

The impacts of governing agency: A comparison of resources in the patchwork of medicolegal death investigation systems

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ABSTRACT

In the United States, medical examiners and coroners (MECs) fill critical roles within our public health and public safety systems. These professionals are primarily charged with determining the cause and manner of death as they investigate deaths and respond to associated scenes and mass fatalities and can also help identify trends in public health crises through medicolegal death investigations. Despite their instrumental role, they are organized in disparate systems with varying governing structures, functions, staffing, caseload, budget, and access to resources. This paper examines data from the 2018 Census of Medical Examiner and Coroners to evaluate MEC operations in the United States. The findings show that MEC offices' organizational and operational governance structures greatly influence resources, workloads, and access to information and services. Standalone MEC offices were generally better resourced than those affiliated with law enforcement, public health, forensic science, district attorneys, or other agencies.¹

1. Introduction

In the United States, medical examiner and coroner (MEC) offices are positioned at the crossroads of public health and public safety because they conduct formal medicolegal death investigations (MDIs) surrounding the circumstances of a death and determine the cause and manner [1]. As such, MDIs and their resulting data can inform a wide variety of relevant topics including the ongoing opioid overdose epidemic [2–6], COVID-19 and other pandemics [7–10], deaths in custody [11], deaths associated with natural [12] and artificial [13] disasters, families seeking answers about long-term missing loved ones [14], late-life suicide [15], preventable deaths from extremity wounds [16], and firearm-related deaths [17], among many other critical topics. Informing public health with autopsies and other MDI processes helps detect novel diseases, monitor the spread of infectious disease, register deaths related to epidemics reliably, correct clinical misdiagnoses, identify prognostic and risk factors, and identify target sites for infections and disease to enable better, more timely treatment [8].

Even with the essential, widespread nature of their public health and public safety implications and responsibilities, MEC offices differ widely in how they are organized and operated. For example, some chief medicolegal officers in MEC offices are appointed, whereas others are

elected. In many jurisdictions, the MEC office's chief medicolegal officer or director is a part-time position supplemented with other full-time employment. In some jurisdictions, other government employees such as a sheriff or undersheriff, may be appointed to fill MDI needs. Some states may select the coroner or medical examiner of a separate jurisdiction to fill the role for their own jurisdiction.

MEC offices also have different hierarchical and governance structures. MEC offices can be placed into two general governance categories—standalone agencies that are self-described as not reporting to another agency [18–24] or those that reported being operated as part of a larger agency or organization. Those that operate as part of a larger governing structure include public health agencies, law enforcement agencies, district attorney (DA) offices, forensic science agencies, and other agencies. As a result of these structural differences, MEC offices vary greatly by office type, staffing, pay structure, and access to resources. The Bureau of Justice Statistics (BJS) quantified the wide variation in MEC offices through its 2007 landmark Census of Medical Examiner and Coroner Offices (CMEC). The resulting 2007 report made clear that MDI systems varied widely across all measures, including jurisdiction size and type, caseload, staffing, procedures performed, record retention, use of national databases, operation, and budget [25].

Notably, where MECs sit within a jurisdiction and to whom they report have been acknowledged to play a pivotal role in MECs'

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Abbreviations:

BJS	Bureau of Justice Statistics
CMEC	Census of Medical Examiner and Coroner Offices
CODIS	Combined DNA Index System
DA	district attorney
FARS	Fatality Analysis Reporting System
MDI	medicolegal death investigation
MEC	medical examiner and coroner
NamUs	National Missing and Unidentified Persons System
NCIC	National Crime Information Center
NRC	National Research Council
NVDRS	National Violent Death Reporting System
PDMP	prescription drug monitoring program
POST	Peace Officer Standards and Training
SUDORS	State Unintentional Drug Overdose Reporting System.

authority, responsibilities and accountability, goals, priorities, and overall decision-making power [26]. Specifically, a small but persistent body of literature has grown over the years that has questioned the hierarchical relationship of MECs and the potential conflicts of interest therein [27], because many MECs operate under public health, public safety, forensic service providers, and other types of agencies. A National Association of Medical Examiners survey found that over 70% of responding MECs reported being subjected to pressures influencing their MDI findings and facing negative consequences for resisting those influences [27]. Thus, where an office sits can potentially affect what is exerting these pressures.

In 2010, the U.S. Department of Justice hosted a meeting of MECs and related forensic practitioners to explore issues in the community and to address issues raised in the 2009 National Research Council (NRC) report [20]. One of the themes that emerged was the lack of resources and opportunities for practitioner training, especially for coroners. More than 10 years later, these issues persist—for example, Le et al. (2019 [28]) found that despite having a high-risk job, only one-third of MEC staff received training in infectious diseases, with 20% of offices spending on average less than 1 h per year per person. In addition, Roper-Miller et al. (2020) studied publicly available data from the 2004 CMEC to highlight how under-resourced MEC offices were in terms of toxicology testing capabilities to address the opioid epidemic that began in 2009 and continues to persist [5]. Many MEC offices operate in destitution with limited resources and staffing, as documented in the National Institute of Justice's 2019 report to Congress indicating that the MEC system experienced a \$640 million deficit in 2017 and had high turnover and low morale and that the existing number of board-certified forensic pathologists is less than half of what is needed [29]—and that was before the COVID-19 pandemic, which compounded MEC strain.

