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A Model to Assess the Feasibility of 911 Call Diversion Programs

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ABSTRACT

Reforms to deploy civilian responders to non-criminal emergency calls may reduce demands on police departments and reduce negative interactions between police and civilians, but there is presently little empirical evidence on the feasibility of these proposals. We develop a model to evaluate which calls could be transitioned to civilian responders based on their crime risk. We use a rich dataset of community-initiated emergency calls to Baltimore Police Department to evaluate the effect of re-tasking based on three call diversion design scenarios. We find that 22 to 57% of 911 calls could be assigned to civilians. We then apply Monte Carlo methods to estimate the financial and time use implications of transferring low risk calls to civilians. Under the most conservative scenario, re-tasking frees police officer time equivalent to 59 additional full-time officers (95% CI: 43 – 75 officers), about nine percent of the Department's current patrol personnel.

1. Introduction

The police-involved deaths of George Floyd, Breonna Taylor, and other Black Americans led many to critically reappraise the role of police in society. These focusing events gave rise to widespread calls for reforms to diminish systemic racism and the role of law enforcement in American society by reducing local police budgets and reallocating those resources toward civilian agencies (Lum et al., 2022). Amid increased attention to violent crime nationally (Brennan, 2022; Goodman, 2021), policymakers seek reforms to shift police resources toward crime control and prevention (Parker & Hurst, 2021).

Empirical evidence supports both sides of this duality by demonstrating that expanded police presence (supported by increased spending) can reduce crime while also amplifying tension between communities of color and police. This conundrum speaks to the pressing need to understand the implications of police spending as

well as how police budgets and resources are allocated. Recent analyses suggest U.S. cities consistently under-invest in policing relative to the crime-reducing potential of additional police (Chalfin & McCrary, 2018). There are also considerably fewer U.S. police officers per homicide compared to other high- and medium-income countries (Lewis & Usmani, 2022). Mello (2019) estimates the marginal social benefit of hiring an additional police officer exceeds $300,000 annually. While there may be tangible benefits to crime control associated with investing in police, the actions of police officers can also impose harm on communities, especially predominantly Black communities (Soss & Weaver, 2017). For example, police are more likely to use force in interactions with Blacks than with whites (Edwards et al., 2019; Fryer, 2019; Knox et al., 2020; Hoekstra & Sloan, 2022). Black residents also report less satisfaction with police, more legal cynicism, and are more likely to believe that police act unjustly (Hagan et al., 2005; Pickett et al., 2022; Sampson & Bartusch, 1998; Weitzer et al., 2008; Wu et al., 2009).

One potential pathway to reducing harm associated with police presence while preserving or even enhancing public safety is to limit unnecessary interactions between police and community members by diverting certain calls for service to civilian responders.[1] From this perspective, re-tasking police emergency service calls that are outside the scope of crime control and prevention (that is, do not require an armed law enforcement officer with broad coercive powers) to civilian agencies should reduce police misuse of force in the United States. Indeed, the presence of an armed officer can worsen some situations; individuals with behavioral health problems may see armed officer as a threat, not a source of security.

Reforms to emergency responses could yield other benefits. For example, they have the potential to free police officer time to focus on serious crime which may also yield improvements with community satisfaction in police. In fact, recent studies estimate that 40 to 70% of community-initiated emergency calls for service do not involve a criminal incident (Brantingham & Uchida, 2021; Lum et al., 2022; Neusteter et al., 2020; Ratcliffe, 2021). Further, given that police officers may be costlier to deploy than other first responders, efficiency gains may accrue where calls for service are unlikely to require police presence. These funds could be diverted to other community agencies or services that could "step in" to respond to non-emergency situations.

In this study we consider the viability of re-tasking a subset of police emergency calls to civilian first responders in Baltimore, Maryland. We then identify the implications of retasking using two related measures: police time use and the financial cost of police. We estimate both outcomes using Monte Carlo simulation methods to account for uncertainty in the components of the call dispatch and response process. Our approach is based on the police service costing method proposed by Ellingwood (2016) that assigns the financial cost of each emergency call for service based on time use reported by officers and the wages of uniformed officers or civilian responders such as an Emergency Medical Technicians (EMTs) or social workers. The baseline analysis shows that calls that are already re-tasked by several "early adopter" municipalities could be resolved by civilian responders while freeing the equivalent of 59

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[1]We use the terms "calls for service (CFS)", "emergency call", "911 call", and "service call" interchangeably throughout the manuscript.

officers' labor time annually (95% confidence interval: 43—75 officers) in Baltimore with minimal impact on public safety expenditure. The middle estimate represents about 9% of the Department's current patrol officers.

Our findings build on prior work by investigating the relative risks and costs of emergency public safety response in a major U.S. city. This paper is also the first to present a model to evaluate the time use and fiscal consequences of program design alternatives for 911 call diversion to civilian first responders. We demonstrate that the model can be adapted to varying re-tasking regimes to suit jurisdictions' varying conditions and preferences. Based on administrative data from Baltimore, we further show that the calls diverted in existing programs operated by other large U.S. cities are conservative in terms of risk of serious crime, but relatively lax in terms of patrol officers' perceived need for police response. However, the underlying purpose of this paper is to provide a data-driven model through which re-tasking decisions can be evaluated, not to prescribe which calls should be re-tasked.

This paper is organized as follows. Section 2 reviews relevant literature on civil-police relations, dispatching, and police retasking. Section 3 describes qualitative data obtained through interviews with and on-site observation of three large urban police jurisdictions that adopted 911 call diversion programs. Section 4 summarizes the data and methods used to evaluate the risk of emergency calls for service and the potential for transition. Section 5 reports the findings of this analysis. Section 6 concludes with a discussion of the implications of these results for Baltimore and U.S. cities broadly.

2. Background

The deaths of many Black Americans in police custody inspired a wave of mass protests in the summer of 2020. A subset of these protesters demanded local governments "defund" their police departments. These calls quickly grew to a broader set of criticisms about the role of police in American society encompassing their responsibilities, practices, and funding. This section assesses relevant literature on police funding, force size, crime, and civil-police relations with minority communities. Social upheaval and calls for reform provide a window of opportunity for police reforms aimed at reducing the role of police in non-criminal emergency events. These reforms have the potential to decrease the incidence of police violence while freeing police resources that could be reallocated to crime control or other priorities.

Several studies find race is an important correlate of municipal police spending and that police forces grow with the proportion of the minority population in the community (Holmes et al., 2008; McCarty et al., 2012). Notably, McCarty et al. (2012) show police strength as measured by budgetary resources is strongly positively related to the share of African American residents in a municipality and weakly to the crime rate. Beck and Goldstein (2018) find that police budgets grew in recent decades even as crime declined because municipalities increasingly rely on police to address social problems in lieu of traditional social service providers.

A growing academic literature considers the intersection of policing and race. Owens (2020) notes that extant literature that estimates the benefits of police in reducing crime or the fiscal cost of criminal justice administration has largely ignored

"the impact that police actions can have on the legitimacy of law enforcement and credibility of the state as a benevolent social planner" (p. 11). Recent empirical evidence by Chalfin et al. (2022) recognizes the differential impact of policing among racial groups within a community. They find additional police deter homicides and that the benefit is twice as large for Black Americans compared to whites. However, additional police also means more arrests for minor offenses, and these arrests disproportionately fall on Black Americans without any clear benefit in terms of reduction in criminal harms.[2] Further, Knox et al. (2020) and Hoekstra and Sloan (2022) separately find Black and Latine people are more likely to experience force than whites during police encounters in studies of large U.S. cities.[3] Police use of force incidents can also have a chilling effect on public safety and other social outcomes. For example, Cheng and Long (2022) find that highly publicized police killings reduced subsequent proactive policing activities and arrests in several U.S. cities between 2014 and 2016. On the other hand, Moyer (2021) finds community-initiated emergency calls for service in Baltimore were not impacted by the death of Freddie Gray while in police custody in 2015. Several studies suggest that loss of trust in police can reduce the willingness to report crimes (Rosenfeld et al., 2003; Carr et al., 2007; Slocum et al., 2010; Tyler & Fagan, 2008), though some other papers do not find evidence of this relationship (Frank et al., 1996; Davis & Henderson, 2003).

