Title: Improving the Clearance of Serious Crime: The Case of Aggravated Assault

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Abstract

Purpose. This paper addresses the clearance of aggravated assaults (AAs). Specifically, we consider variations in these clearances over time for large agencies and test which crime, investigation, and agency factors are associated with the likelihood of clearance by arrest or exceptional means. In doing this work, we seek to extend our understanding of how police can improve their investigations and ability to solve serious offenses.

Design. Using case, investigative, and organizational data collected from seven large police departments selected on the basis of their trajectory of index crime clearances, and measures of case characteristics, investigative effort, and organizational best practices, this paper uses descriptive and inferential statistics to analyze AA investigations and case clearance.

Findings. Key findings include: trajectories of AA clearance vary across large agencies and covary with a measure of organizational best practices and the relationship between investigative effort and case clearance can depend on organizational practices. We find that measures of investigative effort are either not related to case clearance, or there is a negative association.

Originality. This research is original in that it uses a multi-agency sample and crime, investigation, and organizational measures to understand AA clearance.

Research implications. Now that we have a better understanding of AAs and their investigations, we need to test how this knowledge can be used to improve the quality of police investigations. Tests, preferably multi-agency randomized control trials, of new investigative strategies and organizational practices are needed.

Keywords: aggravated assault; investigations; clearance; law enforcement

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INTRODUCTION

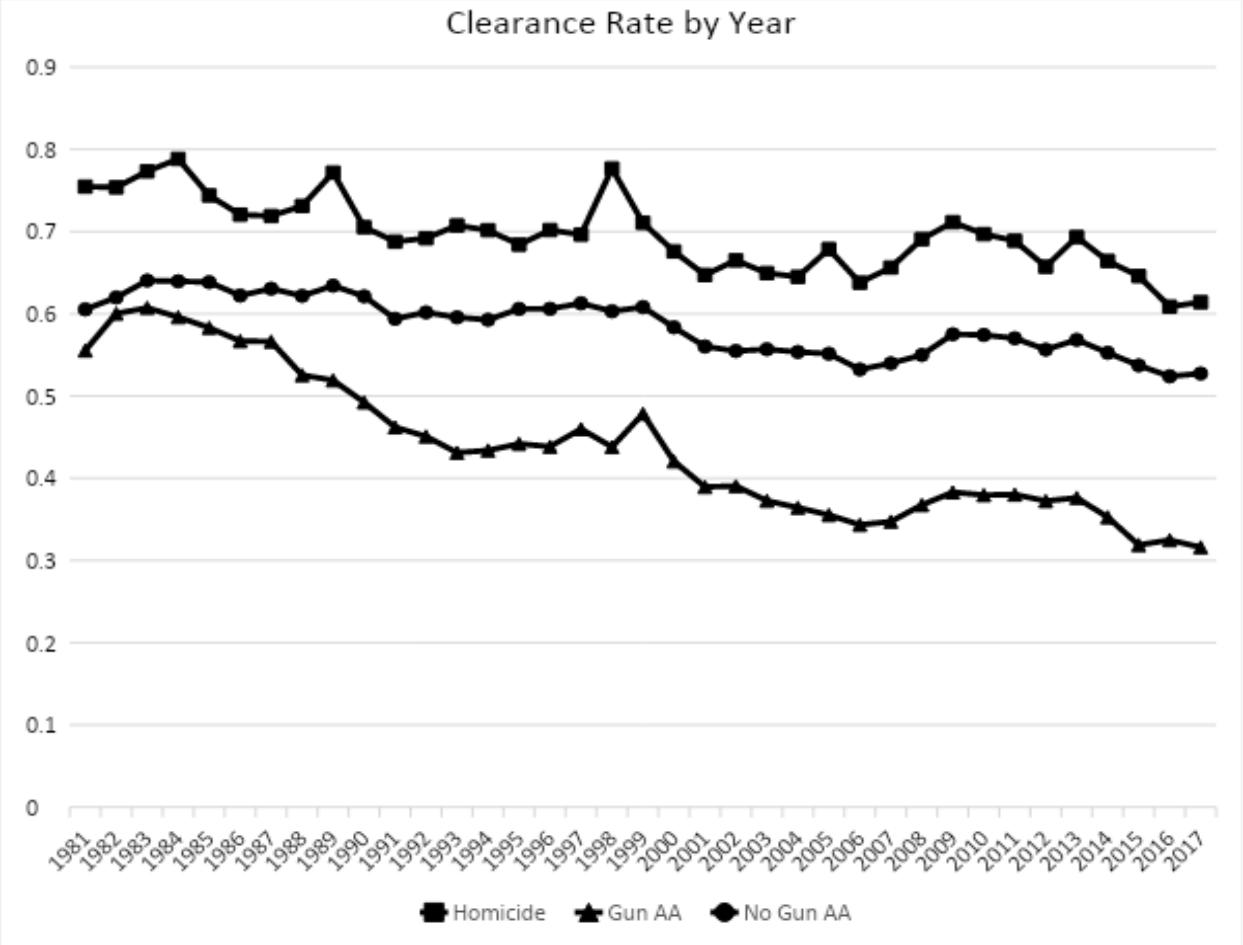
In recent years, a substantial body of research has identified several factors that influence the clearance of crime. Almost all of that research has focused on the crime of homicide. In this paper we use the substantive and methodological lessons from research on homicide clearances to address the crime of aggravated assault (AA). The focus on AAs including those committed with a gun reflects the seriousness of these offenses and the suggestion that intervening in the cycle of violence involving, especially, nonfatal shootings could reduce the number of homicides in a jurisdiction. In addition to the seriousness of the offense, AAs occur frequently in America. Results from the National Crime Victimization Survey show that there were over one million AAs in 2019 (Morgan & Truman, 2020). Data from the Uniform Crime Reporting (UCR) program for 2019 indicate that in the United States there were roughly 821,182 AAs reported to law enforcement with approximately 28% of these crimes committed with a firearm (Federal Bureau of Investigation, 2020). For a variety of reasons, only a small percentage of these AAs result in the arrest of an offender each year.