Despite the importance of medicolegal death investigators, there is a general lack of research on MECs. The literature is virtually silent on the resources available to MEC offices by type of governing agency, despite acknowledgments that a lack of adequate resources likely exists given differing MEC office missions, goals, priorities, budgets, staffing, and resources [27]. Access to resources for MECs might include having the ability to tap key technologies or expertise that can be used to investigate deaths, general information infrastructure (i.e., computerized recordkeeping and access to the internet), use of national and state databases, and access to trainings.

To better understand these resource needs, we use public data from BJS's 2018 CMEC to examine how the governing agency of MEC offices impacts budget, staffing, caseload, practices, and access to resources [25,30–32]. Because of the myriad ways MEC office data inform public health and public safety, MEC office participation in national, state, and local data collections is also examined by governing agency.

2. Methods

The 2018 CMEC captures critical information about U.S. MDI system infrastructure (e.g., staffing, budget) [25,30–32]. The present study draws from the 2018 CMEC data collection RTI International performed for BJS (contract number 2017-MU-CX-K052); the methodology has been documented elsewhere [30–32]. Given the paucity of information that has been published since BJS's seminal 2007 report [25], with a few exceptions (e.g. [5,29]), the analyses herein use publicly available data to show differences and similarities across MEC offices by governing agency type. Data analyzed in the present study are from responses to the long and short CMEC questionnaires, which may be found on BJS's website [32] and are documented in the publicly available data set at the National Archive of Criminal Justice Data [31].

2.1. Data collection

BJS and RTI identified nearly 2040 MEC offices eligible to participate in the 2018 CMEC. A MEC office was defined as an office that conducted MDIs and rendered causes of death. The 2018 CMEC data were collected via web, mail, and telephone. Follow-up efforts were made via telephone and email to resolve data quality issues such as question nonresponse and inconsistencies among reported data. The 2018 CMEC instrument included 63 questions with skip patterns to minimize burden across topics related to administrative characteristics, budget and capital resources, workload, specialized death investigations, records and evidence retention, and resources and operations. A shortened survey was administered late in the data collection period to bolster survey response and contained critical items such as staffing, budget, and workload measures.

Of the MEC offices eligible for CMEC participation, 80.9% submitted a long or short questionnaire [30]. Over four-fifths—81.4%—of all responding MEC offices completed the long survey, and 18.6% completed the short survey [32]. The CMEC had a very low refusal rate of 1%.

Within this analysis, the critical items included on both versions of the survey included office type (Question A2 on the long form), government level (Question A3), full-time employee status (Question A8), workload (Questions C1–C4), completed autopsies (Question C11), office functions (Question C12), recordkeeping system (Question E1), access to database resources (Question F2) and access to trainings or resources (Question F3), and participation in data collections (Question F8). Noncritical items included on the long form (but thus, not on the short form) included agency type (Question A4) and forensic functions (Question C12).

Within this analysis, the overall question nonresponse rates across the short and long forms ranged from 0.0% (Question A2 regarding office type and Question A3 regarding level of government) to 12.3% (Question C4 regarding total number of cases accepted by the MEC office). BJS used a hot deck imputation method to account for nonresponse across all critical items, including Question A3; these procedures are described elsewhere [32]. Notably, the noncritical variables for this analysis were agency type (Question A4), which had a modest item nonresponse rate of 1.04% and the set of forensic function questions (Questions C12h–m and C13a–f), which all had overall nonresponse rates of 1.49% or less.

2.2. Measures

To determine how MEC offices may differ by governing agency type, we examined data related to staffing, budget, caseload, and access to particular types of technologies or resources using 2018 CMEC data publicly available through the National Archive of Criminal Justice Data [31].

For governing agency type, the following analysis uses the categories that BJS defined within the long form of the survey for Question A4 (i.e.,

“Which of the following best describes the agency your office reports to?”) including: 1) public health agency; 2) law enforcement agency; 3) Government or district attorney’s (DA’s) office; 4) department or division of forensic science; 5) my office does not report to another agency; and 6) Other. For brevity’s sake, we refer to the MEC respondents that endorsed the fifth governing agency type hereafter in the text and in the exhibits as agencies that are “Standalone.” Based on several annual reports of MEC offices that self-describe as independently operated [18–24], we understand that these types of offices are not beholden to another agency for competition for resources other than the overall county or state general government. Notably, our analysis of the sixth category— or “other” agencies —show that these MECs largely reflect offices that are governed by county or city commissioners or boards, county or city managers or executives, mayors and governors, vital statistics agencies, and universities.

The study team created measures to determine caseload and autopsy ratios. The caseload ratio is defined as the percentage of reported cases that were accepted by an office, which was captured by Question C3 on the long form and Question 8 on the short form. The autopsy ratio is defined as the percentage of accepted cases that had an autopsy performed, which was captured by Question C11 on the long form and Question 10 on the short form. Both metrics are subject to a ceiling value of 100%.

