1.101 (0.401)	0.805 (0.366)	0.997 (0.455)
CELLPHONE INVESTIGATED	0.58 (0.50)	0.473 (0.359)	0.128 (0.144)*	0.109 (0.116)*
Organizational best practices scale				
ORGANIZATIONAL BEST PRACTICES	5.0 (3.2)		1.951 (0.302)***	2.802 (0.387)***

(Continues)

TABLE 2 (Continued)

	Mean (SD)	(a) Model 1 *Case information only* Odds Ratio (RSE)	(b) Model 2 *Case information, and organizational best practices scale* Odds Ratio (RSE)	(c) Model 3 *Case information, organizational scale, and interaction terms* Odds Ratio (RSE)
ORG*MANY EMPLOYEES RESPONDED				1.072 (0.246)
ORG*MANY INVESTIGATORS RESPONDED				0.623 (0.137)*
ORG*WITNESS FOLLOWUP				0.885 (0.082)
Constant		0.133 (0.135)***	0.020 (0.015)***	0.007 (0.009)***
Number of observations		238	238	238
Log Pseudolikelihood		−73.853171	−63.316527	−60.709981
McFadden's Pseudo R^2		0.5290	0.5962	0.6128

Notes. RSE = robust standard error. All minimum and maximums for each variable are 0 and 1, respectively, except for "ORGANIZATIONAL BEST PRACTICES" whose minimum and maximum are 1 and 12, respectively.
*$p < .10$. **$p < .01$. ***$p < .001$.

- Investigators followed up with any witnesses (WITNESS FOLLOWUP)
- Additional evidence or technologies were used later in the investigation (ADDITIONAL EVIDENCE AND TECH)
- A specialized unit provided help with the investigation (SPECIALIZED UNIT ASSISTED)
- Social media was used in the investigation (SOCIAL MEDIA USED)
- A cell phone was investigated (CELLPHONE INVESTIGATED)[16]

Again, these covariates are binary, and most are self-explanatory. It should be noted, however, that although measuring effort using dichotomous variables may be more efficient given the complex nature of quantifying investigative processes, doing so may not be able to capture the qualitative nature of these investigative efforts. For example, PHYSICAL EVIDENCE COLLECTED can include a wide range of evidence collected and at various stages of the investigation. We emphasize that more physical evidence may not equate to "better" evidence in terms of the quality of meaning of that evidence for case clearance. Another example is the variable ADDITIONAL EVIDENCE AND TECH, which does not specify the broad range of technologies and additional evidence that might be used in an investigation. The challenge of understanding the quality of different investigative efforts and processes is also present in even the more self-explanatory variables. For example, INVESTIGATIVE SUPERVISOR PRESENT does not indicate that the specific actions an investigative supervisor took at the scene or the qualifications or quality of that supervisor's response. Again, given the scope of this study and our

inability to interview the specific detectives responsible for each case folder, these qualitative details were not able to be collected. We discuss the implications of these limitations in the Conclusion section.

The overall clearance rate across all cases examined was 63%.[17] Using logistic regression, we first regressed case status (opened = 0, closed = 1) on these 28 covariates (see Table 2(a), Model 1). We clustered standard errors by agency to correct for heteroscedasticity in general and statistical dependence within the departments.

First, note the strong model fit (McFadden's Pseudo R^2 = .53, which indicates that the covariates explain a substantial share of the variation in the probability that a homicide case is cleared.[18] Because of our small sample size, we used the more liberal standard of 0.1 or below as our measure of statistical significance. Most of the covariates identified as significant have values less than 0.01. For example, the first significant coefficient shown in Table 2 is for whether a weapon was recovered (WEAPON RECOVERED). The odds ratio (OR) is 14.69, which indicates that recovering a weapon is associated with an increase in the odds of clearing a case by 1,368% holding all the other covariates constant. In terms of marginal effects, recovering a weapon increased the predicted probability of clearing a homicide by 32% with all other covariates held at their mean values. Specifically, compared with the 0.82 predicted probability of solving a homicide with all covariates at their mean values, the predicted probability of solving a homicide was equal to 0.64 when a weapon was not recovered and 0.96 when a weapon was recovered.