A new literature emphasizes the role of emergency communication centers in shaping police interactions, including those with the potential to result in use of force.[4] Lum et al. (2020) finds that emergency calltakers resolve a substantial percentage of calls for service without direct police involvement. However, call centers are typically required to dispatch police if certain conditions are met, and about half of non-violent calls reviewed by Lum et al. (2020) received a police dispatch. Gillooly (2020) shows that calltakers' risk appraisals prime responding officers' responses to incidents. Other research suggests that calltakers and dispatchers are often poorly equipped to make these assessments. For example, the Pew Charitable Trusts (2021) found less than half of emergency communication centers provided behavioral health crisis training to identify high priority calls. The emerging research suggests successful re-tasking efforts require calltakers and dispatchers to accurately identify calls for service that may be resolved by civilians. It also raises the possibility that certain emergency calls may be systematically misidentified as eligible for a civilian response when police are required. We address this concern in our empirical analysis.

In summary, the extant academic literature reaches remarkable and problematic conclusions about policing, crime, and race. Police funding is associated with the racial composition of a municipality, and thus marginalized communities are more heavily policed than predominately white communities even if the underlying crime rates are comparable. The evidence of the direct effects and externalities of intensive

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[2]For example, Beckett et al. (2005) and Mitchell and Caudy (2015) show that drug enforcement and resulting arrests fall disproportionately on racial minorities. This disparity most directly reflects bias in police perceptions about drug use in these communities rather than differences in drug offending behavior.

[3]We use "Latine" as a pan-ethnic, gender inclusive alternative to "Latina" and "Latino".

[4]This literature typically distinguishes calltakers who are responsible for the initial communication with the emergency caller from dispatchers that communicate and manage resulting emergency calls with sworn officers.

policing is mixed, with recent studies suggesting that it delivers some benefits but also disproportionate costs to Black residents. Owens (2020) argues over-policing of these communities damages the legitimacy of the police, and, in turn, may erode legal compliance in the community (Papachristos et al., 2012; Tyler et al., 2015).

Advocates of police reform argue that transitioning police service calls to civilian responders can simultaneously rebuild civilian-police relations and reduce crime. There is some preliminary evidence this may be the case; Dee and Pyne (2022) find that a novel civilian response pilot program for mental health and substance abuse calls in Denver reduced reports of other criminal activity, including in the hours that the program was not in operation. We build on prior work by defining a model to systematically evaluate emergency events for retasking to civilians that incorporates the empirical data on crime risk and costs, and by incorporating uncertainty in these calculations.

3. Emergency Call Diversion in Large U.S. Cities

We performed site visits to active programs in three large U.S. cities: the Albuquerque Community Safety (ACS) department in Albuquerque, New Mexico, the Policing Alternatives and Diversion (PAD) initiative in Atlanta, Georgia, and the Crisis Call Diversion (CCD) and Mobile Crisis Outreach Team (MCOT) programs in Houston, TX. In each jurisdiction, we interviewed between eight and twelve stakeholders, including program administrators, police, call-takers, and civilian first responders, community advocates that are familiar with the origin and purpose of the diversion programs. We observed each program in the field by riding along with civilian first responders in late-2022 and early-2023. We also collected and evaluated administrative documents and publicly available reports.

The ACS, PAD, and CCD/MCOT programs were all developed to reduce police patrol officer workloads, limit the potential for dangerous and unnecessary use of force incidents, and to reduce call volume by matching those in need to social services.[5] Other design elements vary in ways that are important but less germane to the present study. Atlanta's PAD is a city-funded non-profit borne from public decarceration activism. Houston's CCD and MCOT programs are partnerships that build on prior successful collaborations between the Houston Police and Fire departments and the Harris Center, a county mental health agency. These retasking efforts pre-date the police reform movement that stemmed from the 2020 Black Lives Matter mass protests. Albuquerque's ACS was formed in 2021 as a municipal agency parallel to the police and fire departments to address provisions of a 2014 consent decree stemming from evidence of systemic excessive use of force. Tensions exist between police and the community in both Atlanta and Albuquerque due to perceived excessive use of force and overreliance on arrest and incarceration, echoing the sentiments of Baltimore residents.

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[5]While other programs have been in operation longer those that we observed, most notably the Crisis Assistance Helping Out On The Streets (CAHOOTS) program in Eugene, Oregon, our sampling frame focused on large, socioeconomically and demographically diverse urban jurisdictions similar to Baltimore.

The programs we observed have notable differences in their operations that help to inform our understanding of call diversion program design. Although the composition of the civilian responder teams varies, each program deployed teams that had expertise in mental health crisis intervention and strong familiarity with available local health and social welfare services to which clients could be referred. Most civilian teams were also equipped to provide basic needs such as hygiene products, bedding, and clean clothes.

The specific incidents to which each program responds also varies, but each targets incident types that were unlikely to involve violence or a weapon and had characteristics that were thought to be better served by civilians with specific technical expertise outside the central tenets of patrol policing. Table 1 lists the call types to which each program responded at the time of the site visits and the analogous call type in Baltimore. Albuquerque Community Safety (ACS) behavioral health and community responders field calls to events involving mental health, substance use, and homelessness issues. In Atlanta, the Policing Alternatives and Diversion Initiative (PAD) responds to indecent exposure calls. The table also includes the Denver's STAR program as another well-known example of an early re-tasking program for which there is evidence of success. In Denver, calls for intoxication, suicidal ideation or suicide attempts, welfare checks (i.e., alerts to

Table 1. Summary of calls assigned to civilian responders by early adopter call diversion programs.

Construct	Baltimore Dispatched Incident Type	Albuquerque ACS	Atlanta PAD	Denver STAR	Houston CCD/ MCOT
Intoxication and substance abuse	Intoxicated person		Intoxication and substance abuse	Intoxication	
	Person lying on street	Person down with no safety issues (with or without suspected drug use)			
	Sick person				
Syringe disposal	*None*	Needle pickup		Syringe disposal	
Mental and behavioral health crises	Behavioral crisis	Mental and behavioral health crises	Mental and behavioral health crises		
	Suicide	Suicidal ideation & suicide attempt		Suicidal ideation & suicide attempt	Suicidal ideation & suicide attempt
Needs of unsheltered and indigent individuals	Panhandling	Panhandler			
	Lewd act			Indecent exposure	
		Unsheltered individuals	Homelessness and public indecency		
		Welfare checks			Welfare checks
Non-criminal disturbances	Disorderly person	Disturbance			Disturbance
	Suspicious person	Suspicious person			Suspicious persons and events
				Trespass	Trespass

respond to concerns for someone's safety), indecent exposure, trespass of an unwanted person, and syringe disposal can be reassigned to STAR (Dee & Pyne, 2022). STAR, ACS, and PAD responders only are sent when there is no apparent threat of violence, acute medical need, or serious criminal activity; otherwise, police are dispatched and may request alternative response if or when the threat to civilian responders is minimized.

Across all three jurisdictions we observed, decisions about which calls would receive a civilian response through one of the diversion programs were constrained by risk aversion. For example, although several stakeholders intimated that the present diversion set is too narrow and the call triage process erred toward dispatching police, law enforcement frequently expressed worries about the potential harms to unarmed civilian first responders. This risk aversion carries over to the broader national discourse on police reform. Many U.S. citizens and policymakers orient their understanding around the notion that 911 callers can expect police response. An official who worked with law enforcement and public health officials in the planning and implementation of Houston's CCD program summarized the public's need for emergency response differently after its first five years of operation: "People call 911 when they don't know what else to do, not just because they want a uniformed officer."

The interplay between civilian decisions to call the police, call center and dispatcher decisions, and police discretion on the scene is indeed complex. The vast majority of crime is never reported and civilians call the police for a variety of non-criminal matters, which is why diversionary programs may lead to improvements for police and communities alike. Before we detail our model of re-tasking below, it is important to note the complexity of this discretion which we cannot fully account for in our study. On the one hand, individuals who call the police may report inaccurate information (Reiss, 1971), which could spur a chain of events leading to further misclassification or errors. As noted by Black (1970), crime data is also produced by police officers who respond "on a case-by-case basis to sanctionable conduct" (p.734). While most studies analyze police decisions to make an arrest, law enforcement officers also make important decisions about whether to record a crime in the first place, which can be influenced by a range of factors related to the individual, the situation, and the community. For example, Warner (1997) finds that police are less likely to record burglary crimes in neighborhoods that are more disadvantaged, but assault did not show this same variation.