2.3. Data analysis

Statistical analyses were conducted in SPSS, version 28.0.1.1, and R, version 4.2.1. The analyses largely consist of descriptive statistics to provide foundational knowledge about the state of different office and agency types. The statistics are provided for the sample of responding offices as a whole and as a cross-tabulation by office characteristics. Importantly, in many cases, the median is used as a primary measure of central tendency in place of the mean because of the item distributions. In particular, the distributions for budget, population, and caseload measures are characterized by extreme outliers on the high end and an inflated number of “zero” responses. Beyond descriptive statistics, linear logistic regressions, chi-square tests, and correlation matrices were used to better understand the relationships among office characteristics, their operating capacity, and the population that they serve.

3. Results

General and Administrative Characteristics. MEC offices report to a variety of agency types, but of the 1326 MEC offices for which data are available, over half identified as self-governing, or standalone offices (51.0%; $n = 676$ offices). The remaining MEC offices were governed by public health agencies (15.2%; $n = 201$ offices), law enforcement agencies (13.1%; $n = 174$ offices), DA offices (5.9%; $n = 78$ offices), forensic science agencies (3.8%; $n = 50$ offices), and other agencies (11.1%; $n = 147$ offices), as presented in Fig. 1.

The type of agency to which an office reports is closely related to the office type and the population of the jurisdiction it serves. Coroner, medical examiner, and sheriff–coroner offices can all be characterized as reporting to different types of agencies, and a chi-square test highlights this as substantively and statistically significant ($\chi = 213.89$, $p < 0.001$).¹ Coroner offices are more commonly self-governing and less likely to report to law enforcement agencies. Medical examiner offices more commonly report to public health agencies and DA offices and are less likely to be standalone. As expected, sheriff–coroner offices commonly report to law enforcement agencies.

The size of the population the MEC office served was significantly related to whom it reports ($\chi = 47.89$, $p < 0.001$). An examination of the

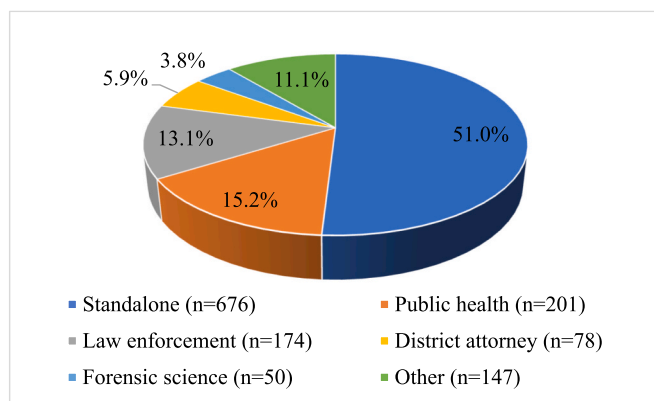


Fig. 1. MEC offices, by governing agency: 2018. ^a

^a Governing agencies in the “other” category includes MEC offices that report to city commissioners or boards, county or city managers or executives, mayors and governors, vital statistics agencies, or universities.

Note: Percentages may not add to 100.0% because of rounding.

Source: Bureau of Justice Statistics, 2018 Census of Medical Examiner and Coroner Offices (CMEC).

difference between observed and predicted values in the chi-square test demonstrates that standalone offices are most common in medium-sized populations (25,000 to 249,999). MEC offices reporting to public health agencies are most common in large populations (250,000 or more). Conversely, MEC offices reporting to law enforcement agencies and DA offices are rare in large populations and most prevalent in smaller populations (fewer than 25,000).

Acknowledging the relationship among reporting agency, office type, and population, we can characterize the capacity and functioning of the different agency types across several metrics captured in the CMEC data, including budget, staffing, caseload, and autopsies performed. Because of the distribution of reported budgets ranging from \$0 to over \$20, 000, 000 and the effect on mean averages, we present the median budgets for MEC offices overall and by governing agency in Table 1. The overall median budget was \$68,000 across all agency types, ranging from \$27,500 among MEC offices governed by forensic science agencies to \$100,000 among standalone offices.

Staffing. When examining staffing, BJS’s final report [32] revealed that 34 states had city, county, district, or regional MDI systems based on offices responding to the 2018 CMEC. Because many of these offices operate at the county or municipal level and serve smaller populations (45%), the median and modal responses for full-time employees were 0 or 1 across offices. Moreover, some MECs reported having no budget, for example, because they worked on a fee-for-service basis. Thus, the percentage of offices without any full-time staff by governing agency provides a more holistic understanding of staffing levels. Overall, 33.8% of MEC offices had no full-time employees. Although the data are not shown, analyses revealed that the vast majority of MEC offices operate without any full-time autopsy pathologists (88%), and over two-thirds operate without any full-time death investigators (68%).