Figure 1 shows clearance rates for the years 1981 through 2017 for homicides and gun-involved and no gun-involved AAs for the 100 largest jurisdictions in the United States in 1980.[1] These data, which come from the UCR, demonstrate the low level of AA clearances relative to homicides. In addition, we note the gradual decline of clearances for both offense types. Research suggests different clearance levels across violent crime types can be explained by differences in investigative effort and resources that are applied to some crimes more than others (Cook, Braga, Turchan, & Barao, 2019). While research on homicides has provided us with an understanding of what explains clearance (see Wellford, Lum, Scott, Vovak, and Scherer (2019)

[1] We focus on large cities as they account for most AAs with and without a weapon, and because large police departments have the resources to investigate AAs.

for a review), this is not the case for AAs. In this paper, we describe research that seeks to advance our knowledge of AA clearances. Specifically, we examine whether multiple case, investigative, and organizational characteristics predict the likelihood that an AA is solved. Following a review of the literature on the topic of serious crime clearance, we describe the methods we use to assess these relationships and the results and conclusions our research supports.

Figure 1. Clearances for Homicides, Gun Aggravated Assaults, and Non-gun Aggravated Assaults 1981-2017 for the 100 Largest Cities in 1980



LITERATURE REVIEW

Any consideration of crime clearance must begin with the classic study conducted by the RAND Corporation in the 1970s. This work, done primarily by Greenwood and Petersilia (1975), Chaiken (1975) and summarized in Chaiken, Greenwood, and Petersilia (1977), is best known for its overall conclusion, "arrest and clearance rates reflect activities of patrol officers and members of the public more than they reflect activities of investigators" (192). The authors concluded that they had "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" (215). Of course, they recognized that this conclusion was not entirely appropriate for all offenses, noting that particularly in the case of homicides, what the police do matters. However, the widely accepted summary of this study was, as David Bayley concluded in 1994, that the belief that police solved crimes was a myth.

In addition to the substantive findings of their research, Greenwood, Chaiken, Petersilia, Prusoff, Castro, et al. (1975) described a model to use in studying clearances and a design to do this research. Unfortunately, few social scientists have followed these insights. Greenwood et al. (1975) observed that clearances were a function of three dimensions: the nature of the case, the investigators and their investigation, and the policies and organization of the agencies conducting the investigation[2]. A proper model to explain clearances would need to include all of these. The design that they advanced and is still appropriate for clearance research involved: the sampling of multiple agencies that varied in policies, training, and other organizational components, variation in levels of clearance across the sampled agencies, access to case files for opened and closed cases to document the details of investigative effort, and the use of statistical analyses that

[2] Volume two of the RAND report on investigations describes a survey of agencies with more than 150 employees (Chaiken, 1975). In that volume, Jan Chaiken describes how agencies vary in policies, procedures, resources, and operational characteristics and then relates those differences to crime and clearance rates.

account for organizational attributes, which is now best accomplished with multi-level modeling. While they were not able to achieve this in their research, they set the standard for research on investigations.

Since the RAND report, there have been at least 46 studies of homicide clearance. Wellford et al. (2019) provide a detailed analysis of these studies. In that review, the authors note that no study has met the design requirements identified in the RAND study, that only 14 of those studies had some access to case files, and only two involved multiple agencies that were sampled to assure variations in clearance. Further, the authors concluded that:

> 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 (Wellford, et al., 2019, 383).

The research reported in that paper comes closest to the design recommended by RAND. This analysis of homicide cases concluded that, as suggested in the RAND study, case, police effort, and agency characteristics mattered in explaining homicide clearances. Specifically, Wellford and colleagues (2019) found that higher rates of clearing homicide were associated with:

- Structured and active leadership who convey goals and performance targets
- Information sharing is regular and across units and with patrol
- Adequately resourced investigative unit, with team approach to investigations
- Specific training and experience required of investigators

- Detailed SOPs, case management system, mandatory and regular review of cases, maintain crime scene logs
- Especially strong support from intelligence, crime analysis, and digital analysis
- Witness protection programs and victim services
- More varied and involved community interactions (see also Wellford, 2018).

In addition, the nature of the offense (including whether a weapon was recovered at the scene, witnesses cooperated at the scene, and leads were provided to detectives or others at the scene), and the investigation (including, many detectives going to the scene of the crime, maintenance of a crime scene log, many detectives working the case, effective witness follow-up, and recovery and analysis of a cell phone) were associated with case clearance.

Research on the clearance of other serious offenses is much more limited (e.g., Eck, 1983) and on AAs is almost nonexistent. One recent paper (Cook et al., 2019) advanced our understanding of the characteristics associated with the clearance of nonfatal shootings, which is one type of AA.

Cook et al. (2019) considered the clearance rate for fatal and nonfatal shootings in one agency. Among their most important conclusions were the following:

1) "The two groups of cases, fatal and nonfatal, are statistically indistinguishable with respect to circumstances, with the sole exception of whether the shooting was indoors or outdoors. The former is more lethal."
2) "The clearance-by-arrest rate for gun homicide cases was over twice as high as the corresponding rate for gunshot assault cases (43% and 19% respectively). That difference would quite possibly be still larger except for the fact that homicide arrests (but not assault cases) were subject to prior review for probable cause by the district attorney."

3) "For both fatal and nonfatal cases, the likelihood of arrest is higher for cases involving personal disputes or domestic violence than for cases arising from gang- and drug-related disputes. But regardless of circumstance, fatal cases have a higher clearance rate than nonfatal."
4) "The arrest rates during the two days immediately following the shooting are the same for fatal and nonfatal cases, 11%. The fatal-nonfatal difference in arrest rates emerges in the much higher rate of homicide arrests that occur subsequently, sometimes months after the shooting."
5) "Relatively easy cases are solved quickly and without the need for the extra resources deployed in homicide investigations. Given the similarity in fatal and nonfatal case distributions, we expect that the prevalence of easy cases would be about the same in homicides as in nonfatal cases."