Next, if the offender was identified at the time of the response, the odds of clearing the case increase by more than 700% net the other covariates. In terms of marginal effects, with all other covariates at their mean values, the predicted probability of solving a homicide changed from 0.69 if an offender was not identified immediately to 0.95 if an offender was identified immediately. For homicide cases where the suspect knew the victim, the odds of clearing the case increased by 2,356%. The predicted probability of clearing the case increased from 0.47 when the suspect did not know the victim to 0.96 when the suspect knew the victim, holding all other measures at their means. Solving a homicide was 480% more likely when a witness cooperated holding all other factors constant. Witness cooperation increased the probability of closing a homicide by 34 percentage points. The presence of an initial lead regarding the motive increased the chance of solving the case by 515% or, in terms of marginal effects, raised the chance of solving the case by 27.6 percentage points. These findings are consistent with previous research. Interestingly, for those few cases where the victim survived long enough to cooperate (n = 14), the odds of solving the murder went down by 98%.

The regression coefficient for MANY EMPLOYEES RESPONDED shows that when many law enforcement employees (officers, detectives, support personnel) responded to the scene (in terms of the median number), the chance that the homicide was solved increased by 142%. The odds of solving the homicide were even higher when many investigators responded to the scene as this increased the odds of solving the homicide by 239%. Both of these factors may indicate that when more human resources are given to a homicide investigation, the likelihood of its clearance is greater, shifting the marginal probability from 0.75 to 0.88 and from 0.73 to 0.90 when many officers or investigators were assigned to the case. The last significant variable in the model is for whether or not the detective followed up with witnesses. The odds ratio suggests that following up with a witness was associated with a 71.5% decrease in the odds of solving the murder, net all other factors. The predicted probability of clearing a homicide decreased from 0.92 when investigator(s) did not contact witness(es) during a follow-up investigation to 0.76 when investigator(s) made contact, holding covariates at their means. The lack of witness cooperation may indicate the case is more difficult to solve, but it also points more generally to the fact that clearance is not best understood in terms of individual factors. Instead, clearance is understood by considering the full characteristics of the case and the investigation.

We then linked the rich organizational data collected from our interviews and focus groups of the eight agencies to the individual-level data, specifically for homicide investigations for these seven agencies. Using the results of our qualitative analysis, we selected the following "best practices" indicators for agencies in which to create our score for each agency based on whether:

- The homicide unit is centralized
- The oversight structure for homicide investigations is highly structured
- The homicide unit shares information often with other investigative units
- The homicide unit routinely shares information with patrol
- Patrol officers have a formal method of providing information to detectives
- There is a good relationship between patrol units and the homicide unit
- The homicide unit routinely shares information with other investigative units
- Leadership meets with the homicide unit on a weekly basis
- Leadership–homicide unit meetings are formal management meetings
- Leadership conveys specific clearance goals for the homicide unit
- Any performance measures are used for the homicide unit
- Leadership conveys investigations to be a priority over patrol
- The homicide unit claims to be well resourced

Again, we note that using dichotomous values for each does not always capture the complexities of these variables (which we will explore in a subsequent article). For simplicity in this initial analysis, however, we used these factors to create a 12-point scale for each agency based on its specific responses related to homicide investigations, which is denoted "ORGANIZATIONAL BEST PRACTICES" in Table 2. If the agency's homicide unit seemed from our qualitative analysis to engage in that best practice, it was given a point for that practice. The points were then summed. We then added this scale to the homicide case-level regression presented earlier in Table 2(a). The results of this new regression are shown in Table 2(b) (Model 2). As with previous analyses, we clustered standard errors by the agency to correct for heteroscedasticity in general and statistical dependence within the departments.

Table 2(b) shows that the direct effect of organizational best practices on case status is positive and statistically significant. In other words, homicide cases that we examined were more likely to be cleared if they were within organizations that have more of the best practices when it comes to homicide investigations. Treating this variable as continuous, the odds ratio indicates that for each one-unit increase in the number of organizational best practices a department adheres to, there is a 95% increase in the likelihood of solving a homicide. Additionally, a likelihood ratio test indicates a distributed chi-squared statistic of 21.073, with 1 degree of freedom. Thus, the addition of the organizational best practices scale in Model 2 results in a significantly better fit ($p < .001$) than without including organizational context in Model 1.