Given this reality, we examined the percentage of MEC offices with full-time staff by governing agency. Table 1 shows that MEC offices with any full-time staff ranged from 48.0% among those reporting to forensic science agencies to 72.6% among standalone offices. The presence of full-time staff across offices differed significantly based on the agency to which the office reports ($\chi = 24.65$, $p < 0.001$). MEC offices governed by other agencies and public health agencies had the highest proportions of offices operating with full-time autopsy pathologists (24.5% and 21.4%, respectively), followed by those governed by forensic science agencies (12.0%) and standalone offices (9.5%). MEC offices governed by DA offices had the lowest proportions of offices operating with full-time autopsy pathologists (5.1%) or death investigators (16.7%). Standalone offices and those governed by public health or law enforcement

¹ Note that the Texas justices of the peace were excluded from the 2018 CMEC data collection because they were deemed to be out of scope.

Table 1
Median reported annual.

Governing agency	Budget Median	Full-time staffing		
		Overall (%)	Autopsy pathologists (%)	Death investigators (%)
Standalone	\$100,000	72.6	9.5	35.4
Public health	\$72,000	60.7	21.4	34.8
Law enforcement	\$37,197	66.7	9.2	32.8
District attorney	\$63,318	57.7	5.1	16.7
Forensic science	\$27,500	48.0	12.0	26.0
Other ^a	\$87,000	66.0	24.5	43.5
Overall	\$68,000	72.6	9.5	35.4

^a Governing agencies in the “other” category includes MEC offices that report to city commissioners or boards, county or city managers or executives, mayors and governors, vital statistics agencies, or universities.

Source: Bureau of Justice Statistics, 2018 Census of Medical Examiner and Coroner Offices (CMEC).

agencies had nearly equal proportions operating with full-time death investigators (35.4%, 34.8%, and 32.8%, respectively). Just over one-quarter of MEC offices governed by forensic science agencies operated with any full-time death investigators (26.0%).

Workload. In the 2018 CMEC, respondents were asked about their reported and accepted caseloads. Reported cases were defined as “all cases in which your office documented or investigated the report of a case to your office.” Accepted cases were defined as cases for which “the office completed the death certificate or otherwise determined the cause and manner of death.” These cases exclude cremation approval cases or cases in which jurisdiction was declined. Caseload analyses revealed that of the 1647 responding offices, 166 (10.1%) did not receive any reported cases during 2018. Additionally, 157 (9.5%) offices reported that although they had received cases, they did not track statistics in 2018 and therefore could not provide any caseload data. Thus, these 157 MEC offices were excluded from the caseload analysis.

Caseload acceptance and autopsy ratios are key performance metrics that provide a window into how these types of agencies may differ in terms of their operational capacity and functioning. The percentage of reported cases accepted by offices ranged from the low of 64.8% of MEC offices reporting to other agencies to a high of 86.1% accepted by those within forensic science agencies, with law enforcement-embedded offices accepting the second-highest percentage of cases at 75.0% (Table 2).

The percentage of accepted cases that receive a complete autopsy (defined in Question C11 on the long form of the 2018 CMEC as “examination and dissection of a dead body by a physician for the purpose of determining cause, mechanism or manner of death”) provides other insights about caseload and operational performance. The percentage of accepted cases receiving a complete autopsy ranged from 20.0% of accepted cases being autopsied by forensic science agency-embedded MEC offices to 30.8% by offices governed by other agencies. MEC offices governed by public health agencies and standalone offices autopsied about 30% of accepted cases (29.7% and 29.8%, respectively).

Although governing agency type, population, budget, staffing, and caseload provide key windows into MEC office characteristics, it is also

Table 2
Percentage of cases accepted and autopsied, by governing agency and: 2018.

Governing agency	Reported cases accepted (%)	Accepted cases autopsied (%)
Standalone	66.9	29.8
Public health	70.9	29.7
Law enforcement	75.0	23.1
District attorney	70.3	27.5
Forensic science	86.1	20.0
Other ^a	64.8	30.8

^a Governing agencies in the “other” category includes MEC offices that report to city commissioners or boards, county or city managers or executives, mayors and governors, vital statistics agencies, or universities.

Source: Bureau of Justice Statistics, 2018 Census of Medical Examiner and Coroner Offices (CMEC).

important to show how these measures are interrelated. The appendix contains a correlation table demonstrating a high level of substantive and statistical significance in the relationships among these factors. Although all relationships are in the anticipated direction and support our current understanding of how agencies work, it is important to understand how these relationships differ among governing agency types. The correlations show that MEC offices serving larger populations tend to have more staff and perform more work. The relationship between population and budget is particularly illustrative. With a significant correlation of 0.506, we observe that as population increases, so too does the budget of the office serving that jurisdiction.

Given these correlations, we conducted a linear regression to examine and predict the budget by office type and population served. Thirteen extreme outliers were removed based on a population larger than 8,000,000 and a budget over \$20,000,000. Overall, larger populations significantly predict a larger budget ($F = 1166.4$, $p < 0.001$). This is the case across all MEC offices, with population size explaining 42% of the variance in the budget. However, for offices governed by law enforcement agencies, although the relationship is still statistically significant, the population size explains 5% of the variance in budget, demonstrating a weaker relationship and that not all agency types respond to external factors like population size in the same way.