The primary conclusion is that fatal and nonfatal shootings are essentially the same except for the accuracy of the shooter and that therefore, differences in clearance are solely a result of levels of effort and resources applied by the police to shootings that are relatively difficult to solve (also see Hipple and Magee, 2017; Zimring, 1972).

The few studies on the correlates of AA clearance typically analyze NIBRS data, which has no information on the nature of the investigation or the characteristics of the organizations that relate to investigations, and therefore suggest case characteristics are the primary predictors (Roberts, 2008; Roberts and Lyons, 2009; Taylor, Holleran, and Topalli, 2009). For instance, Roberts and Lyons (2009) predicted time to clearance using incident characteristics for all AAs that were not cleared on the same day as the offense and that were reported to the 2005 NIBRS. Their results showed that the racial status of the victim and offender affected case clearance, with

AAs between Whites most likely to be cleared, followed by interracial incidents and then incidents between non-Whites. In addition to racial status, other incident-level factors like the sex and age of the offender and victim predicted time to clearance (Roberts and Lyons, 2009). Although studies like this add to the almost non-existent body of knowledge on the clearance of AA, their designs are limited in that they do include the full range of expected explanatory variables. To advance our understanding of AA clearances, it is essential to understand which agency- and investigation-level characteristics predict assault clearances after controlling for incident-level factors.

To our knowledge, these are the only research articles that address characteristics of AAs and their clearance. The purpose of this paper is to extend our understanding of AA clearances by using the design and models that have proven to be effective in explaining homicide clearances to unpack the full range of variables that are associated with AA clearances. To do so, we apply the methods used by Wellford and colleagues (2019) to AA cases.

METHODS

To describe the correlates of AA clearances, we use data collected by Lum and colleagues (2018). In this research project funded by the Laura and John Arnold Foundation, Lum and colleagues first sampled historically high and low performing agencies in terms of their clearance rate trajectories (see Scott et al., 2019)[3]. The authors collected organizational attributes by interviewing the staff of each agency (police officers, investigators, supervisors, commanders, crime scene investigators, prosecutors, and crime analysts) who worked on serious crime investigations. In addition, they obtained crime- and investigation-level information by

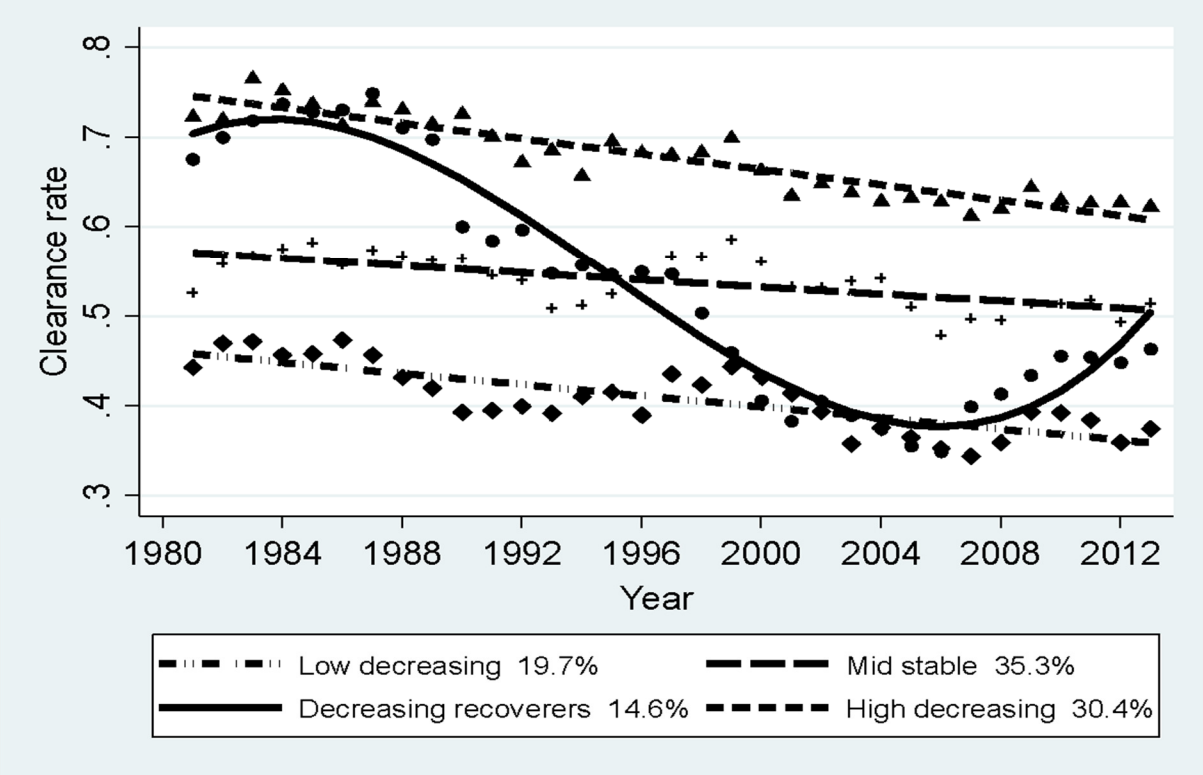
[3] The focus on high and low performing agencies provides the best test for differences in clearance. The other patterns would be most useful in a study of the sources of changes in rates, an issue that would require detailed data on cases, investigations, and organizations for each year during the time frame used to estimate the trajectories.

reviewing randomly selected, cleared and uncleared case files for homicides, AAs, burglaries, and robberies (Lum et al., 2018). In a different study, Wellford et al. (2019) regressed the likelihood that a homicide was cleared on attributes of the crime, investigation, and department. In this article, we apply similar methods to the crime of AA.

Data. A series of articles provide a detailed description of the data used in this study (Lum et al., 2018; Scott et al., 2019; Wellford et al., 2019), but we briefly review them here. The case-level data include information on 388 AAs that occurred in 2014 in seven large cities. The seven departments used in this analysis were sampled from 100 large police agencies based on their longitudinal clearance rate trajectory for four crime types—murder, AA, robbery, and burglary (Scott et al., 2019). These clearance data came from the UCR Summary Reporting System (SRS). Relevant to this analysis, the original investigators generated yearly AA clearance rates by dividing the number of AAs police cleared each year by the total number of AAs reported each year for each city.[4] The results from their AA model, shown in Figure 2, reveal that from 1981 to 2013, large police agencies followed one of four distinct clearance trajectories. Although Lum and colleagues (2018) selected the agencies we use in this study based on their clearance trajectories across four crime types and their willingness to allow researchers access to their departments for data collection, it is useful to demonstrate how their AA clearance trajectories compared to other large cities.