When looking at the other coefficients, one can interpret them as we did earlier, but now each relationship is estimated holding the agency's value on the organizational scale constant. Compared with Model 1 in which nine significant effects predicted case closure, seven additional variables significantly predict the case status outcome. The new results reveal that holding organizational best practices constant, the odds of solving a homicide go down by 70% when medical treatment is provided to a victim.[19] Having an investigative supervisor present during the initial response, collecting a crime log, and

having many investigators (more than the median) assigned to investigate the case all *reduced* the odds that a homicide was solved. Thus, it may matter more that an organization has good investigative practices than whether any of these specific activities were undertaken. Or, because these relationships are not causal, it could be the case that harder-to-resolve cases require more investigators or the presence of a supervisor. If additional evidence or technologies were used later in the investigation, the odds of solving the homicide increased by 189%. As mentioned, however, this dichotomous variable may not capture the quality of that additional evidence or the extent or types of technologies that were used. Tests of specific technologies would be needed to understand better their impact of investigations (see, for example, Koper & Lum, in press). If a specialized unit assisted with the investigation, the odds of solving the case increased by 159%, possibly suggesting that added resources to an investigation can be helpful in resolving homicide cases. Finally, cases where a cell phone was investigated were 87% less likely to be closed, a result that further demonstrates the fact that these findings may be correlational and not causal.

Investigations occur within organizations and as such are influenced by the policies and practices of those organizations. For example, if an agency requires full collaboration throughout an investigation, the number of detectives and others at a crime scene will be larger than in an agency that only requires the lead and secondary detective to be at the scene. The more structured the investigative resources and policies of an agency, the more they will impact investigations practices and clearance. To explore this aspect of the factors influencing clearance, we present a further exploratory analysis with homicide in Model 3 of Table 2(c). Here, we created three cross-level interactions between the organizational best practices scale and the investigative predictors of whether many employees went to the scene (MANY EMPLOYEES RESPONDED), whether many investigators went to the scene (MANY INVESTIGATORS RESPONDED), and whether investigators followed up with any witnesses (WITNESS FOLLOWUP). These three case-level measures were the only statistically significant investigative effort predictors of case resolution in the early homicide model shown in Table 2(a). We hypothesized that the organizational best practices of the homicide unit might moderate the effects of these indicators of case-level effort on case resolution, although the expected direction of these cross-level interactions was unclear. It could be that agencies that follow best practices regarding how their homicide unit is organized receive more returns for the effort they put into solving murders. It could also be, however, that adhering to more organizational best practices provides its benefits regarding case resolution (see previous results), thereby weakening the marginal returns of exerting more effort to solve a case. For this reason, we included these interactions as part of an exploratory effort to see whether case-level and agency-level features interact to predict the successful resolution of a homicide.

Including interaction terms only slightly improved the fit of our model from that presented in Table 2(b). The likelihood ratio test indicates that the change in McFadden's Pseudo R^2 results in a distributed chi-squared statistic of 5.213 (3 degrees of freedom), which is a nonsignificant improvement in fit. The only statistically significant cross-level interaction occurred between the organizational best practices scale and the number of investigators that went to the scene. The odds ratio for this interaction is below 1, which indicates that the positive effect of having many investigators go to the scene on solving a homicide is reduced when the homicide unit follows more best practices as an organization. For those departments that follow fewer best organizational practices, it is more important to send a larger number of investigators to the scene of the homicide. Although this analysis is exploratory, this finding could occur because organizations that have better practices and stronger homicide investigative processes may not need as many investigators as a result of the strong support from patrol, support units, and supervisors.

4 | DISCUSSION AND CONCLUSION

Since Greenwood and colleague's (1975) RAND study, a belief among police scholars and perhaps police agencies themselves has persisted: that the work of investigators may not necessarily matter in clearing serious crimes. Rather, certain elements of the crime contribute to whether a crime will be cleared. In our site visits, we found some of these beliefs to be institutionalized into investigative practices of other serious crimes as well. For example, supervisors in some agencies (often low-performing ones) triaged cases for investigative effort based loosely on beliefs about a crime's solvability. Our findings here suggest these beliefs and practices may not be evidence based, at least not for homicide cases and likely not for other types of crimes, as we show elsewhere. By using a research design based on the more holistic conceptual model laid out initially by Greenwood et al., we found that the police can and do matter with regard to case clearance. Case clearances are not only determined by the nature of the crime itself but also by detective effort as well as by the organizational best practices associated with investigations. What individual detectives do for each case investigation and the more general organizational practices that a detective operates in both can make the difference in whether a case is solved.

By using a more complete conceptual model, our research findings extend those of previous investigative studies. For example, the results of our initial trajectory analysis provide a systematic and empirical foundation for selecting our agencies for this in-depth analysis, rather than using convenience sampling often employed by researchers in prior studies. Our data collection and coding were also highly structured activities. As a result, we were better positioned than researchers in previous studies to use our case studies to examine organizational differences between agencies that do poorly with regard to crime clearance and those that do exceptionally well. Finally, linking actual homicide cases and their specific elements of both the crime as well as the investigative effort that went into the crime, adds to our holistic approach, making this study one of the few, if any, in which an attempt was made to test Greenwood et al.'s (1975) complete model.