Forensic Functions. The 2018 CMEC long survey form also included questions to capture whether MEC offices perform MDI functions, including death scene investigation, death scene photography, medical record review, external examinations, partial autopsies (defined in Question C12e as “minimal dissection, less than a complete autopsy”), and complete autopsies (defined in Question C12f as “remove and examine the brain, thoracic, and abdominal organs”). Overall, almost 9 in 10 MEC offices performed death scene investigation and death scene photography functions. For these two functions, the lowest rate was in death scene photography among MECs governed by DA offices (88.5%), and the highest rate was 100% of MECs governed by forensic science agencies performing death scene investigations. Similarly, medical record reviews ranged from 91.1% among MECs governed by DA offices to 95.9% among standalone offices. External examinations ranged from 89.8% among MEC offices governed by DA offices to 96.0% among MEC offices supervised by law enforcement agencies (data not shown).

Partial autopsies were less commonly offered overall (ranging from 62.6% to 72.6%), with MEC offices governed by public health agencies (64.2%) and by other types of agencies (62.6%) providing these services less frequently (Fig. 2). A higher percentage of standalone offices performed complete autopsies (87.0%) compared with MEC offices governed by other types of agencies (75.5%); the next most common MEC offices to perform complete autopsies were offices governed by DA offices (80.7%) and those led by public health agencies (78.6%).

A series of questions on the long form of the 2018 CMEC asked respondents about whether their office had access to selected MDI-associated functions. The forensic functions and proportions of offices reporting access in 2018 included: forensic toxicology testing (range: 71.4%–87.1%), autopsy photography (range: 73.5%–86.5%), imaging

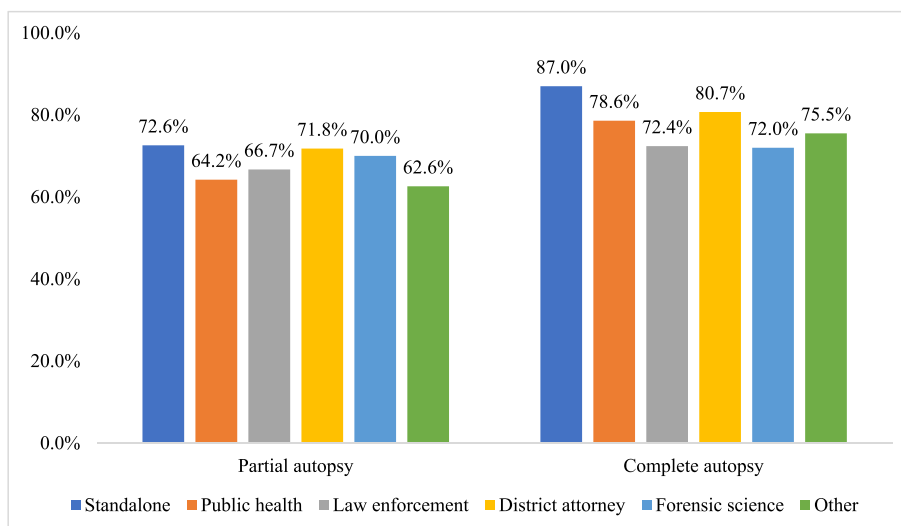


Fig. 2. MEC offices performing partial and complete autopsies, by governing agency: 2018. ^a

^a Governing agencies in the “other” category includes MEC offices that report to city commissioners or boards, county or city managers or executives, mayors and governors, vital statistics agencies, or universities.

Source: Bureau of Justice Statistics, 2018 Census of Medical Examiner and Coroner Offices (CMEC).

(x-ray, CT; range: 71.5%–85.2%), metabolic screen (range: 69.4%–82.0%), cardiac pathology (range: 65.3%–79.3%), odontology (range: 66.7%–79.4%), histology (68.4%–79.0%), microbiology (66.7%–78.1%), anthropology (63.3%–77.2), and neuropathology (66.7%–77.1%). Of all types of offices, standalone offices reported the highest levels access across all 10 functions, with the least common being neuropathology (77.1%) and anthropology (77.2%). At least two-thirds of MECs governed by each agency type had access to the 10 functions except for law enforcement–led MEC offices, which had less access to anthropology and cardiac pathology (63.3% and 65.3%, respectively).

Recordkeeping. BJS’s 2018 report highlighted that only 43% of MEC offices have computerized records management systems across the United States; moreover, 25% of MEC offices were found to lack access to the internet separate from personal devices [25]. Analyses by governing agency showed variation in information infrastructure, as shown in Fig. 3. Access to the internet independent of personal devices ranged from 67.5% for MEC offices governed by DA offices to 83.0% for offices led by other types of agencies. Computerized recordkeeping systems

ranged from 32.0% among MEC offices governed by forensic science agencies to 53.7% among MEC offices led by public health agencies.

Access and Use of Databases. Because MECs sit at the intersection of public health and public safety, their access to national databases is important. We identified differences in access by governing agency, including to criminal histories databases (range: 66.0%–75.6%), fingerprint databases (range: 62.0%–72.8%), and prescription drug monitoring programs (52.0%–72.8%). Of all three databases, the highest access reported was to criminal history databases by MECs operated by DA offices (75.6%). MECs that were led by forensic or other agencies had the lowest level of access for criminal history databases (both 66.0%). Standalone offices had the highest proportion of access to fingerprint databases (72.8%), whereas forensic agency–led MEC offices had the lowest proportion of such access (62.0%). MECs governed by forensic science agencies also had the lowest proportion of access to prescription drug monitoring programs (52.0%), while MECs governed by other types of agencies reported the highest level of such access (72.8%).