4. Administrative Data and Methods

4.1. Study Site

This study considers the feasibility of re-tasking police emergency calls in Baltimore, Maryland. Baltimore is an appealing study site for several reasons. In 2020, the city spent $843 per resident on its police department, ranking first among U.S. cities for which data were publicly available (Holder et al., 2020). Baltimore also has a history of troubled interactions between police and its Black community. Notably, six Baltimore Police Department (BPD) officers were involved in the April 2015 death of Freddie Gray. Although all six were indicted, none were convicted. Major protests and violence

marked the death. In March 2017, nine BPD officers on the Gun Trace Task Force were indicted on racketeering charges alleging at least three years of robbery and extortion from city residents (Fenton, 2021). Under a 2017 consent decree, Baltimore now collects and disseminates detailed police performance data necessary to monitor the activities of police officers toward reforms prescribed by the decree. These reforms include revision of dispatch policies to cede crisis intervention responsibilities to specially trained officers, "With a goal of limiting police involvement in crises where appropriate, calls related to crises that do not necessitate a police response will be sent to other crisis services" (U. S. Department of Justice, 2017, pp. 39–40). Beginning in June 2021, Baltimore initiated a small pilot program that authorized dispatchers to route calls related to non-weapon suicidal ideation to a community partner, Baltimore Crisis Response, Inc. (BCRI) without the involvement of BPD officers.[6] The city hopes to expand the program, but we were unable to find evidence of any other ongoing retasking efforts.

Like many U.S. law enforcement agencies, the BPD is experiencing a staffing crisis (International Association of Chiefs of Police, 2020). Nationwide, police officer staffing declined 3.5% between 2020 and 2022 and over five percent of budgeted sworn officer positions are unfilled (Police Executive Research Forum, 2022). Baltimore's staffing shortfall is more drastic. As of April 2022, the BPD was 25% below its planned patrol officer and sergeant force size (Baltimore Police Department, 2022). Many police departments are now considering laxer eligibility requirements to expand the hiring pool to candidates that would otherwise not be qualified to serve (Bureau of Justice Assistance & Office of Community Oriented Policing Services, 2023). Another method to reduce the staffing shortfall is to reduce patrol officer responsibilities to policing activities that most directly affect public safety and crime control. In this approach, officer resources expended on core duties increase in proportion to the reduction in secondary responsibilities, such as non-criminal responding to non-criminal behavioral health problems.

4.2. Baltimore Police Department Administrative Data

We rely on 911 call data made available by the BPD that permit categorization of police responses by the disposition of the call event (e.g. recorded crime, situation abated on site, police not needed). The complete dataset is comprised of about 2.5 million community-initiated calls between July 2014 and June 2020; each year about 400,000 calls are received, more than 1,000 per day. Each record includes the event's location, time stamps marking dispatch and the start and end of investigation, and the criminal offense recorded. From these data, we define the probability of a call for service resulting in the report of a Part I crime or that otherwise requires police involvement based on the call's disposition as recorded by the responding officer. Table 2 provides detailed definitions of each call dispositions and Table 3 provides a breakdown of the frequency of each disposition for all calls in the sample. The Technical Appendix contains additional information about the methodology used to

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[6]In its first year the program cumulatively diverted 297 of 507 incidents routed to BCRI (City of Baltimore, 2022).

Table 2. Definitions of BPD call dispositions.

Disposition	Definition
Police Essential	
Report Written	There was not an eligible crime or other reportable incident, and the officer assisted the complainant to reasonably satisfy their need.
Police Not Essential	
Police Not Needed	Officer indicates the incident was resolved without police assistance or did not require police assistance.
Abated	There was not an eligible crime or other reportable incident, and the officer assisted the complainant to reasonably satisfy their need.
Handled In Service	Officer resolved incident without need for report.
Resolved Before Arrival	The person, or persons, are no longer present when the officer arrives to the call location.
Response Impossible	
Unfounded	Based on responding officer assessment, an eligible crime or otherwise reportable incident did not take place.
No Address	The address provided does not exist. After canvassing the area, there is not an alternate location or a corrected location could be found.
No Complainant	After making reasonable attempts to locate the complaint, the officer is unable to locate the complaint or contact with the complaint.
False Alarm	No evidence that incident occurred (typically silent alarms).

Table 3. Distribution of call dispositions.

Disposition	N	Proportion	Mean Investigation Time (Hours)
Police Essential			
Report Written	550,489	0.218	1.989
Police Not Essential			
Police Not Needed	654,620	0.260	0.453
Abated	627,220	0.249	0.562
Handled In Service	4,665	0.002	0.818
Resolved Before Arrival	348,545	0.138	0.372
Response Impossible			
Unfounded	105,146	0.042	0.392
No Address	126,768	0.050	0.399
No Complainant	9,042	0.004	0.453
False Alarm	63,855	0.025	0.344
Missing Disposition	32,289	0.013	0.481
Total	2,522,639	1.000	0.797

determine the probability of crime or the need for police based on observed dispositions.

We also use the time stamps on each service call record to determine how much officer or civilian time is required to clear a service call. Officer time use is determined by calculating total time spent (in hours) responding to each type of call from initial dispatch. Although this is a simple and reliable measure of officer response and investigation time, it may be confounded by factors beyond the incident itself. For example, officers may be required to spend more time on scene for incidents in neighborhoods with more crime or lower perceived police legitimacy because citizens may be less willing to cooperate with law enforcement agents (Brunson & Wade, 2019; Carr et al., 2007; White et al., 2016). Civilian responders may not encounter these same challenges but may also spend additional time on scene given that arrest or other coercive force cannot be used to resolve the call.

4.3. Baltimore City Municipal Workforce Data

Employee salary information for BPD officers and other City of Baltimore employees was obtained from the Open Baltimore data hub from 2014 to 2020. These data report the name, title, hire date, and the annual salary of each Baltimore city employee in each fiscal year. We use these data to determine the hourly wage rates of police officers, firefighters with an Emergency Medical Technician (EMT), Advanced Life Support (ALS), or Paramedic certification, and social workers. On average, BPD officers earned a base salary of about $69,500 annually, or about $38 per hour between FY15 and FY20. Firefighters earned a comparable hourly wage rate, while social workers earned considerably less ($28/hour). The Technical Appendix contains a detailed summary of the data and method for determining wage rates for City of Baltimore employees.

We pair these wage data with officer time use information derived from the BPD service call dataset to estimate to cost of dispatching uniformed officers or civilians to emergency calls. We accomplish this by adapting the activity-based costing method originally developed by Ellingwood (2016) to the BPD dataset. This costing method considers direct resources required in each call for service, which primarily reflects the cost of officer time spent responding to the call. Given that the CFS dataset does not specify how many officers responded to a call for service, we assume that 2.2 officers respond to each call based on a study of the Phoenix Police Department (Huff, 2021).[7] Mirroring other early adopter cities, we assume that one EMT/ALS/ Paramedic and one social worker will respond to emergency calls tasked to civilian responders. We provide a more detailed discussion of each of these decisions in the Technical Appendix.

4.4. Estimating the Change in Police Time Use and Budgetary Impact of Retasking

This study is motivated by the idea that many activities currently executed by police officers may not require their involvement. Reduction of police-civilian interactions in situations with low-risk of crime but high risk of behavioral health problems may in turn reduce occurrences of police violence and improve police-community relations (Vermeer et al., 2020). We evaluate the empirical distributions of incident types, call volume, call disposition and time use in BPD calls for service data to assess which activities presently performed by uniformed officers could be done safely by non-enforcement actors such as paramedics or social workers. We then use the results of these analyses to determine the implications of reallocating low-risk calls to civilian responders on BPD officer time use and the city budget. Both estimates are informative separately but require careful consideration when viewed together. The estimate of officer time savings assumes that BPD staffing levels remain constant, which implicitly entails expanded investment in civilian first responders. The estimated financial

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[7]Due to the staffing shortage in Baltimore, this may overstate the true average number of officers who respond in Baltimore. This positive bias in personnel may be compensated for by tactical changes in policing, including shorter investigation times or fewer responses, though we do not attempt to account for these differences with added uncertainty in the Monte Carlo model.

costs (or savings) represent the difference in the expected costs of responding to a set of calls with police or civilians at a predicted annual volume. Since changes in policing and civilian first-responder practices may affect call volume itself, these estimates cannot be directly interpreted as the subsequent reduction (or increase) in the BPD or Baltimore's city budget.