Figure 2. Aggravated Assault Clearance Trajectories from a Sample of 86 Large Agencies.

[4] According to the UCR SRS user manual, AAs "include assaults or attempts to kill or murder, poisoning, assault with a dangerous or deadly weapon, maiming, mayhem, assault with explosives, and assault with disease (as in cases when the offender is aware that he/she is infected with a deadly disease and deliberately attempts to inflict the disease by biting, spitting, etc.). All assaults by one person upon another with the intent to kill, maim, or inflict severe bodily injury with the use of any dangerous weapon are classified as Aggravated Assault. It is not necessary that injury result from an aggravated assault when a gun, knife, or other weapon that could cause serious personal injury is used." (Federal Bureau of Investigation, 2013).



Adopted from Scott et al. (2019).

As discussed in Lum et al. (2018) and Wellford et al. (2019), three of the seven cities were considered low performers, because they were in the lowest clearance trajectories for all crimes studied. The remaining four agencies were considered high performers because they were in the highest clearance trajectories across the four crime types. In each of the seven large police departments, the original investigators conducted qualitative interviews with numerous personnel, and then quantified those narratives by creating crime-specific scales of the number of evidence-based practices the department engaged in. Specific to this study, Wellford and colleagues (2019) created three organizational scales measuring best practices in 1) organizational resources, 2) the investigative unit that responded to AAs, and 3) the investigations of AAs. We describe each of these scales in the next section.

Next, for each department, the original investigators generated a random sample of approximately 25 open and 25 closed AA cases from a sampling frame of all AAs that occurred

in the departments' jurisdictions in 2014. Since the original data collection took place in 2017, the investigators decided that cases from 2014 would allow enough time for case clearance to occur. Lum et al. (2018) developed a coding instrument based on a combination of previous research and discussions with subject matter experts, which they applied to each case file to obtain information on attributes of the crime and investigation. In addition, for each agency, the original project collected information on the characteristics of the department that prior research and experience suggested were associated with higher clearance rates. We describe these measures below (the actual data collection instruments can be found at http://cebcp.org/wp-content/Investigations/WellfordetalCodingCases.pdf and http://cebcp.org/wp-content/Investigations/WellfordetalInterviews.pdf).

Measures. Before describing each measure in detail, we briefly summarize how they are grouped. The case- and investigative-level measures drawn from the case files form two substantive groups. The first set of indicators measure case characteristics. The second set of indicators measure the amount of investigative effort applied to the case. Most case-level and investigative-level measures are binary, with a value of one indicating the presence of that measure, and a value of zero indicating its absence. We treated missing values as equal to zero so that each binary measure indicates whether a detective had that piece of information in their case file (e.g., knowing that a weapon was recovered). The organizational measures drawn from personnel interviews form three substantive groups. The first set of organizational indicators measures the extent of best practices in the AA investigative unit's organizational structure. The second set of indicators measures the extent of best practices in the investigations of AAs. The third set of indicators measures the extent of best practices for AA detectives and investigative supervisors. We initially coded each of the organizational variables as binary based on the

narrative interview data. We then summed the variables within each group to create three scales measuring the number of best practices.[5] We assessed "best practices" based on extant literature, conversations with subject matter experts, and the second author's experience in agency studies and police research. Next, we describe the measures that compose each group, starting with the measures obtained from the review of AA case files (case attributes and investigative effort) before describing the measures obtained from the employee interviews and site visits (best practices in organizational structure, investigations, and investigators). We provide summary statistics for these measures in the Appendix.

Case attributes. We measured characteristics of the crime including the victim's sex, race, and age, the number of victims, and the number of suspects at the time of response. Although we coded for suspect demographics, we do not include these measures due to the large amount of missing data. Cases were considered to have relatively higher solvability if: a weapon was recovered; the mode of entry was known to law enforcement; the offender was identified at the time of response; the suspect was arrested on scene; identifying information was given on the suspect; the suspect had a relationship with the victim; the suspect was injured; the victim was seriously injured; the victim received medical treatment; the crime occurred in a residence; the crime did not occur on the street; property was taken by the suspect; there were one or more witnesses to the assault; the witness(es) had a relationship with the victim or suspect; the victim or a witness reported the crime; the victim cooperated; a witness cooperated; or, the motive was known to law enforcement.

[5] With only seven cases we could not create more refined scales of the organization measures. We understand the problem with summated scales but until we have a larger number of agencies, we cannot do true hierarchical modeling with better organizational measures.

Investigative effort. Cases were considered to include high investigative effort if: a detective went to the initial scene; many police employees went to the scene, which was determined by the median number of employees who responded to any AA, many investigators went to the scene, which was determined by the median number of investigators who responded to any AA, many investigators were assigned to the case, which was determined by the median number of investigators who were assigned to any AA case; crime scene investigators processed the scene; physical evidence was collected at the scene; an investigative supervisor went to the scene; there was a follow-up investigation; an investigator followed up with a victim or witness during a follow-up investigation, investigators used additional evidence or technologies in their investigation if the case remained open for a while, or, a specialized unit assisted with the investigation.

Organizational structure. An agency was considered to follow best practices in organizational structure if for the investigation of AAs: 1) the organization is centralized; 2) oversight is highly structured; 3) the investigative unit shares information often with external units; 4) the investigative unit routinely shares information with patrol; 5) patrol officers have a formal method of providing information to detectives; 6) patrol units and the investigative unit have a good relationship; 7) the investigative unit routinely shares information with internal units; 8) leadership meets with investigative units weekly; 9) leader-investigative unit meetings are formal; 10) leadership conveys specific clearance goals; 11) leadership uses one or more performance measures for the unit; 12) leadership conveys that it believes investigations to be a priority in the department over patrol; and, 13) the investigative unit is perceived to be well resourced. This scale ranges from 1 to 12, with a median of 5.