Evidence Retention Schedules. MEC offices reported whether they had

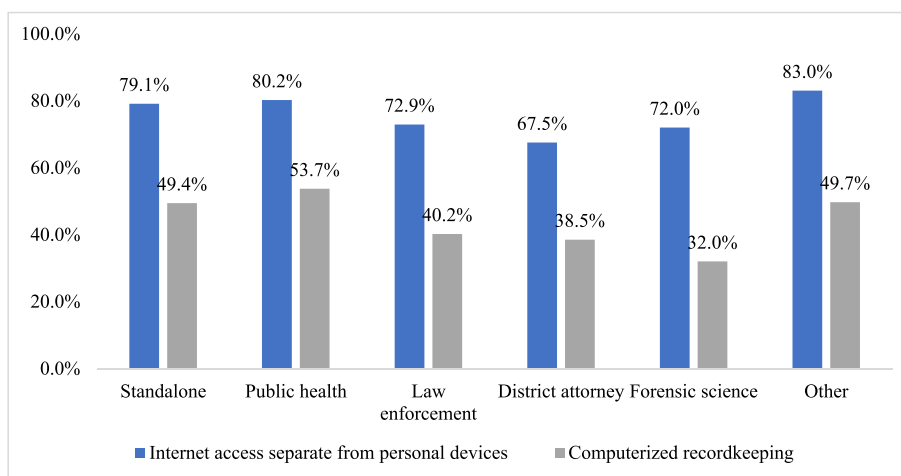


Fig. 3. MEC offices, by access to the internet and computerized recordkeeping and by governing agency: 2018. ^a

^a Governing agencies in the “other” category includes MEC offices that report to city commissioners or boards, county or city managers or executives, mayors and governors, vital statistics agencies, or universities.

Source: Bureau of Justice Statistics, 2018 Census of Medical Examiner and Coroner Offices (CMEC).

written retention schedules for case records, forensic toxicology specimens, physical evidence, unidentified remains, and records pertaining to unidentified human remains, including x-rays, fingerprints, and DNA. Regardless of governing agency type, 82% or more of responding MEC offices reported having a written retention schedule across each of the categories. Case records retention schedules were reported by 91% or higher across all governing agency types. MEC offices run by law enforcement agencies and DA offices had the lowest proportions of written retention schedules across the remaining items; percentages for these schedules were in the low to mid-80s. The lowest percentage was 82.8% for law enforcement–run MEC offices reporting a schedule for retention of records pertaining to unidentified human remains. The lowest percentage for DA office–led MEC offices was 84.5% for written schedules related to unidentified human remains (data not shown).

Participation in Data Collections. In recent years, federal agencies have increasingly asked MEC offices to participate in national data collections to inform the community on public health and public safety issues. Table 3 provides findings related to MEC office participation in national and state or local data collections. As shown, MEC office participation in state or local data collections is more common than their participation in national collections: With the exception of MEC offices governed by forensic science agencies, about two-thirds or more of MEC offices across the other agency types participated in local or state data collections, ranging from 65.2% for DA office–governed MEC offices to 71.6% for MEC offices led by public health agencies.

Law enforcement–governed MEC offices had the highest proportions of participation in the Combined DNA Index System (CODIS; 29.3%) and the National Crime Information Center (NCIC; 34.5%) and ranked second and third, respectively, for participation in the Fatality Analysis Reporting System (FARS; 34.5%) and the National Missing and Unidentified Persons System (NamUs; 42.0%). Over a quarter of MEC offices governed by DA offices participated in CODIS (25.6%), FARS (29.5%), and the National Violent Death Reporting System (NVDARS; 25.6%). Notably, the lower percentage of FARS participation may be because MEC offices often report to state agencies, which in turn report to FARS.

MEC offices led by public health agencies reported some of the highest proportions of participation in NamUs (41.3%), NVDARS (38.8%), and the State Unintentional Drug Overdose Reporting System (SUDORS; 27.9%). Standalone offices ranked first for participation in FARS (36.5%), NamUs (46.2%), and NVDARS (40.7%) and second for participation in SUDORS (27.2%). MEC offices governed by forensic science agencies had the lowest participation in four of the data collection efforts and were among the lowest for the remaining collections, with the highest percentage participating in NVDARS (30.0%). Generally, while national databases used to identify missing and

unidentified human remains (i.e., NCIC, CODIS, NamUs) were established between 1975 and 2007, the year established did not mandate or influence participation with entry for missing persons for the national databases. The use of national databases is likely affected by who can access and enter information. For example, only law enforcement agency staff can enter information into NCIC.