We define a model to estimate the impact of retasking calls that currently are diverted to civilian responders in the early adopter jurisdictions. We begin by identifying 13 constructs that characterize the labor costs associated with responding to calls for service using patrol officers or civilian first responders. In all, we estimate 30 parameters for this model for which we can assign feasible values from a distribution. Table 4 describes the parameters, distributional assumptions, and definitions of identity functions over which we estimate. The column titled "Mean/Middle" provides the measure of central tendency that corresponds with each distribution or equation.[8]

We then apply Monte Carlo simulation methods to translate the uncertainty in each parameter into a range of estimates concerning officer time use and the budgetary implications of retasking. This approach lets us describe a complex process in a relatively transparent way and predict its most likely outcome while describing underlying uncertainty about this prediction. In this model, we define a set of set of inputs to capture the process that leads from a 911 call, through emergency response, to its final disposition (e.g., the number of calls received, the probability that a call involves a crime, and the amount of time responders spend on-scene). The relationship between each of these inputs and the outcomes of interest (i.e., time use and expenditure) is defined, and each input is assigned a probability distribution (e.g., uniform, normal, triangular). Finally, the model results are generated over 100,000 trials based on random draws from the input distributions. The mean of the distribution for each outcome is its expected value, and uncertainty is captured by the width of the calculated outcome distribution.

Whenever possible, we incorporate model inputs directly from Baltimore administrative data. The frequency of incidents per year (row 1), the proportion of cases that result in police reports (row 2), the share of calls in which a response is feasible (row 3), time spent per incident (row 6), first responder wages (row 8), and call misidentification risk (row 14) are all drawn directly from Baltimore administrative data. A subset of the emergency service calls we consider lack an address, complainant, were unfounded, or were the result of a false alarm. These events do not generate Part I crimes and require less time, on average, compared with calls that require the responder to engage with a member of the public. We therefore make an adjustment for calls that neither a police or civilian responder could conceivable respond to in rows 4 and 6 of the Monte Carlo model.

Both empirically derived measures of the need for police that we evaluate—the probability of Part I crimes and the probability that police are not essential—are agnostic about calltakers' ability to correctly classify calls for service into a specific call category and the need for police action. However, an incorrect initial assessment

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[8]The mean is used for normal, uniform, and binomial distributions and the median is used for triangular distributions. Functions that are described with a formula use the expected value of the function. See the Technical Appendix for more details.

Table 4. Monte Carlo simulation model inputs and assumptions for early adopter design scenario.

Construct	Row #	Quantity	Quantity Detail	Low	Mean/Middle	High	Plug-in Value	Distribution or Formula
Cases	1	Incidents per fiscal year			420,435		sd = 23,508	Normal, BPD
	2	Incidents qualifying for retasking			93,301		$p_2=0.222$	$\#1 \times p_2$; BPD
	3	Proportion of incidents to which first responders can respond					$p_3=0.671$	$\#1 \times p_3$; BPD
	4	Re-task Eligible Cases	Possible Response		62,595			Binomial($\#2, p_3$)
			Impossible Response		30,705			$\#2 \times (1-p_3)$
Reports	5	Cases ending in reports			6,021		$p_5=.073$	$\#2 \times p_3 \times p_5$
Time	6	Time spent (hours)	Possible Response		0.623		sd = 0.02	Normal; BPD
			Impossible Response		0.360		sd = 0.01	
Officers	7	Officers responding			2.2		sd = 1	Normal
Wages	8	Personnel-weighted average hourly wage plus fringe of responder	BPD		$60.53			Normal, BBMR
			Social Worker		$44.35			
			EMT		$55.86			
BPD Time	9	Time (hours)			110,073			$\#4 \times \#6 \times \#7$
BPD Expenditure	10	Expenditure, BPD status quo ($ millions)			$6.66			$\#8 \times \#9$
Civilian Time	11	Resolution pace with civilian responders		0.75	1	3		Triangle
	12	Time (hours)			145,745			$\#6 \times \#13$
Civilian Expenditure	13	Expenditure assuming 1 EMT & 1 social worker ($ millions)			$7.30			$\#8 \times \#14$
False Negatives	14	Probability of false negative at 1% Part I risk					$p_{14}=0.018$	BPD
	15	Events requiring BPD backup			2,324			Binomial($\#4, p_{14}$)
	16	Additional civilian time from late BPD arrival		1	1.1	5		Triangle
	17	Total civilian false negative time (Hours)			5,578			$\#15 \times \#16$
	18	Civilian cost of false negatives			$0.28			$\#8 \times \#17$
Risk Calculation for False Negatives	19	BPD time for civilian backup		0.5	1	3		Triangle
	20	BPD officers responding			2.2		sd = 1	Normal
	21	BPD time for civilian backup			5,417			$\#15 \times \#19 \times \#20$
	22	BPD cost of civilian backup			$0.33			$\#8 \times \#21$
	23	Expenditure assuming 1 EMT & 1 social worker w/ false negatives ($ millions)			$7.91			$\#13 + \#18 + \#22$
Arrest Reduction	24	Reduction in arrests (Dee & Pyne, 2022; se × 3)		−0.002	0.336	0.560		Triangle
	25	Case reduction			1,795			$\#5 \times \#25$
	26	Time spent on arrests		0.5	1.5	4		Triangle
	27	Total time savings from fewer arrests (hours)			7,912			$\#25 \times \#26$
	28	Avoided BPD officer labor ($ millions)			$0.48			$\#27 \times \#8$
Effect	**29**	**Annual Savings (Cost) w/ Risk ($ millions)**			**($0.77)**			$\#10 - \#23 + \#28$
	30	**BPD Time Savings (hours)**			**107,575**			$\#9 - \#21 + \#27$

Notes: Shaded cells are specified values; other numeric values are random variables. Estimates drawn from BPD data and the Baltimore Bureau of Budget and Management Research indicated as BPD and BBMR, respectively.

by the emergency call center can be costly. False negatives—incorrectly identifying an event that should be handled by police as divertable—potentially endangers civilian first responders and public safety generally. False positives—incorrectly identifying an event as high risk—results in inefficient use of police resources and present a chance for the misuse of coercive force. Over the study period in Baltimore, we find the false negative rate is 3.6% and the false positive rate is 1.5% for the early adopter design scenario. In the model, we only estimate the impact of false negatives. It would be straightforward to incorporate false positives as well, but we exclude this component of the model since Baltimore and other municipalities are likely to err toward a police response when an incident may require one because of risk aversion. We estimate the net effect of false negatives in rows 14-23 of Table 4 assuming both civilian responders and police spend more time than average dealing with cases that are initially misidentified. Standard practice in all operating sites we observed is for civilian first responders to retreat and call for police intervention when they feel they are at risk. This procedure is time-consuming but is seen as essential by program architects since it mitigates safety risks to civilian first responders. We provide a detailed overview of the methodology for evaluating the risk of misidentification in Baltimore 911 calls in the Technical Appendix.

A few parameters in the model are defined with less empirical support. For example, row 7 indicates that we expect 2.2 BPD officers (with a s.d. = 1 officer) to respond to each call, on average. Practically, this implies that the Monte Carlo model assumes that, on average, two alternative civilian responder hours replace 2.2 BPD officer hours. We also assume that it will take civilian first responders approximately the same amount of time as BPD officers to resolve incidents, though they might take more or less time. There is no empirical basis for this assumption in Baltimore, but we believe a reasonable range based on field observations is 25% faster to three times as long, with a modal time that is equal to BPD time use (row 11). The triangular distribution we specify draws a random variable from this specification. We make similar assumptions in rows 16, 19, and 26.

One common theme in the discussion of civilian re-tasking of police events is that fewer arrests will be made. Although evidence to inform this assumption is again sparse, the Dee and Pyne (2022) quasi-experimental evaluation of the Support Team Assistance Response (STAR) program pilot in Denver provides a baseline estimate to consider. They find that STAR reduced arrests for trespassing, public disorder, and resisting arrest by 33.6% in affected neighborhoods, which we use as the middle estimate for arrest reduction parameter. We also multiply their standard error by three when calculating the upper and lower bounds of the distribution of the random variable (row 24). This decision reflects underlying uncertainty about how Dee and Pyne's findings for Denver translate to Baltimore, and results in a distribution of feasible values that ranges from a 56% reduction in arrests for these incidents to a very slight increase in arrests. The resulting upper and lower bounds of the predicted change in arrests are not symmetric because Dee and Pyne modeled log-arrest rates. We assume that the median time spent processing an arrest is 1.5 hours with an upper bound of 4 hours and a lower bound of 0.5 hours. The remaining components of the simulation model (rows 2-4, 9-10, 12-13, 17-18, 21-23, 25, 27-30) are arithmetic steps that are entirely based on the inputs we define above.