Investigations. An agency was considered to follow best practices for its AA investigations if: 1) all AAs are assigned to an investigator; 2) investigators are available 24/7 Monday through Sunday; 3) on call investigators have take-home cars; 4) investigators are paid additional wages to be on call; 5) investigators can receive overtime compensation; 6) there is no limit on overtime; 7) two or more investigators are assigned to each case; 8) the unit maintains detailed standard operating procedures; 9) the unit maintains an investigative case management system; 10) the unit uses solvability factors for case assignment; 11) the unit maintains a case file checklist; 12) the unit engages in mandatory and regular reviews of case progress; 13) involvement of the state attorney is specified and/or required; 14) a log is kept at the scene as to who responds and what their role is; 15) forensics/a crime scene unit provides much support during investigations; 16) an intelligence unit provides much support during investigations; 17) a crime analysis unit provides much support during investigations; 18) investigators receive much support for digital evidence collection; 19) a fugitive task force/warrant apprehension squad provides much support during investigations; 20) investigators attempt to interview victims in the hospital; 21) an investigative supervisor or an investigative supervisor and unit commander review initial investigative reports; 22) an investigative supervisor or investigative supervisor and unit commander review subsequent investigative reports; 23) investigators always collaborate during investigations; 24) investigators have ready access to a smartphone; 25) investigators have ready access to a tablet or laptop; 26) investigators have ready access to a digital camera; 27) all interviews are recorded; 28) there is a specific policy that describes when cases can be cleared by exceptional means; 29) unit commanders or both investigative supervisors and unit commanders must approve the use of an exceptional clearance; 30) investigators regularly use information technologies/databases; 31) investigators regularly use

regional databases; 32) investigators regularly use social media platforms; 33) investigators regularly use Shot Spotter; 34) there is some form of witness protection or a witness help program in place; 35) investigators describe a good relationship with the state attorney; 36) the agency uses social media to interact with the community about solving AAs generally; 37) leadership uses community meetings to assist with AA investigations; 38) the unit described a good relationship with the community; and, 39) the agency uses social media to interact with the community about solving specific AAs. This scale ranges from 7 to 32, with a median of 23.

Investigators. An agency was considered to follow best practices for its AA investigators if: 1) to be an investigator an officer must have prior experience/special skills in investigations; 2) to be an investigator an officer must have specific training; 3) to be an investigator and officer must have a certain number of years of experience in the police department; 4) higher-level command staff make the final decision on selection of investigators; 5) investigators receive extra pay; 6) the investigative unit is perceived as a prestigious assignment; 7) investigative supervisors must have experience/special skills supervising investigations; 8) investigative supervisors must have specific training related to the supervision of investigations; 9) investigative supervisors must have a certain number of years of experience as a supervisor in the police department; 10) final decisions on the selection of investigative supervisors are made by higher-level command staff or someone else other than unit commanders; 11) immediately upon selection, formal training is required for investigators; 12) there is a formal evaluation of new investigator performance during their initial stages of training/being in the unit; 13) there is a formal mentoring system in place in the unit; 14) investigators are evaluated on the basis of their ability to clear their assigned cases; 15) investigative supervisors are evaluated on the basis of their unit's ability to clear cases; 16) the department regularly supports additional training for

investigators; 17) investigators are formally trained on the science of solvability factors; and, 18) there are two or more command levels between the head of the investigative unit and the chief. This scale ranges from 4 to 13, with a median of 8.

Analytic plan. This study's analysis proceeds as follows. First, we examine whether agency values on the organizational best practices scales relates to longitudinal AA clearance trajectories. Next, we test whether a set of investigation-related variables are associated with the likelihood that an AA is cleared by arrest or exceptional means after controlling for case-level factors and agency values on the best practices scale. Then, we examine whether the number of best practices an agency follows moderates the relationship between investigation-level factors and case clearance. We test the following hypotheses:

> Hypothesis 1: there will be a positive relationship between the number of best practices an agency follows in its investigations of AAs and agency AA clearance rates;
>
> Hypothesis 2: ceteris paribus, there will be a positive relationship between investigative effort in an AA case and the likelihood that the case is cleared; and,
>
> Hypothesis 3: the impact of investigative effort on case clearance will depend on the number of best practices an agency follows.

Research on homicide investigations (e.g., Brookman, Maguire, & Maguire, 2019; Wellford, 2018; Wellford et al., 2019) shows that certain agency and investigative unit practices impact clearance rates. Therefore, Hypothesis 1 is based on the belief that these practices also impact AA clearance rates. The second hypothesis is based on the belief that the more effort investigators apply to a case, the more likely the case is to result in a successful outcome. The third hypothesis is two-tailed, because either a) high performing agencies do not need to rely as much on investigative activities as low performing agencies to close cases or b) the investigative

activities of high performing agencies are higher quality than the activities of low performing agencies, so their presence in a case has a greater impact on the likelihood that the investigation results in a clearance. To test our hypotheses, we rely primarily on multivariable logistic regression analysis. Due to sample size limitations, we do not use hierarchical models, but we adjust standard errors for the nested data structure of cases within agencies.

RESULTS

We begin by demonstrating the relationship between an agency's longitudinal AA clearance rate trajectory and the number of best practices the agency follows. The seven agencies were aggregated into their assigned AA trajectory groups estimated by Scott et al. (2019), which is shown in Figure 2. Looking at the values for the combined scale in Table 1, one can see that, on average, high performing agencies followed more than twice as many best practices in the areas of organizational structure, investigative unit structure, and investigative practices than low performing agencies. Although alternative factors could explain this bivariate relationship, prior research suggests that engaging in these best practices enhances agency performance, including the ability to solve open crimes. A remaining question we test below is whether organizational characteristics are associated with the likelihood that a given AA is solved.