Using this systematic analysis, we found that investigative effort and organizational best practices do matter to clearing individual homicide cases in addition to specific aspects of the crime (i.e., whether the victim and offender knew each other, the offender was identified, or the weapon was recovered). Specifically, the probability of a case being cleared can depend on when investigators are successful at getting witnesses to cooperate and when a greater number of agency employees respond to the scene, especially when more investigators respond as well as when investigative supervisors are present at the scene. These factors remained significant even when controlling for the amount of investigative best practices that the agency engaged in. The number of agency-level best practices for homicide investigations also was associated positively associated with whether cases are more likely to be cleared. These best practices can include homicide units having good cooperation and information flow with other investigative units and with patrol; setting performance metrics and goals; strengthening investigative experience, expertise, and training; and having structured oversight, procedures, and supervision. We also discovered from our analysis of interactions between investigative effort and agency best practices that agencies with stronger homicide investigative processes may then not need as many investigators to respond to homicides. This finding may be a result of a higher level of expertise of investigators in agencies with more best practices or with greater support from other units.

Despite these findings, there are also challenges to researching investigations to which we were not immune. Like Greenwood et al. (1975), our study was a large undertaking with multiple components and methods used across eight sites. Although we could connect agency, investigative, and case-level

quantitative and qualitative data, we could not interview detectives assigned to the specific cases we collected about the specific processes and decision-making of their investigations. Doing so could provide more details about the sequential aspects of specific parts of the investigation, as well as greater ranges of values for each of our covariates. For example, as Koper and Lum (in press) have discovered, the use of license plate readers are sometimes deployed at later stages of investigations when all other possible leads and efforts have already been tried. Thus, the use of that technology may be an indication of the difficulty of case resolution, not necessarily of investigative effort. Similarly, easy-to-solve cases may require a different approach by investigators, patrol officers, and supervisors than those that are harder to solve. Such approaches may rely on quantity, speed, and efficiency of various investigative aspects, whereas harder-to-resolve cases might rely more on type and quality. Some scholars have used survival analysis methods to determine the impact of various factors on how long homicide cases take to resolve (see Regoeczi et al., 2008; Roberts, 2007; Roberts & Lyons, 2009). The analysis needed here, however, is not only on the time to resolution but also on the various typologies of investigative efforts for various classifications of the resolution potential of homicide cases. New metrics of investigative efforts beyond those used here should be developed in future studies to advance this work (see Cook, Braga, Turchan, & Barao, 2019, this issue).

Despite the challenges of research on investigations, the findings of this study are important. Just as we now know that police can be effective in preventing crime (see National Academy of Sciences, Engineering, and Medicine, 2017), we now also know that law enforcement agencies can develop evidence-based policies and practices to achieve higher levels of crime clearance. Furthermore, investigative efforts as well as organizational characteristics, net of all other dimensions, add to the explanation of clearance. Thus, in addition to being concerned with investigative policies and practices and the resources devoted to investigations, law enforcement agencies should pay careful attention to organizational structure and policies for investigative units that impact and interact with other explanations of clearance. Specifically, high-performing agencies seem to have such characteristics as structured and active leadership that convey specific clearance goals and performance targets; investigative units that are held accountable by all levels of management; enjoy regular information sharing across all units including patrol; investigative units that are adequately resourced and operate with a team approach; specific training and required experience for all investigators and first-line investigative supervisors; detailed investigative policies, a case management system for investigations, mandatory and regular formal case reviews, checklists for various aspects of the investigation, training for first-responders, and the use of a complete crime scene log system; strong support from intelligence, crime analysis, and digital support; employ an effective witness protection program; and enjoy strong community interactions generally for specific investigations. Of course, assuring that all of these requirements are met and followed must be a critical part of training and management at all levels.

Future research should be aimed at building on these and others findings and research designs to estimate better models of clearance. Replications of the holistic approach we have used with a larger number of agencies would allow for a better estimation of the impact of case, investigative, and organizational factors on clearance, albeit costly and difficult to arrange. Case-level studies should also be designed to consider how to modify the way investigative processes are measured, as discussed earlier. Second, more evaluation research like that in Braga and Dusseault (2018) is needed to determine whether adjustments in investigative effort can improve clearance rates. Research in which a more conceptually complete method of data collection and an evaluation of changes in agencies practices are integrated would help clarify our understanding of the factors leading to the clearance of homicides and other serious crimes and how to improve clearances.