4.5. Three Feasible 911 Diversion Program Design Scenarios

A core purpose of 911 call diversion programs is to recast the construct of perceived police utility, which is inherently a normative judgement that likely varies across jurisdictions. For this reason, we present a model that can estimate the impacts of alternative program designs. The primary design scenario we consider is based on existing practices of *early adopter* U.S. Cities: Albuquerque's ACS, Houston's CCD/MCOT, Atlanta's PAD, and Denver's STAR program. The perspective that diversion programs err too far on the side of caution suggests a potentially broader mandate than those of early adopter cities. We therefore consider two potential alternatives based strictly on the available empirical evidence from Baltimore.

The second design scenario is relatively *permissive* compared to baseline early adopter scenario. All dispatched incident types with less than a 0.01 (1%) probability of generating a Part I crime are reassigned to civilian responders. The *permissive* design scenario is a potentially drastic departure from current policing practices in the U.S. but offers a simple and useful alternative classification method. This is the most aggressive re-tasking design scenario we consider but is consistent with the logic described by several program architects we interviewed.

Still, a narrow focus on the probability of a recorded Part I crime minimizes other less serious crimes that are not systematically recorded in Baltimore administrative data and occasions when police on the scene could be beneficial for reasons other than responses to crime incidents. We also note that some calls for service may still merit a police presence even if a serious crime was not recorded. For example, police frequently mediate disputes or control crowds and traffic at the scene of a non-criminal event. These matters may be handled as effectively by civilians without the authority to coerce individuals, but this assessment is *ex ante* subjective. Current community oriented policing practices that are unlikely to involve coercive force can generate both tangible immediate benefits to public safety and potential intangible benefits toward police-community relations.

This understanding motivates a third design scenario based on two criteria. First, a service call's Part I crime probability must be less than 0.01, and second, the probability that a police response is essential must be less than 0.1. This latter probability is based largely on officers' own assessments. In the BPD data, we observe four mutually exclusive and complementary officer-determined call dispositions for incidents where officers can take action: the probability that a report was written after an incident; as well as the probabilities that "police [are] not needed", and the incident was "abated on scene" or "handled in service." We consider the latter three dispositions to determine when police were not essential to resolve a call.

This *restrictive* design scenario will err toward a police response compared to the permissive scenario. It will also call for a police response to certain categories of emergency calls that meet the criteria described above that other early adopter cities already designated as eligible for re-tasking to civilians. We note that many of these calls could be resolved by civilians even if police responders often report that their presence was necessary. For example, disputes where no crime is committed may be resolved by personnel with mediation training. In-person responses to calls about child neglect without evidence of harm may be ably handled by a social worker.
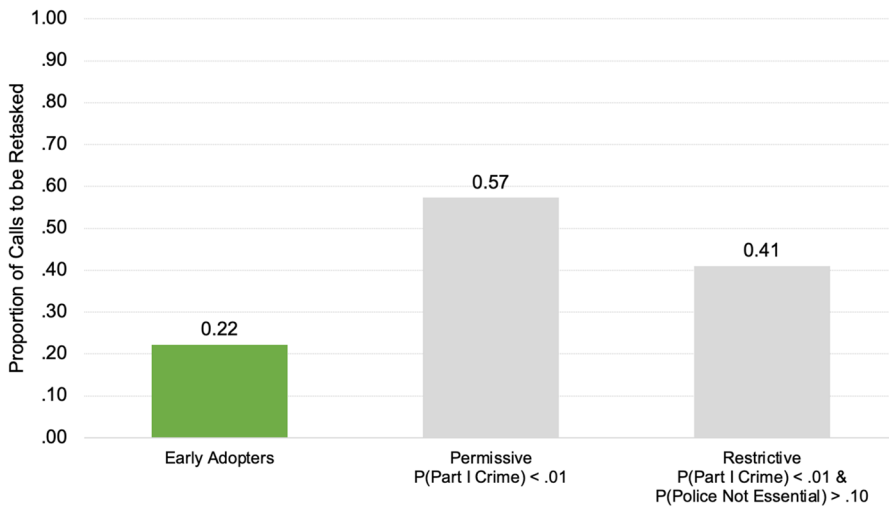
Figure 1. Volume of 911 calls diverted to civilian first responders based on alternate design scenarios, FY2015-20.

Though the third scenario reassigns certain 911 calls based on current police assessments, we highlight the inherent subjectivity in these judgements.

Further, the threshold choices of 0.01 Part I crime probability and 0.1 probability that police are essential are ultimately arbitrary, but these thresholds are consistent with commonly held perceptions of a "rare" events in scientific literature. Lowering either threshold represents greater risk aversion, as calls with lower risk of generating a Part I crime are also less likely to present risk of harm to responders and citizens in the immediate vicinity of the incident. Raising either threshold would result in a more expansive set of incidents and would be a relatively drastic action to limit police-community contact.

Figure 1 shows the difference in the share of 911 calls to be retasked for each of the three design scenarios. To evaluate the alternative design scenarios using the Monte Carlo model, we change the call diversion choice to be based on the *permissive* 0.01 Part I crime probability threshold, then we adopt the *restrictive* filter to include incidents that satisfy both the 0.01 Part I crime probability criterion and the 0.9 police not essential probability. For each specification of the model, we vary the definition of calls for retasking and find new statistics for model parameters #2 through #6, as well as #16.

5. Results

5.1. Descriptive Analysis of Call Dispositions and Time Use

Table 3 shows a summary of call dispositions over the study period. The data indicate emergency calls assigned to the BPD have an approximately equal probability of four outcomes: the event resulted in a police report ("Report Written"; 0.218), was abated after officers arrived on-scene ("Abated"; 0.251), did not require police response ("Police Not Needed"; 0.260), or could not be processed because the event was unfounded, an address or complainant could not be found, or the event was

resolved before police arrived ("Unfounded," "No Address," "No Complainant," "Resolved Before Arrival," and "False Alarm"; 0.259).[9] On average, calls take 48 minute from dispatch to disposition, but the amount of time leading to disposition varies based on the outcome of the call. Police spend approximately 23 min on calls that cannot be processed, about one hour when a call can be processed, and two hours when a report is written.

From these basic summary findings, one practical finding is apparent. Over the seven-year study period, more than 50,000 officer hours—equivalent to about 9 patrol officers per year—are spent responding to calls where the associated address could not be found, assuming that 2.2 patrol officers respond to each call. There are call processing technical solutions to this problem that verify addresses are valid prior to dispatch. It is less apparent whether all calls that are abated by uniformed officers would be similarly abated by a civilian first responder. Based on field observations and to maintain simplicity in the specification of our simulation model, we assume this is the case.

5.2. Differences in Calls Diverted across Design Scenarios

Table 5 displays counts and probabilities that each incident type yields a Part I crime or that police are not essential (i.e., "Police Not Needed," "Abated," and "Handled In Service") for the 25 most frequent CFS types based on calltaker incident descriptions over FY2015 to FY2020.[10] We also indicate the share of calls to which police can respond (i.e., calls where a report is written or police are not essential) and whether each incident type would be retasked based on each of the three design scenarios. In the calculation of the probability that police are essential, we exclude disposition codes where a response is impossible from the denominators because we calculate probabilities conditional on first responders' ability to respond to the call. Only emergency calls that generated a report also result in a recorded crime.[11]

Figure 2 visualizes the relationship between need for police response and Part I crime. Responding officers most often indicate that incidents are resolved without a report when a call entails a low likelihood of a reported crime. Many common incident categories rarely result in a recorded crime or the need for a police officer response. For example, fewer than 1% of calls involving disorderly persons result in a Part I crime and only 8.5% are resolved with a police report filed. Similarly, juvenile disturbances, behavioral crises, parking complaints, and loud noises all fit this description (see Table A2 in the Technical Appendix for these probabilities). By contrast, larceny (0.402 and 0.557), burglary (0.295 and 0.498), aggravated assault (0.259 and 0.619) all entail a very high probability of resulting in a Part I crime. Common assault, which is not a Part I offense but can sometimes result in very

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[9]About 1.3 percent of emergency calls are missing a disposition code.
[10]A complete listing of BPD calls for service during the study period is reported in Table A2 of the Technical Appendix.
[11]We assume that the small number of cases where a crime is recorded without record of a report were erratic; we recoded these as though a report was recorded.

Table 5. Twenty-five most frequent categories of BPD calls for service, FY2015-20.