Table 1. Organizational Best Practices Scales, by Aggravated Assault Clearance Rate Trajectory

	Trajectory group	
	Low decreasing Mean (SD)	High decreasing Mean (SD)
Combined scales	20.9 (6.6)	46.1 (9.7)
Organizational	2.7 (1.7)	7.2 (3.4)
Investigators	6.3 (2.0)	10.3 (3.0)
Investigation	12.0 (3.8)	28.5 (4.0)

Note: One of the seven departments did not report assault crime or clearance statistics to the UCR for most of the years between 1981 and 2013. We placed this agency in the low decreasing trajectory group based on its clearance rate values for other index crimes during this time (see Scott et al., 2019).

Due to the similarities across AA types and the small number of cases, we combine all AAs in a multivariable logistic regression predicting case clearance, with weapon type as one of the independent variables. Using logistic regression and clustering standard errors by the department, we conduct a series of logistic regressions to test our hypotheses about the relationships between investigative effort, organizational best practices, and case clearance (0 = open, 1 = cleared). First, we regress clearance status on investigative-level measures while controlling for organizational best practices (Model 1). Then, we control for attributes of the case that are typically beyond the control of investigators (Model 2). Finally, we examine whether an agency's score on the organizational best practices scale moderates the statistically significant associations between investigative effort and case clearance from Model 2 (Models 3 and 4). We added covariates in blocks starting with the investigative effort variables and then adding the case attributes to determine which effort variables remained significant predictors of case clearance when potentially confounding factors are held constant. Models 3 and 4 are the same as Model 2 except that they include unique interaction terms.

We selected variables to include in our regression analyses based on background knowledge and statistical considerations. The second author selected a large list of available measures to include in our models based on background knowledge and prior research, which the first author narrowed down based on statistical considerations including variable redundancy and multicollinearity, missing data, and ensuring a sample size of around 15 cases per independent variable. For instance, because many of the case attributes and investigative effort measures were highly correlated, we selected measures that best represented each construct while avoiding multicollinearity. As an example, we did not include whether a witness was present in the case because the measure's correlation with witness cooperated was equal to 0.8. In addition, some

variables like the number of police employees who went to the initial crime scene were missing too many values to include in our analyses. Other variables like whether a specialized unit assisted with the investigation were excluded from the analyses because they were seldom present in our sample of AA cases.

Additionally, due to high collinearity among the three agency best practice scales ($\rho > 0.7$), we summed them to create an overall best practices scale in the areas of organizational structure, investigations, and investigators. This finding suggests that when a large police department follows relatively more best practices compared to other large police departments in one aspect of their organization, they are likely to follow more best practices in other aspects of their organization as well. The combined scale ranges from 12 to 57, with a mean of 36 and a standard deviation of 15. Each department has a unique value on this measure. Even though combining the scales this way gives more weight to the scales with more measures (i.e., the investigations scale), this is not problematic for our regression analyses. The purpose of our analyses is to understand whether characteristics of the organization moderate the relationships between investigative activities and the likelihood of case clearance, not to determine which organizational characteristics are the most impactful. Because of the high correlation across best practices subscales, the latter goal would be challenging to do and would require a more focused research design. The results of our regression models using investigation, case, and organizational measures are shown in Table 2.

Table 2. Multivariable Logistic Regression of Case Clearance for AAs

Independent variables	Model 1 (OR, RSE)	Model 2 (OR, RSE)	Model 3 (OR, RSE)	Model 4 (OR, RSE)
Investigative effort				
Detective went to initial crime scene	0.72 (0.30)	0.90 (0.39)	:	:
Crime scene investigators processed crime scene	0.32 (0.10) **	0.70 (0.20)	:	:
Physical evidence collected at initial response	1.04 (0.24)	0.54 (0.17) *	:	0.50 (0.18)
Follow up investigation conducted	0.26 (0.15) *	0.24 (0.15) *	7.78 (3.60) **	:
Video or cell phone evidence investigated	0.78 (0.29)	1.48 (0.58)	:	:
Case attributes				
Firearm used	-	0.64 (0.26)	:	:
Knife used	-	1.01 (0.39)	:	:
Weapon recovered	-	5.06 (3.01) **	:	:
Known mode of entry	-	1.63 (0.88)	:	:
Suspect a family member or partner of victim	-	2.69 (1.56)	:	:
Suspect a stranger to victim	-	0.50 (0.25)	:	:
Location of crime was a residence	-	1.54 (0.46)	:	:
Location of crime was on the street	-	1.27 (0.37)	:	:
Victim not injured		1.03 (0.29)	:	:
Victim seriously injured	-	0.80 (0.23)	:	:
Victim reported crime	-	0.84 (0.33)	:	:
Victim cooperated	-	2.11 (0.62) *	:	:
Witness(es) cooperated	-	1.90 (0.69)	:	:
Known motive	-	0.97 (0.45)	:	:
Victim male	-	1.25 (0.65)	:	:
Victim white	-	2.81 (0.96) **	:	:
Victim black	-	1.91 (0.52) *	:	:
More than one victim	-	0.92 (0.36)	:	:
More than one suspect	-	0.61 (0.19)	:	:
Organizational best practices scale	1.00 (0.01)	1.00 (0.02)	1.10 (0.01) **	1.00 (0.02)

Organizational best practices scale x follow up investigation	-	-	0.89 (0.02) **	-
Organizational best practices scale x physical evidence	-	-	-	1.00 (0.01)
Constant	4.18 (1.95) *	0.54 (0.56)	0.02 (0.01) **	0.55 (0.62)
Pseudo r-squared	0.05	0.22	0.25	0.22
Number of observations	386	375	375	375

* $p < 0.05$, ** $p < 0.01$

Note: A "-" means that the variable was not included in the model. A ":" means that the variable was included in the model, but its regression results are not shown in the table because the variable is not relevant to the interpretation of the model. "OR" means odds ratio. "RSE" means robust standard error.