ENDNOTES

[1] The *Murder Accountability Project* was originally developed for the McClatchy newspapers. See http://www.murderdata.org/ for more information.

[2] Many more aspects of each study were collected, but they are not shown here because of space restrictions.

[3] Regoeczi and Jarvis (2011) do study case files but do not collect investigative effort data from those files.

[4] In the UCR program. offenses cleared by arrest or those cleared by exception are not distinguished in counts of clearance, which may lead to overestimating the clearance rate of homicide when using UCR data.

[5] Eight agencies in our 100-agency sample of the largest U.S. agencies did not have enough year-to-year data to include in this trajectory analysis.

[6] The choice of eight agencies was estimated given the available funding for this project.

[7] The three approaches used to rank-order the agencies from highest to lowest performing with regard to clearance rate trends across the four serious crime types were (1) assigning ordinal labels to trajectory groupings from lowest to highest long-term trajectory; (2) assigning probability weights from the trajectory analysis itself to create the ranks; and (3) using multitrajectory modeling techniques to estimate trajectory groups for multiple groups simultaneously (see Scott et al., 2019).

[8] By selecting agencies at the extreme, we are more likely to identify agency-level differences than if we had taken a random sample of the same size of all agencies. We understand that the other trajectories not sampled in this study might be explained by other factors. Although that is a question for future research, for reasons we explain in text, we do not think that is likely.

[9] See http://cebcp.org/wp-content/Investigations/WellfordetalInterviewInstruments.pdf.

[10] The second author also has major crimes investigative experience as a detective in a large jurisdiction.

[11] The coding instrument for the interviews is available at http://cebcp.org/wp-content/Investigations/WellfordetalCodingInterviews.pdf.

[12] We also collected open and closed robbery, aggravated assault, and burglary investigative case file information as well, which will be analyzed in other papers.

[13] The coding instrument for the case files is available at http://cebcp.org/wp-content/Investigations/WellfordetalCodingCases.pdf.

[14] Although we collected information on victim demographics, we did not include these covariates in the reported regressions because their inclusion led to the loss of 20 additional observations and because after running the models without those 20 cases, victim characteristics did not emerge as consistent predictors of case resolution.

[15] We did run tetrachoric correlations between specific motive and clearance and found only one to be significant—self-defense.

[16] For all of the independent variables, we treated missing values and cases where the response was not applicable as equal to zero. Using the witness cooperate covariate as an example, a zero could indicate that either there was no witness to cooperate, there was a witness who did not want to cooperate, or there was a witness who cooperated but the information was not included in the case file for the detective to read. The rational for this is that we cannot discern *why* information was not included. So, for each covariate, the coefficients should technically be interpreted as whether a detective had that information (e.g., knowing a gun was recovered) and not whether the event actually occurred (e.g., a gun was recovered).

[17] Of the closed cases, 83% were cleared by arrest and 17% were exceptionally cleared.

[18] It should be noted that Pseudo R^2 should not interpreted as the R^2 is interpreted in linear regression. McFadden's R^2 should be interpreted as a goodness-of-fit statistic, one that indicates a reduction in error variance, rather than a measure of variance explained. Thus, caution should be exercised in comparing the Pseudo R^2 across different data analyses presented in this article (see Allison, 2014).

[19] Of course, this finding does not mean that withholding medical treatment can increase the chances of a case being solved but that something about the case that led to medical treatment or even a delay in the determination of death may be correlated to a smaller probability of clearance.

REFERENCES

Abrahams, N., Jewkes, R., Martin, L. J., & Mathews, S. (2011). Forensic medicine in South Africa: Associations between medical practice and legal case progression and outcomes in female murders. *PLoS ONE*, *6*(12), 1–5.

Addington, L. (2007). Hot vs. cold cases: Examining time to clearance for homicides using NIBRA data. *Justice Research and Policy*, *9*(2), 87–112.

Alderden, M. A., & Lavery, T. A. (2007). Predicting homicide clearances in Chicago: Investigating disparities in predictors across different types of homicide. *Homicide Studies*, *11*(2), 115–132.

Alexander, T. S. (2012). *Homicide clearances: An examination of race and police investigative effort*. (Unpublished Ph.D. dissertation). University of Maryland, College Park, College Park, MD.