Dispatched Incident	N	Prob. Police Can Respond	Part I Crime Prob.	Prob. Police Essential	Early Adopter	Permissive	Restrictive
Disorderly Person	408,277	0.685	0.006	0.085	■	■	■
Accident	258,067	0.876	0.003	0.429		■	
Common Assault	226,118	0.733	0.043	0.388			
Other	225,153	0.719	0.003	0.095		■	■
Narcotics	191,486	0.477	0.000	0.066		■	■
Silent Alarm	171,597	0.636	0.013	0.046			
Larceny	160,911	0.853	0.402	0.557			
Burglary	110,602	0.804	0.297	0.498			
Family Disturb.	105,700	0.868	0.015	0.376			
Suspicious Person	66,876	0.441	0.006	0.062	■	■	■
Destr. Property	64,874	0.877	0.083	0.617			
Agg Assault	51,505	0.774	0.259	0.619			
Stolen Vehicle	49,852	0.862	0.378	0.642			
Armed Person	47,541	0.507	0.066	0.408			
Missing Person	36,172	0.919	0.002	0.503		■	
Behavioral Crisis	32,586	0.847	0.003	0.220	■	■	
Loud Noise	30,192	0.803	0.000	0.008		■	■
Parking Complaint	29,316	0.789	0.000	0.092		■	■
Juvenile Disturbance	23,908	0.532	0.004	0.034		■	■
Suicide	20,263	0.838	0.002	0.241	■	■	
AED Nonbreathing	18,882	0.925	0.008	0.519		■	
Robbery, Armed	15,335	0.876	0.712	0.936			
Discharging Firearm	12,946	0.461	0.088	0.868			
Overdose	12,314	0.873	0.001	0.242		■	
Person Lying on Street	11,835	0.717	0.003	0.045	■	■	■

Notes: The 25 most frequent incident types are displayed here. See Appendix Table A2 for a complete list.
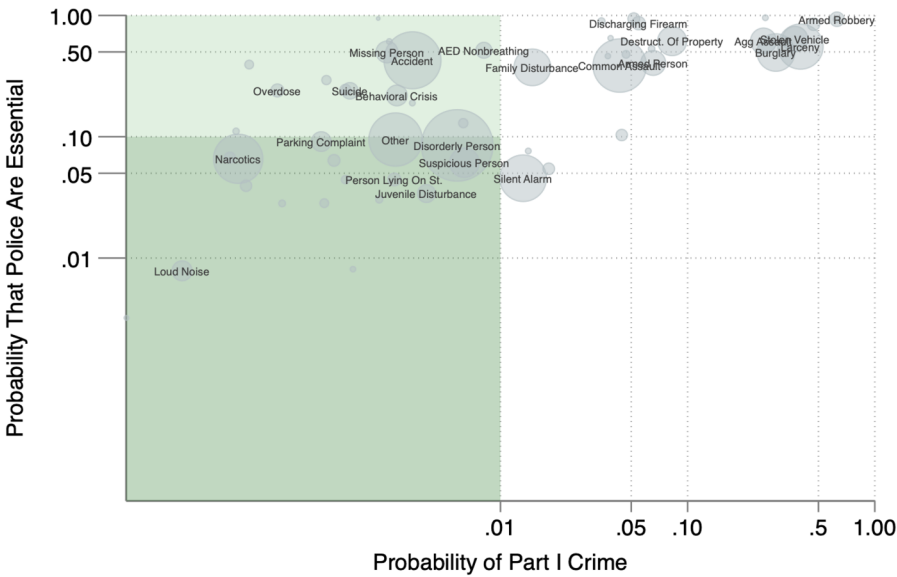

Figure 2. Outcome probabilities of emergency calls assigned to Baltimore police by category, FY2015-20.
Notes: Gray circle size represents the volume of calls by incident type; shaded areas represent regions that include retasked calls under restrictive (darker shading) and permissive (lighter shading) designs. The axes are displayed in a logarithmic scale to differentiate low probability incidents. The data used to create this figure are reported in Table A2 of the Technical Appendix.

serious injuries to the victim, yields a sufficiently high risk of ultimately being declared a Part I crime that no programmatic design scenario we consider would re-task these calls away from police. Narcotics calls, on the other hand, yield very low risk of Part I crime and only result in a police report in 6.6% of cases. This suggests that status quo policing practices in Baltimore rarely yield a crime or arrest despite the well-known links between drug markets and violent crime. The empirical findings from both our permissive and restrictive models implicitly suggest that some other agent may be more effective than the status quo police practice.

We identify nine incidents to which the early adopter programs respond in the Baltimore calls for service data: behavioral crisis, disorderly person, intoxicated person, lewd act, panhandling, person lying on street, sick person, suicide, and suspicious person. All nine incidents have less than one percent chance of generating a Part I crime, but five of the nine have a probability of requiring police response beyond the 0.1 threshold value we consider, based on police assessments: behavioral crises (0.22), lewd acts (0.19), sick persons (0.13), and suicide (0.241). Thus, on this dimension, early adopter jurisdictions demonstrate less risk aversion than the parameter set in our restrictive design scenario.

5.3. Estimated Change in Police Time Use and Budgetary Impact of Retasking

The emergency calls eligible for retasking by early adopter cities account for 22% of the BPD's call volume. We estimate that the total cost of a police response to these calls in Baltimore is about $6.7 million annually. The estimated new costs associated with increasing the civilian workforce to field first responders to reassigned calls is about $7.8 million (95% confidence interval: $4.9 million to $12.1 million). After accounting for additional officer time use savings based on reduced arrests, re-tasking generates about $0.8 million in added public safety expenditure by the City of Baltimore (95% confidence interval: -$2.2 million to $4.8 million). Uncertainty about police staffing is a major contributing factor to the wide confidence intervals around each estimate. We assume in the model that first responders will be deployed in pairs; as discussed above, we do not make this assumption about BPD officers.

We find BPD time savings of 107,600 h per year (95% confidence interval: 98,000—128,900 h), which is equivalent to 59 full-time patrol officers (95% confidence interval: 43—75 officers). One component of this estimate is the budgetary impact of false negatives, which increase the cost of re-tasking by about $0.6 million each year. False negatives increase the total labor cost of emergency call response as they require a police response after the preliminary civilian response. The financial savings from a potential reduction in arrests are trivial in the context of the BPD or police budgets generally but may generate important social externalities for the community.[12] Table 6 summarizes the simulation output and Figure 3 plots the corresponding histograms.

It is important to note that the emergency call response cost estimates above rely on numerous assumptions. The wide variation in these estimates is a consequence

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[12]If Baltimore were to realize a reduction in arrests equivalent to Denver's experience with the STAR pilot, it would generate financial savings equivalent to $0.5 million annually (95 percent confidence interval: $0.1 million – $1.1 million).

Table 6. Monte Carlo simulation estimates for early adopter design scenario.

	Mean	Std Dev	95% CI Lower	95% CI Upper
Annual Net Change in Expenditure Compared to the Status Quo, in Millions (*Row 29*)	−$0.77	$1.99	−$7.11	$3.74
Annual BPD Time Savings in Thousands of Hours (*Row 30*)	107.6	7.6	77.6	137.2
Annual Cost of Civilian Retasking, in Millions (*Row 13*)	$7.91	$2.03	$3.92	$15.26