Model 1 provides the results of our analysis using only investigative-level factors and the organizational best practices scale. Each measure of investigative effort either had no statistically significant relationship to case clearance, or had a negative relationship to case clearance, meaning cases with investigative effort were less likely to be cleared. Specifically, if crime scene investigators processed the initial crime scene, the odds of clearing the case dropped by 0.32, and if investigators conducted a follow-up investigation, the odds dropped by 0.26. From our qualitative interviews with investigators, this may be a result of investigators and their supervisors targeting more complicated or serious cases for further investigation. Therefore, it is essential to control for case characteristics that make cases more difficult to solve to determine whether investigative effort impacts case clearance net these crime attributes.

Model 2 shows the results of this regression. One can see that the McFadden's pseudo r-squared increases from 0.05 to 0.22, indicating a large increase in the fit of the model once the explanatory effect of case attributes are accounted for. The odds ratio and statistical significance of a follow up investigation barely changes. But now there is no statistically significant relationship between crime scene investigators processing the crime scene and case clearance, and there is a statistically significant, negative relationship between the collection of physical evidence and the likelihood of an AA being cleared. Specifically, a case with physical evidence collected during the initial police response was almost half as likely to result in a clearance than a case without this evidence. For case attributes, the recovery of a weapon and the presence of a cooperative victim significantly increased the odds of clearing the assault. Additionally, cases that involved a White victim and cases that involved a Black victim were more likely to be cleared than cases that involved a victim of a different race or ethnicity.

Next, we test our hypothesis about the moderating effect of the number of organizational best practices an agency follows on the relationships between case clearance and the two investigative effort measures that were statistically significant in Model 2. One of these two interactions was statistically significant: the negative relationship between case clearance and the presence of a follow up investigation grows as agency values on the organizational best practices scale increase (Model 3). The other interaction between the presence of physical evidence and the number of organizational best practices an agency follows was not statistically significant (Model 4). For ease of reading, we only display the regression output for the relevant variables in Models 3 and 4.

Interpreting an interaction using odds ratios can be confusing, and in this case, the finding from Model 3 is better portrayed by examining the data. These data show that for the lowest agency on the organizational best practices scale, 33% of cases without a follow up investigation were cleared, whereas for the highest agency on the organizational best practices scale, 94% of cases without a follow up investigation were cleared. We interpret this interaction as suggesting that when high performing agencies do not conduct a follow up investigation, it is because one is unnecessary to solve the case. On the other hand, it appears that lower performing agencies sometimes did not conduct a follow up investigation when one may have been called for to resolve the case.

In summary, we find that with regards to our first hypothesis, there was a positive relationship between the number of organizational, investigator, and investigative best practices an agency follows and an agency's performance in clearing AAs over time. In fact, agencies that cleared a relatively high proportion of their AAs between 1981 and 2013 followed over twice as many best practices as agencies that cleared a relatively low proportion of their AAs over time.

For hypothesis two, we found no statistically significant positive relationships between measures of investigative effort and case clearance. Instead, we found either no relationships or statistically significant negative relationships. With regards to our third hypothesis, we found that relationships between measures of investigative effort and case clearance can depend on organizational characteristics like the number of best practices an agency follows. We interpret these findings in the next section.

DISCUSSION

We began this paper with the observation, drawn from recent research on homicide and shooting clearances, that contrary to the findings from the RAND study, investigator actions do influence case outcomes much of the time. Although research exists on homicide clearance, few studies have examined whether these findings translate to the investigation of AAs. To fill this research gap, we used data collected by Lum and colleagues (2018) and methods applied by Wellford et al. (2019) to test whether investigation- and agency-level factors impact AA case outcomes when elements of the crime incident are held constant. Unlike Wellford et al. (2019), who found investigative effort was positively related to the clearance of homicides, we found that there was no relationship between most measures of investigative effort and case clearance, and, when there was a relationship, AA cases with more investigative effort were less likely to be solved. We attribute this finding to differences in crime and investigation features between homicides and AAs.

Specifically, detectives thoroughly investigate almost every homicide, and homicide investigators are typically the most resourced investigative unit in the department. On the other hand, AA units have fewer resources, and their detectives carry higher caseloads than homicide units. Additionally, the presence of a surviving victim means that the victim can decline to press

charges. In our discussions with agency supervisors, we found that in higher performing agencies, AA cases are selected for investigation that have characteristics that suggest they can be cleared. This was not found in lower performing agencies. It may well be that this triage process explains our findings that effort is not associated with clearance. Although we controlled for several factors that are associated with case difficulty, like whether there was a cooperative witness and whether the victim knew the offender, the negative relationships we found could be the result of detectives applying more effort toward more difficult-to-solve cases, which our measures did not adequately capture. Overall, our data suggest that unlike homicide investigations, AA investigations involve much less investigative effort as it is conceptualized here (see Appendix).

Similar to Wellford et al.'s (2019) findings on homicide clearance, we found that elements of the organization relate to AA clearance rates and the relationships between investigative activities and the likelihood of case clearance. Therefore, future research on this topic should seek to obtain multi-agency samples and measure key organizational characteristics of the department and relevant investigative units. In this case, we found a relationship between the number of organizational, investigator, and investigation best practices an agency followed for AA investigations and 1) agency longitudinal AA clearance rate trends and 2) a case-level relationship between investigative effort and clearance. Investigations do not occur in a vacuum, and the impact of any activity is likely to depend on characteristics of the investigation, the investigator(s), the investigative unit, and the larger department. Unfortunately, due to financial constraints, most studies on investigations take place within a single police department. More funding is needed so that researchers can measure variation in agency structure, policies, and

practices to determine the impact of this variation on investigation outcomes and the relationships between investigative practices and case outcomes.

The current study is limited in several ways. First, we estimated relationships between case clearance and investigative activities while controlling for a limited number of observable case characteristics. Police incident reports often lack detail, which limits the number and completeness of crime and investigation attributes that one can measure for a given case. Therefore, omitted variables may bias our results. In fact, although we controlled for important features of the crime, we believe the most likely explanation for the negative relationship between investigative effort and case clearance is the presence of unmeasured crime characteristics that determine case difficulty. More advanced designs could apply methods like propensity score matching to compare like cases that differ only on certain investigation elements. However, we believe analyses like these are not currently practicable given data and sample size constraints. For this same reason, we could not use multi-level modeling, which would advance future studies.