Allison, P. (2014). *Measures of fit for logistic regression* (pp. 1485–2014). Paper Philadelphia, PA: Statistical Horizons LLC and the University of Pennsylvania. Retrieved from https://support.sas.com/resources/papers/proceedings14/1485-2014.pdf

Armstrong, J., Plecas, D., & Cohen, I. M. (2013). *The value of resources in solving homicides: The difference between gang related and non-gang related cases*. Abbotsford, BC, Canada: University of the Fraser Valley. Centre for Public Safety & Criminal Justice Research.

Bayley, D. (1994). *Police for the future*. New York: Oxford University Press.

Borg, M. J., & Parker, K. F. (2001). Mobilizing law in urban areas: The social structure of homicide clearance rate. *Law & Society Review*, *35*(2), 435–466.

Braga, A. A., & Dusseault, D. (2018). Can homicide detectives improve homicide clearance rates? *Crime & Delinquency*, *64*(3), 283–315.

Carter, D. L. (2013). *Homicide process mapping: Best practices for increasing homicide clearances*. Washington, DC: U.S. Department of Justice, Bureau of Justice Assistance.

Carter, D. L., & Carter, J. G. (2016). Effective police homicide investigations: Evidence from seven cities with high clearance rates. *Homicide Studies*, *20*(2), 150–176.

Chaiken, J. M. (1975). *The criminal investigation process: Volume II: Survey of municipal and county police departments*. Santa Monica, CA: RAND Corporation. Retrieved from https://www.rand.org/pubs/reports/R1777.html

Chaiken, J. M., Greenwood, P. W., & Petersilia, J. (1977). The criminal investigation process: A summary report. *Policy Analysis*, *3*(2), 187–217.

Cloniger, D. O., & Sartorius, L. C. (1979). Crime rates, clearance rates and enforcement effort: The case of Houston, Texas. *American Journal of Economics and Sociology*, *38*(4), 389–402.

Cook, P. J., Braga, A. A., Turchan, B. S., & Barao, L. M. (2019). Why do gun murders have a higher clearance rate than gunshot assaults? *Criminology & Public Policy*, This issue.

Cordner, G. (1989). Police agency size and investigative effectiveness. *Journal of Criminal Justice*, *17*, 145–155.

Davies, H. (2007). Understanding variations in murder clearance rates. *Homicide Studies*, *11*(2), 133–150.

Decker, S. (1995). Reconstructing homicide events: The role of witnesses in fatal encounters. *Criminology and Criminal Justice*, *23*(5), 439–450.

Eck, J. E. (1983). *Solving crimes: The investigation of burglary and robbery*. Washington, DC: Police Executive Research Forum.

Eck, J. E. (1992). Criminal investigation. In G. Cordner & D. Hale (Eds.), *What works in policing? Operations and administration examined* (pp. 19–34). Cincinnati, OH: Anderson.

Fallik, S. W. (2017). Detective effort: What contributes to arrests during retrospective criminal investigations? *Policing & Society*, https://doi.org/10.1080/10439463.2016.1275625

Gilbert, J. N. (1983). A study of the increased rate of unsolved criminal homicide in San Diego, California and its relationship to police investigative effectiveness. *American Journal of Police*, *2*(2), 149–166.

Greenwood, P. W., Chaiken, J. M., Petersilia, J., Prusoff, L. L., Castro, R. P., Kellen, K., & Wildhorn, S. (1975). *The criminal investigation process: Volume III: Observations and analysis*. Santa Monica, CA: RAND Corporation. Retrieved from https://www.rand.org/pubs/reports/R1778.html

Greenwood, P. W., & Petersilia, J. (1975). *The criminal investigation process: Volume I: Summary and policy implications*. Santa Monica, CA: RAND Corporation. Retrieved from https://www.rand.org/pubs/reports/R1776.html

Hawk, S. R. (2015). *A multi-method examination of homicide investigations on case outcomes* (Unpublished Ph.D. dissertation). George State University, Atlanta, GA.

Higginson, A., Eggins, E., & Mazerolle, L. (2017). Police techniques for investigating serious violent crime: A systematic review. *Trends & Issues in Crime and Criminal Justice*. Canberra, ACT: Australian Institute of Criminology.

Hsu, K-H. (2007). *Homicide clearance determinants: An analysis of the police departments of the 100 largest U.S. cities* (Unpublished master's thesis). University of Maryland, College Park, College Park, MD.

Jarvis, J. P., & Regoeczi, W. C. (2009). Homicides clearances: An analysis of arrest versus exceptional outcomes. *Homicide Studies*, *13*(2), 174–188.

Keel, T., Jarvis, J. P., & Muirhead, Y. (2009). An exploratory analysis of factors affecting homicide investigations. *Homicide Studies*, *13*(1), 50–68.