Notes: Results based on a Monte Carlo simulation with 100,000 trials based on the inputs shown in Table 4. Row numbers also refer to Table 4. See Figure 3 for the empirical distributions of each result.
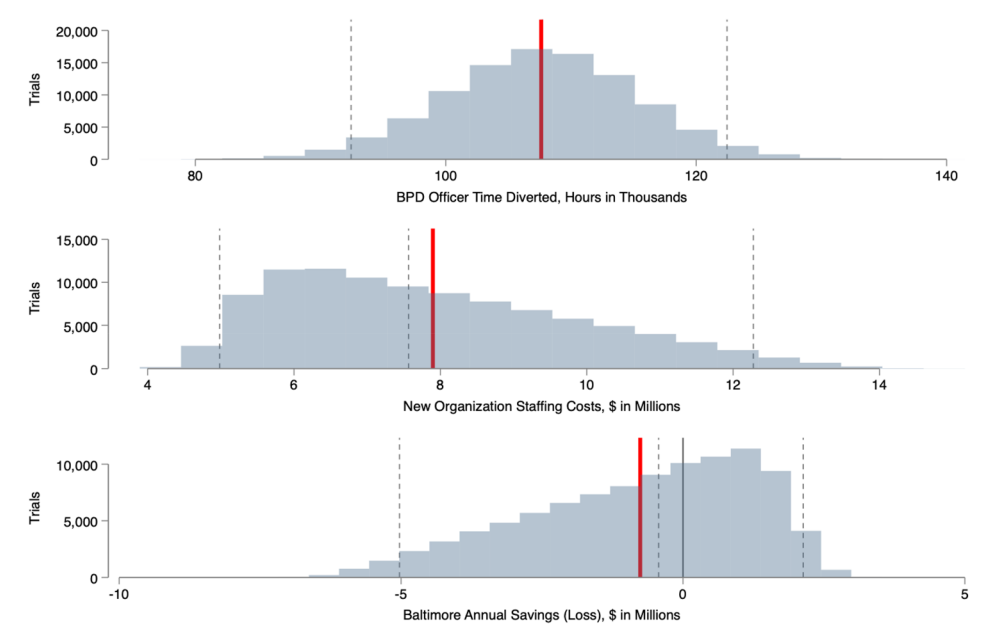
Figure 3. Histograms of early adopter design scenario estimates of BPD time diverted, civilian re-tasking cost, and the net budgetary impact on the city of Baltimore based on Monte Carlo simulations.
Notes: Vertical dotted lines represent, from left to right, the lower bound of the 95% confidence interval, the median prediction, and the upper bound of the 95 percent confidence interval. The vertical red line is the mean prediction.

of uncertainty in parameters that have weak empirical foundation, particularly the amount of time a civilian first-responder spends at an incident relative to BPD officers, the number of police or civilians deployed, and the effect of retasking on arrests. One other consideration is how retasking is accomplished. Baltimore could opt to hold the police force size constant while adding additional civilian workers needed to meet the emergency call demand. This effectively increases total municipal spending on public safety. Alternatively, the city could reduce the police force size commensurate with the reduced emergency call demand, effectively replacing uniformed officers with civilians. Here, practical grounding is important. Given that BPD is already

operating well below its planned force size, the city may be unlikely to consider further cuts without external pressure.

Additional sensitivity analysis indicates that BPD officer hours that can be diverted and the net cost of responses to calls for service is positively related to the Part I crime probability threshold, but so too is uncertainty around the model's estimates. Figure 4 plots the estimates derived from the specifications corresponding to our main *early adopter* design scenario alongside the *restrictive* and *permissive* design scenarios that require probability that Part I crime risk to be below 0.01 and the probability that police response is essential to be below 0.10. The expected budget impact remains negligible across these alternative scenarios. However, we demonstrate that greater patrol officer time savings can be realized under both the restrictive and permissive design scenarios. The estimated officer time savings under the permissive scenario is statistically greater than those under the restrictive scenario ($z = 6.65$, $p < 0.001$). Similarly, the estimated officer time savings under restrictive scenario is statistically greater than the early adopter scenario ($z = 3.85$, $p < 0.001$). However, we only find a statistically significance difference in the expected program cost between the early adopter and permissive scenarios ($z = 2.29$, $p = 0.022$). Due to the inherent risk of diverting calls based on Part I crime risk alone, the estimated impact of the permissive design scenario carries considerably more uncertainty, which is reflected by systematically wider confidence intervals.
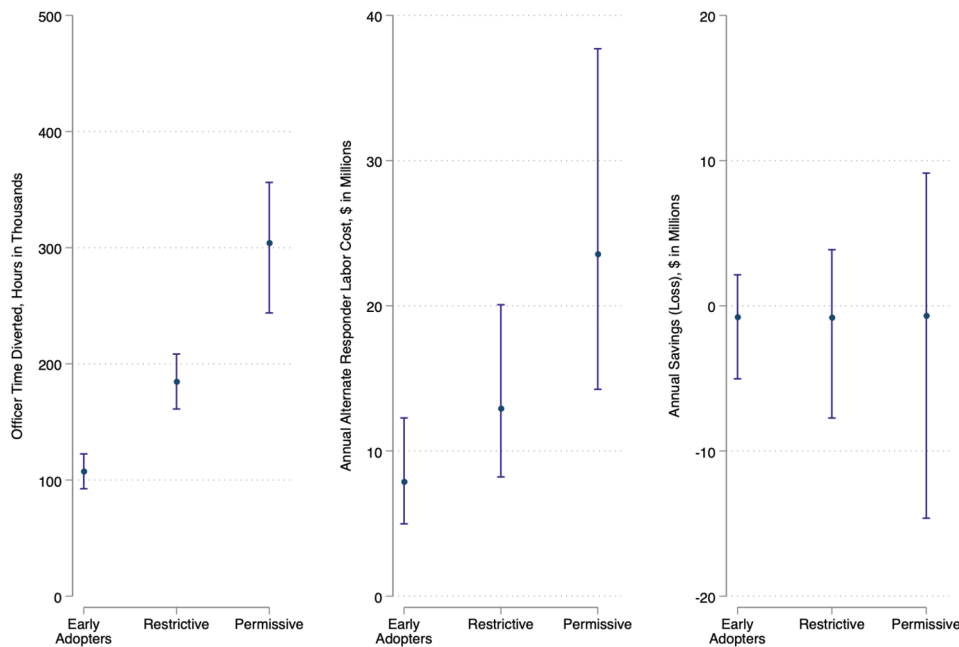

Figure 4. Monte Carlo estimates for alternate design scenarios.
Notes: Dots correspond to mean estimate generated for each scenario by the Monte Carlo model; lines reflect 95 percent confidence intervals around the mean estimate.

6. Discussion and Conclusion

Police reform advocates contend that many emergency calls could be addressed by civilian social workers, thereby improving police efficiency, performance, and relations with the community. We add to this conversation by measuring and monetizing time use explicitly, and by identifying a broad set of calls for service that are suitable candidates for re-tasking based on the risk that they coincide with an ongoing crime that may endanger the first responder or otherwise require a sworn officer. We specifically consider these reforms in the context of Baltimore, a majority Black or African American city with an above average crime rate and police expenditure.

Our primary objective in this analysis is to present a model by which the complex decisions required to design a 911 call diversion program can be systematically evaluated. While the simulation model we define is value free, the assumptions we make in the alternative models are not. As William James opined, "Objective evidence and certitude are doubtless very fine ideals to play with, but where on this moonlit and dream-visited planet are they found?" Although there is no objectively correct specification of this model, we attempt to make reasonable, systematic, and transparent assumptions to inform policymakers about the potential costs and benefits of diversion programs. In this analysis, we assume police are uniquely qualified to respond to crime events, but civilians may provide adequate or superior response to other types of emergencies. Although we limit the model to evaluate diversion to civilian responders only, many jurisdictions now deploy community resource officers as an alternative to response by traditional police officers. To demonstrate the utility of the model, we define three feasible program design scenarios for Baltimore specifically. However, we encourage researchers and practitioners to add, remove, or adjust the model's current assumptions to reflect the available data on 911 responses in their jurisdiction as they see fit.

Adapting the existing practices of early adopter call diversion programs currently operating in four large U.S. cities, we estimate that at least one-in-five calls that are currently fielded by patrol officers in Baltimore can be successfully diverted to civilian responders. The resulting budgetary impact of such a change are negligible, but the time savings to officers and intangible benefits to the community are not. During field work for this study, we observed civilian teams respond to calls involving persons experiencing mental health crises by employing de-escalation methods to gain trust and gather information about the situation and individuals involved, methodically working to resolve the incident. This may lead to quicker resolution of some cases but may also take hours to play out. According to stakeholders, many of the responders' interactions with these individuals were made possible only by the absence of a police uniform and weapon. This leads us to surmise that successful diversion programs will increase total effort expended on 911 call responses in the short term because the rate of calls that lead to dead ends—e.g., a complainant or person requiring assistance leaves or refuses help—will fall with time. In the long-term, individuals who repeatedly call 911 for non-criminal matters may be more likely to find resolution through civilian response. In the jurisdictions we observed, police perceive the benefits of diversion programs both through the reduction in workload that falls outside of core policing duties and through their ability to spend more time on proactive and

community-oriented policing tasks. The *early adopter* design scenario is in some ways conservative about the variety of incidents to which civilians can respond, but it does include incidents when police reports are written and arrests are probable in far more than ten percent of cases, including suicidal ideation calls and behavioral crises. These situations may give rise to inappropriate use of force as persons under duress may be made more volatile by a police presence.