Staff Training. Training is one of the chief ways in which MEC professionals stay abreast of best practices associated with investigating deaths and responding to stress associated with their jobs. The majority of MEC offices across each governing agency responded about having internal or external access to training on mass fatality investigation (range: 84.0%–91.9%), disaster planning (range: 84.0%–92.0%), bloodborne pathogens (range: 76.0%–87.9%), and stress management (range: 62.0%–76.9%). MEC offices governed by DA offices had the lowest percentages of training access to mass fatality investigations, disaster planning and bloodborne pathogens, while offices governed by forensic science agencies had the lowest percentage of access to stress management. Apart from bloodborne pathogens training, to which offices run by public health agencies had the highest level of access, standalone offices reported the highest proportions of training access across all other training types compared with their counterparts.

4. Discussion

The medicolegal death investigation systems in the United States are shaped by the MEC systems that underpin them. Although it is well established that the MEC community is varied, there is little research analyzing the ways in which governing agencies may influence the resources available to medicolegal death investigators. This analysis has demonstrated that the governing agency is a significant variable affecting resources and operations. Standalone offices that responded to the 2018 CMEC were generally better resourced than MEC offices governed by public health agencies, law enforcement agencies, DA offices, forensic science agencies, and other types of agencies.

BJS' 2018 report [32] shows that MECs accepted about 46% of all cases nationally and conducted one full autopsy for every 7 cases referred and every 3 cases accepted, which provide important metrics for U.S. MDIs. Behind these national statistics, it is notable that coroner offices and sheriff–coroner offices tended to accept more cases than medical examiner offices, whereas medical examiner and sheriff–coroner offices tended to perform more autopsies on accepted cases on average. By governing agency type, standalone offices and MEC offices run by other types of agencies tended to accept two-thirds or less of cases referred to them on average but had among the highest percentages of performing autopsies on accepted cases (30% and 31%, respectively).

Table 3
MEC office participation in data collections, by governing agency: 2018.

Data collection and year established	Standalone (%)	Public health (%)	Law enforcement (%)	District attorney (%)	Forensic science (%)	Other ^a (%)
Combined DNA Index System (CODIS, 1994) ^b	22.6	18.9	29.3	25.6	14.0	21.8
Fatality Analysis Reporting System (FARS, 1975)	36.5	26.4	34.5	29.5	12.0	25.2
National Crime Information Center (NCIC, 1975) ^b	19.7	23.9	34.5	17.9	18.0	21.2
National Missing and Unidentified Persons System (NamUs, 2007) ^b	46.2	41.3	42.0	23.1	26.0	45.6
National Violent Death Reporting System (NVDARS, 2002)	40.7	38.8	31.6	25.6	30.0	40.1
State Unintentional Drug Overdose Reporting System (SUDORS, 2016)	27.2	27.9	25.3	21.8	20.0	26.5
State or local data collection	67.8	71.6	66.9	65.2	26.0	67.3

^a Governing agencies in the “other” category includes MEC offices that report to city commissioners or boards, county or city managers or executives, mayors and governors, vital statistics agencies, or universities.

^b The year established is specific to when the Unidentified Human Remains Index was established as a result of the DNA Identification Act of 1994.

Source: Bureau of Justice Statistics, 2018 Census of Medical Examiner and Coroner Offices (CMEC); CODIS: <https://oig.justice.gov/reports/FBI/a0632/intro.htm>; FARS: <https://www.nhtsa.gov/research-data/fatality-analysis-reporting-system-fars>; NamUs: <https://namus.nij.ojp.gov/about>; NCIC: <https://www.fbi.gov/news/stories/ncic-turns-50>; NVDARS: <https://www.cdc.gov/violenceprevention/about/timeline.html>; SUDORS: <https://www.cdc.gov/drugoverdose/od2a/pdf/SUDORS-Fact-Sheet.pdf>.

Standalone offices that responded to the 2018 CMEC had the highest median budgets which is highly correlated to their overall capacity and resources. Thus, given the high correlation, it makes sense that standalone offices would report high levels of access across all 10 forensic functions and to other services and training. Standalone offices were also among the highest users of key databases to inform casework. Although they had the lowest proportion of offices operating without any full-time autopsy pathologists, standalone offices appeared to have more capacity, reporting the highest portions of overall full-time staff. They reported the highest proportions of MECs being able to perform partial and complete autopsies; thus, they had higher median reported cases, accepted cases, and completed autopsies in 2018. They also participated in more data collections. Standalone offices constitute the majority (51%) of MEC offices that responded to the survey and include many MEC offices, such as several of the elected coroners in South Carolina and the appointed medical examiners in Texas.

On the other hand, although we might assume that forensic science agencies have more access to key resources and functions overall, data from the 2018 CMEC suggest otherwise. MEC offices governed by forensic science agencies reported low staffing levels compared with their counterparts, had the lowest median budget, and had the least access to some critical MEC functions and services (e.g., autopsy photography, forensic toxicology testing, imaging, metabolic screens, microbiology). They were also the least likely to perform complete autopsies. MEC offices run by forensic science agencies also had the lowest percentage of computerized recordkeeping systems, use of critical databases, participation in data collections, and training levels. MEC offices governed by forensic science agencies did accept the largest percentage of reported cases but performed the smallest percentage of autopsies on those accepted cases.