Keppel, R. D., & Weis, J. G. (1994). Time and distance as solvability factors in murder cases. *Journal of Forensic Sciences*, *39*(2), 386–401.

Koper, C. S., & Lum, C. (In press). The impacts of large-scale license plate reader deployment on criminal investigations. *Police Quarterly*.

Lee, C. (2005). The value of life in death: Multiple regression and event history analyses of homicide clearance in Los Angeles County. *Journal of Criminal Justice*, *33*, 527–534.

Leovy, J. (2015). *Ghettoside: A true story of murder in America*. New York, NY: Spiegel and Grau.

Litwin, K. J., & Xu, Y. (2007). The dynamic nature of homicide clearances. *Homicide Studies*, *11*(2), 94–114.

Litwin, K. J. (2004). A multilevel multivariate analysis of factors affecting homicide clearances. *Journal of Research in Crime and Delinquency*, *41*(4), 327–351.

Lum, C., Wellford, C., Scott, T., & Vovak, H. (2016). *Trajectories of U.S. crime clearance rates* (Report for the Laura and John Arnold Foundation). Fairfax, VA: Center for Evidence-Based Crime Policy, George Mason University.

Lundman, R. J., & Myers, M. (2012). Explanations of homicide clearances: Do results vary dependent upon operationalization and initial (time 1) and updated (time 2) data? *Homicide Studies*, *16*(1), 23–40.

Maguire, E. R., King, W. R., Johnson, D., & Katz, C. M. (2010). Why homicide clearance rates decrease: Evidence from the Caribbean. *Policing & Society*, *20*(4), 373–400.

Marché, G. E. (1994). The production of homicide solutions: An empirical analysis. *American Journal of Economics and Society*, *53*(4), 385–401.

McEwen, T., & Regoeczi, W. (2015). Forensic evidence in homicide investigations and prosecutions. *Journal of Forensic Sciences*, *60*(5), 1188–1198.

Madhani, A. (2018, August 10). Unsolved murders: Chicago, other big cities struggle; murder rate a "national disaster". *USA Today*.

Mouzos, J., & Muller, D. (2001). Solvability factors of homicide in Australia: An exploratory analysis. *Australian Institute of Criminology, No*, *216*, 1–6.

Nagin, D. S. (2005). *Group-based modeling of development*. Cambridge, MA: Harvard University Press.

Nagin, D. S., & Land, K. C. (1993). Age, criminal careers, and population heterogeneity: Specification and estimation of a nonparametric, mixed Poisson model. *Criminology*, *31*(3), 327–362.

Ousey, G. C., & Lee, M. R. (2010). To know the unknown: The decline in homicide clearance rates, 1980–2000. *Criminal Justice Review*, *35*(2), 141–158.

Police Executive Research Forum. (2018). *Promising strategies for strengthening homicide investigations*. Washington, DC: Author.

Przeworski, A., & Teune, H. (1970). *The logic of comparative social inquiry*. New York, NY: Wiley.

Puckett, J. L., & Lundman, R. J. (2003). Factors affecting homicide clearances: Multivariate analysis of a more complete conceptual framework. *Journal on Research in Crime and Delinquency*, *40*(2), 171–193.

Quinet, K., & Nunn, S. (2014). Establishing the victim-offender relationship of initially unsolved homicides: Partner, family, acquaintance, or stranger? *Homicide Studies*, *18*(3), 271–297.

Regoeczi, W. C., & Jarvis, J. P. (2011). Beyond the social production of homicide rates: Extending social disorganization theory to explain homicide case outcomes. *Justice Quarterly*, *30*(6), 983–1014.

Regoeczi, W. C., Jarvis, J. P., & Riedel, M. (2008). Clearing murders: Is it about time? *Journal of Research in Crime and Delinquency*, *45*(2), 142–162.

Regoeczi, W. C., Kennedy, L. W., & Silverman, R. A. (2000). Uncleared homicides. *Homicide Studies*, *4*(2), 135–161.

Riedel, M., & Boulahanis, J. G. (2007). Homicides exceptionally cleared and cleared by arrest: An exploratory study of police/prosecutor outcomes. *Homicide Studies*, *11*(2), 151–164.

Riedel, M., & Rinehart, T. (2012). Murder clearances and missing data. *Journal of Crime and Justice*, *2*, 83–102.

Roberts, A. (2007). Predictors of homicide clearance by arrest. *Homicide Studies*, *11*(2), 82–93.