Police (mis)use of force is particularly salient for predominantly Black communities as well. Officers are more likely to use force against Black residents (Knox et al.; 2020; Hoekstra & Sloan, 2022) and in neighborhoods with a larger share of Black residents (Lautenschlager & Omori, 2019). Therefore, diverting calls to civilian responders may be especially beneficial in predominantly Black communities, where the number of interactions with police (and opportunities for force to occur) should be reduced. To be sure, racial *disparities* in the use of force may not decrease because of diversionary programs, especially if there is no variation in their implementation across neighborhoods. However, given that the frequency of low-level interactions with police should decrease generally with diversionary programs, they could be especially beneficial to communities that are predominantly Black.

We also consider alternative programmatic scenarios based on Part I crime risk and the necessity of a police response in the absence of a crime. Approximately 57% of all calls for service currently tasked to uniformed officers have less than a one percent chance of resulting in a Part I crime. Over 40% have less than one percent chance of Part I crime *and* less than 10% chance of requiring a police response based on police assessments. However, there is also a small chance that these calls are misidentified at dispatch and will subsequently result in a crime. In supplemental analyses presented in the Technical Appendix, we show that call misidentification risk is relatively constant across communities of varied socioeconomic characteristics after accounting for call-specific characteristics. While the data and analysis show that call misidentification is rare, the stakes are large. In such a situation, the first responder and the community may face threats that a uniformed officer is best suited to resolve.

Finally, we consider the time use and financial implications of re-tasking these calls. Transitioning emergency calls from police to civilians has the potential to reduce the labor cost of completing calls for service. Although the estimated cost difference is negligible when compared against the BPD's annual budget for police patrol, retasking calls currently fielded by early adopter programs may greatly reduce officer time spent on CFS. The International Association of Chiefs of Police (2023) recommend that patrol officers should spend 30% of their time responding to CFS . While the true share in Baltimore is unknown and likely higher, the potential reduction in workload associated with early adopter program calls is equivalent to nearly 30% of the total time BPD's roughly 690 patrol officers should devote to CFS, consistent with the 9% of all patrol officer time we estimate directly. Many U.S. cities currently utilize a "co-response" or model where sworn officers and civilian clinicians are jointly dispatched to suitable calls for service. This hybrid approach may improve the outcomes of these emergency calls in some cases, but may also require greater labor input which increases the cost of response.

This analysis has several notable limitations. First, the study period is bookended by tumultuous events. It begins with the April 2015 death of Freddie Gray while in

police custody which was followed by a historic increase in violent crime in Baltimore. It ends during the COVID-19 Pandemic which had a profound effect on all aspects of life in Baltimore, including the criminal justice system. These events may have impacted the composition of emergency calls received, time use estimates, and the disposition of cases. We elected to incorporate all available data because we cannot yet distinguish whether these shocks led to momentary disruptions in patterns or systemic changes. It is difficult to gauge their impact on the external validity of our estimates, though it is worthwhile to note that many other U.S. cities faced these challenges during this period.

Second, we assume that officers accurately report incidents. If false positives are undercounted and officers tend to overstate the need for police response and risk of crime, then this analysis is biased toward underestimates the potential financial benefits associated with retasking. In the less likely case that officers understate the need for police, this analysis underestimates the potential costs. In both cases, officers' misrepresentation of public safety risks may produce large intangible social costs. Indeed, prior research suggests that misrepresentation or misreporting may be motivated by a desire to manipulate crime data (Eterno et al., 2016). Failure to correctly dispatch civilians or police to the service calls where they are required may generate social costs such as reduced legitimacy and trust in police.

Third, our cost estimates reflect only the labor costs associated with calls for service. There are numerous other costs that are not considered, including training, emergency vehicles, supplies, and the support workers that facilitate emergency response. A conservative assumption is that these costs are equivalent whether the call is handled by civilians or BPD officers.[13] We further assume that civilian workers respond to and resolve calls for service at the same speed as sworn officers. It is plausible that civilian workers will take longer to peacefully resolve some calls for service given that arrest is not option to terminate the encounter. Further, police may still be required even after initial response by a civilian. These scenarios increase the cost of deploying civilians in lieu of officers. In addition, some emergency calls are suitable for social workers, while others will entail medical emergencies that require paramedics or EMTs; these details were not available in our data. A policy of deploying EMT-social worker responder pairs is inefficient, but probably appropriate given the uncertainty associated with responding to an emergency call. It is also likely that EMTs are currently deployed along with BPD officers to many calls for service. Calls for accidents, non-breathing, behavioral crises, overdoses, persons lying on street, and sick persons account for nearly 40% of calls with under a one-percent probability of generating a Part I crime record. In this case, replacing the modal response of two sworn officers plus EMT with a single EMT-social worker pair would achieve greater cost savings than our model predicts.

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[13]A separate consideration is that retasking efforts, such as Denver's STAR program, typically begin as small pilot programs. For example, Dee and Pyne (2022) report that the STAR pilot program responded to 748 calls at a total cost of $208,141 or $278 per call in 2020. Denver's FY22 budget expands funding for STAR to $3.4 million with a goal of responding to 10,000 calls annually. The estimates we present in this paper represent the cost of a fully implemented retasking effort, though in practice any new re-tasking program will likely require several years of incremental growth to achieve the capacity we assume.

We also make important simplifying assumptions about the composition of first responders to calls for service. However, given the police staffing shortage, single officers may currently respond to some calls for service. We also assume fixed EMT-social worker teams are the only alternative responders, but other combinations of skilled civilian responders are possible. For example, the Albuquerque's ACS Department deploys civilian first responders based on incident acuity. Mobile crisis teams comprised of a police officer and a mental health clinician respond to the most acute situations, while behavioral health responders respond to less acute behavioral crises and other non-criminal events and community responders handle other less urgent calls. Our model's civilian responders approximate Albuquerque's behavioral health responders who are paid higher wages and require more training than community responders. In this sense, our model may then understate potential cost savings compared to other feasible program designs. On the other hand, behavioral health responders cannot respond to more acute events where crime risk is low, but higher than the threshold we consider. In sum, our analysis considers only a single civilian response model even though more sophisticated alternative models may be feasible.

One other important consideration is the role of emergency communication centers to facilitate successful re-tasking efforts. Calltakers and dispatchers must be able to effectively determine whether a call for service meets the criteria for a civilian responder. However, recent research suggests that many emergency dispatch centers are not equipped with enough staff or training to make these judgments (Pew Charitable Trusts, 2021). Moreover, 911 dispatchers experience high rates of burnout and high turnover (Linos et al., 2022). A successful re-tasking effort will entail an ongoing investment in dispatcher training and support, with attention toward minimizing call misidentification. Disagreement between the initial and final description of the incident can be due to a combination of the calltaker, dispatcher, or responding officers. Our model assumes these factors are exogenous to call diversion program design.

We also assume that calls with the disposition codes 'abated' and 'handled in service' are resolved similarly whether a civilian or police response occurs. This assumption may not hold in practice. For example, narcotics calls may frequently be coded as 'abated' because the scene clears when police arrive, or complainants are unwilling or unable to provide further information. An EMT and social worker may not have this deterrent (or displacement) effect. If, instead, these civilian responders are more likely to engage with the complainant or complainee then our model underestimates the costs of retasking. However, if these interactions lead to a reduction in delinquency through referral to beneficial programming or through a more general social control mechanism, then our model may understate the positive impacts of retasking. Our estimates of police time use and service costs may be biased to the extent that these factors vary over time or location and are not taken into account.

While this analysis is focused on the time use and cost implications of call diversion, the broader literature on civil-police relations suggests there may be significant nonpecuniary benefits that we do not consider in this paper. As abovementioned, reduced police involvement in low-risk emergency calls lowers the likelihood of violence between police and marginalized communities. Even if officers' propensity to

misuse force against people from marginalized groups remains the same, the frequency of harmful incidents may decrease. Greater reliance on social workers and treatment programs may also improve community wellbeing, especially given that many programs entail follow-ups by civilian responders (Irwin & Pearl, 2020). These follow-ups generate financial and social benefits and may reduce the likelihood of future 911 calls concerning these individuals. Diversion programs may even improve police-community relations, as residents learn over time that calling 911 may indeed return the kind of help they are seeking. However, it is also plausible that these programs may harm perceptions of police legitimacy if a civilian is mistakenly dispatched to an event that requires a police response. Municipalities that introduce a new diversion program should carefully monitor citizen satisfaction and perceptions of police and civilian responders to ensure the program enhances public safety.

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