It is also important to consider that some of the control variables, like a cooperative witness or the recovery of a weapon, could be the outcome of a thorough investigation. By controlling for these factors, we may have accounted for some of the relationship between investigative effort and case clearance, which could explain the negative associations between our measures of investigative effort and clearance that remain. Although there are additional limitations to this study, we believe this work advances the evidence base on AA investigative outcomes by including a larger sample of agencies than most extant research and by including an analysis of a large number of case, investigative, and agency level features for a relatively large sample of AA cases.

Overall, we conclude that AA clearance rates can be improved by employing investigative practices and organizational resources like those used for homicides. While we are confident that this is a conclusion supported by recent quantitative (Cook et al., 2019) and qualitative (Lum et al., 2018) research, it does not demonstrate how this could be achieved within resources usually available even in large agencies. Research is needed to replicate our work on a larger set of agencies and to demonstrate through carefully controlled experiments that increased effort can increase AA clearances and result in a positive return on investment. In particular, there is a need to address the differences between homicides and AAs and how those differences might impact how investigations should be conducted. Of course, differences may simply be a result of the quality of the investigation (i.e., better investigations might identify alleged strangers and more witnesses). To do this, there will have to be substantial resources to support research in this area.

The RAND report on investigations undoubtedly contributed to the neglect of research on clearances and the lower priority given to clearances in evaluating police agencies. However, we can also see this in the work of Sir Robert Peel, the founder of modern policing. Peel's core ideas and principles had little if any emphasis on detecting crimes. In fact, the first core idea stated "the goal is preventing crime, not catching criminals. If the police stop crime before it happens, we don't have to punish citizens or suppress their rights. An effective police department doesn't have high arrest stats; its community has low crime rates" (Law Enforcement Action Partnership, n.d.). Unsurprisingly, the department Peel created in 1829 did not have a detective unit until 1842.

Beginning in the late 1980's, police agencies in the United States began to place greater emphasis on this core idea. Programs like COMPSTAT began to make clear to police that

reducing crime was the primary goal of the agency and the metric by which they would be evaluated. Crime clearance was not as high a priority. As this happened, clearance rates for homicide and AA began to decline nationally. While we do not argue with the importance of crime prevention, we do think that higher clearances may reduce crime through deterrence and the reduction of retaliatory violence. In addition, higher clearance rates may assist police in garnering more support from the community where crime is most prevalent, support that increases clearances and reduces crime. Together, these observations constitute a research program related to crime clearances.

Imagine if we had a success rate in schools (e.g., graduation rates) of 60-13%—the average clearance rates for homicides and burglaries, respectively; or, reversely, death rates in hospitals of 40-87%. We are sure there would be substantial efforts to close or takeover these agencies. Yet in policing that is the norm for clearance. We contend that research demonstrates that this does not have to continue. While we need large-scale replications of recent research and smaller more controlled experiments, we think that this work is now justified and can result in substantial improvements in policing and reductions in crime. In the interim, agencies can consider their handling of homicide and AA cases and make changes that are grounded in existing research. We now know that police matter in investigations. The fact is that in recent years police agencies, when given the opportunity and information, will look deeply at their investigations, make changes recommended by research, and see improvements in their clearance rates (Braga and Dusseault, 2016; Masterson, 2019; Schmelzer, 2020). To build on this receptivity, we need a program of research on investigations and the ability to experiment at the agency level to identify best practices for all types of investigations.

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APPENDIX

Measures	Mean	Standard deviation	Minimum, Maximum	N
Case attributes				
Case characteristics				
Victim male	0.51	0.50	0, 1	382
Victim White	0.26	0.44	0, 1	378
Victim Black	0.57	0.50	0, 1	378
Victim age	32.91	13.63	3, 82	335
Number of victims	1.34	0.87	1, 8	385
Number of suspects	1.23	0.77	1, 11	388
Gun used in assault	0.28	0.45	0, 1	383
Knife used in assault	0.21	0.41	0, 1	382
Other weapon used in assault	0.59	0.49	0, 1	383
Solvability factors				
Weapon recovered	0.15	0.36	0, 1	388
Known mode of entry	0.66	0.47	0, 1	388
Offender identified at response	0.74	0.44	0, 1	388
Suspect arrested on scene	0.27	0.45	0, 1	388
Identifying information given on suspect	0.85	0.36	0, 1	388

Suspect and victim were family members or partners	0.40	0.49	0, 1	388
Suspect and victim were strangers	0.18	0.38	0, 1	388
Suspect injured	0.05	0.23	0, 1	388
Victim not injured	0.38	0.49	0, 1	388
Victim injured, not seriously	0.39	0.49	0, 1	388
Victim injured, seriously	0.23	0.42	0, 1	388
Victim received medical treatment	0.36	0.48	0, 1	388
Crime occurred in a residence	0.47	0.50	0, 1	388
Crime occurred on the street	0.35	0.48	0, 1	388
Suspect took property from victim	0.07	0.25	0, 1	388
Cooperative witness to crime	0.34	0.48	0, 1	388
Witness knew victim or suspect	0.28	0.45	0, 1	388
Victim reported crime	0.64	0.48	0, 1	388

Witness reported crime	0.11	0.31	0, 1	388
Victim cooperated with investigation	0.66	0.47	0, 1	388
Suspect's motive known to law enforcement	0.60	0.49	0, 1	388
Investigation attributes				
Number of police employees who went to initial crime scene	3.91	6.88	0, 77	340
An investigator went to initial crime scene	0.09	0.28	0, 1	388
Detective assigned to case	0.83	0.37	0, 1	388
Crime scene investigators processed crime scene	0.11	0.31	0, 1	388
Physical evidence collected at crime scene	0.33	0.47	0, 1	388
Follow up investigation conducted	0.83	0.37	0, 1	388
Investigator followed up with a victim or witness	0.64	0.48	0, 1	388

Investigator used additional evidence or technologies in follow up investigation	0.08	0.27	0, 1	388
A specialized unit assisted with the investigation	0.04	0.19	0, 1	388
Video or cell phone evidence investigated	0.10	0.30	0, 1	388