Roberts, A. (2014). Adjusting rates of homicide clearance by arrest for investigation difficulty: Modeling incident- and jurisdiction-level obstacles. *Homicide Studies*, *19*(3), 273–300.

Roberts, A., & Lyons, C. J. (2009). Victim-offender racial dyads and clearance of lethal and nonlethal assault. *Journal of Research in Crime and Delinquency*, *46*(3), 301–326.

Roberts, A., & Lyons, C. J. (2011). Hispanic victims and homicide clearance by arrest. *Homicide Studies*, *15*(1), 48–73.

Roberts, A., & Roberts, J. M. (2016). Crime clearance and temporal variation in police investigative workload: Evidence from National Incident-Based Reporting System (NIBRS) data. *Journal of Quantitative Criminology*, *32*, 651–674.

Rydberg, J., & Pizarro, J. M. (2014). Victim lifestyle as a correlate homicide clearance. *Homicide Studies*, *18*(4), 342–362.

Schroeder, D. A., & White, M. D. (2009). Exploring the use of DNA evidence in homicide investigations, implications for detective work and case clearance. *Police Quarterly*, *12*(3), 319–342.

Scott, T. L., Wellford, C., Lum, C., & Vovak, H. (2019). Variability of crime clearance among police agencies. *Police Quarterly*, *22*(1), 82–111.

Trussler, T. (2010). Explaining the changing nature of homicide clearance in Canada. *International Criminal Justice Review*, *20*(4), 366–383.

Valcourt, D. (2015, August 4). Baltimore police solving disturbingly low number of the city's murders. *CBS Baltimore 13WJZ*, Retrieved from https://baltimore.cbslocal.com/2015/08/04/baltimore-police-have-only-cleared-about-a-third-of-the-citys-murders/

Wellford, C., & Cronin, W. (1999). *An analysis of variables affecting the clearance of homicides: AAmultistate study*. Washington, DC: Justice Research and Statistics Association.

Worrall, J. L. (2016). Investigative resources and crime clearances: A group-based trajectory approach. *Criminal Justice Policy Review*, https://doi.org/10.1177/0887403416650251

AUTHOR BIOGRAPHIES

Charles F. Wellford is professor emeritus in the Department of Criminology and Criminal Justice at the University of Maryland—College Park. He is a fellow and past president of the American Society of Criminology. His current research (with Cynthia Lum) is focused on the determinants of the clearance of serious crimes.

Cynthia Lum is a professor of criminology, law and society at George Mason University (GMU). She is also the director of GMU's Center for Evidence-Based Crime Policy. Professor Lum's research interests include evidence-based policing and law enforcement organizations, crime prevention, and evaluation research. Her recent book, with Christopher Koper, is *Evidence-Based Policing: Translating Research into Practice* (Oxford University Press).

Thomas Scott is a Ph.D. candidate in the Department of Criminology and Criminal Justice at the University of Maryland—College Park. He is also a research public health analyst in the Policing Research Program at RTI International. His research interests include policing, corrections, and theories of crime.

Heather Vovak is a senior research associate at the National Police Foundation. She received her Ph.D. in criminology, law and society at George Mason University. Her research interests include evidence-based policing, crime rate and clearance rate trends, and the use of technology in policing.

J. Amber Scherer received her Ph.D. in criminology, law and society from George Mason University (GMU). She works for the Washington/Baltimore High Intensity Drug Trafficking Area (W/B HIDTA) program and is a research associate at GMU's Center for Evidence-Based Crime Policy.

Prof. Scherer's research interests include investigative effectiveness, evidence-based policing and law enforcement organizations, and evaluation research.

How to cite this article: Wellford CF, Lum C, Scott T, Vovak H, Scherer JA. Clearing homicides: Role of organizational, case, and investigative dimensions. *Criminol Public Policy*. 2019; 1–48. https://doi.org/10.1111/1745-9133.12449

APPENDIX A

Number of individuals interviewed across the eight agencies

Agency	High-ranking commanders	Investigative Commanders	Investigative Supervisors	Investi-gators	Patrol Personnel	Support Services	Total ($N = 155$)
			LOW PERFORMERS				
Agency 1	1	1	5	12	3	0	22
Agency 2	1	1	3	6	2	1	14
Agency 3	1	5	6	3	2	2	19
Agency 4	1	2	6	5	1	4	19
			HIGH PERFORMERS				
Agency 1	1	2	9	4	2	1	19
Agency 2	1	1	10	9	2	2	25
Agency 3	1	0	3	3	3	3	13
Agency 4	1	2	6	9	1	5	24