With respect to the differences in training, some states have mandated training for all MECs in their state, which may skew the data with respect to the governing agency. For example, California's Commission on Peace Officer Standards and Training (POST) mandates certain training for full-time medicolegal death investigators and for those serving a dual role as patrol officer and medicolegal death investigator, and Washington state recently passed House Bill 1326 (2021), which requires all coroners and their deputy coroners to complete specified training requirements to ensure that they are certified as medicolegal death investigators and that the offices become accredited. Notably, however, even with some states addressing training, only between 62.0% of MEC offices (led by forensic science agencies) and 76.9% of MEC offices (led by law enforcement agencies) had access to any stress management training in 2018, and less than 90% received bloodborne pathogens training, despite working with decedents. At the office level, many MEC offices require certification and associated training of their autopsy surgeons as board-certified forensic pathologists, and there are offices around the country that require certification of their investigators with associated training—some through their state POST agency and others through the American Board of Medicolegal Death Investigators. Ultimately, it is generally at the discretion of the office to enact such requirements, which has been recommended at the federal level for several years [20,33,34]. MEC offices and state governments that regulate MDI throughout the state are encouraged to continue the progress toward requiring relevant training for those in MEC offices and mandating certifications for staff performing MDI in their jurisdictions.

Our other major finding is that MEC offices have inadequate levels of basic information infrastructure, regardless of the agency governing them. In this analysis, basic internet access beyond personal devices was unavailable to nearly one-third of MEC offices governed by DA offices, and only 32% of MEC offices governed by forensic science agencies reported having computerized recordkeeping. These infrastructure numbers correlate to the low level of key database use and participation in data collections. Notably, these numbers have not changed appreciably since 2005 [32]. An analysis of BJS's CMEC data showed that 35%

of MEC offices that offered toxicology services had a computerized information management system in 2004 [5]. More recently, the 2022 MEC survey administered by the U.S. Drug Enforcement Administration showed that 20% of MECs had a manual recordkeeping system [35]. Regardless of their governing agency, our analyses indicate that with their current infrastructure, MEC offices cannot participate in important databases or research and data surveillance initiatives.

The MEC workforce is of critical importance—for their medicolegal death investigation functions and responsibilities and for the wealth of information that they can provide to directly inform public health and public safety. Federal agencies, such as the Centers for Disease Control and Prevention and the Department of Justice, have established grants to remedy this issue (e.g., see the Department of Justice's website: <https://www.ojp.gov/funding/explore/overview>). Although helpful, accessing this funding requires that MEC offices submit grant applications to receive such resources. Given the severe bandwidth issues and limited staffing across many offices, including small offices operated by less than one full-time staff member (as the present analyses showed), writing applications for federal grant funds is often not possible or realistic. In addition to the limited federal funding available to MEC offices, state legislatures and local governments must enhance support for their local and state MEC offices to ensure that they have fundamental resources, including basic information infrastructure, no matter their governing agency.

Over 10% of responding MEC offices did not report cases in 2018, and nearly a quarter (22.6%) of all agencies reporting cases performed zero autopsies that year, with the median of 12 autopsies per MEC office. As noted, the distribution of this variable is highly skewed, and many MEC offices serve rural populations of 45,000 or fewer. However, this points to one of the challenges of many jurisdictions, no matter which agency governs the MEC office—it is imperative that MEC offices have knowledgeable staff with relevant experience available when needed, given such low workloads and demands. States and jurisdictions continue to be encouraged to review the recommendations from the 2009 NRC report [20] and the Scientific Working Group on Medicolegal Death Investigation [34] about regional offices to address this issue. Regional offices would allow a conglomerate of jurisdictions to pool resources to meet some of the challenges of small caseloads by creating a larger catchment area. As consideration is given to these proposals for regionalization, further consideration should be given to where those regional MEC offices sit and which agencies govern them. Based on the findings within these analyses, standalone offices generally perform at a higher level than non-standalone offices.

There are several limitations to our present work and the associated data that should be noted. Because there is so much variability among MEC offices, surveys of this community are difficult to study and analyze. For example, an MEC office embedded in a forensic science agency might not have a dedicated budget for the MEC role, or the reported budget could be for MEC responsibilities and other duties. Similarly, some offices have no specified budget but pay for needed services on a per-case basis, yet others may have another indirect budget that makes reporting within the parameters of the survey challenging. An MEC office led by a law enforcement agency might have full-time patrol officers also acting in the capacity of medicolegal death investigators, so its data on full-time death investigators may be difficult to line up with data from other offices that do not have other roles associated with the medicolegal death investigator position. Thus, comparing budgets within the current patchwork of U.S. MDI systems is problematic.

In addition, because MEC offices vary, how they use and define terms varies. MEC offices apply the concepts presented in the survey differently. Although many definitions were provided within the CMEC, such as "complete autopsy" and "accepted cases," there are still many variations on how different offices may interpret and internally define and determine concepts like "jurisdiction" and "investigation," which could have led to inconsistencies in reporting. Another limitation is that the

analysis of the 2018 CMEC is restricted to only MEC offices that participated in the 2018 CMEC (see Section 2), and the present analyses cannot account for definitional nuances that might exist among the nonresponding MEC offices. Finally, it is important to reiterate that not all survey respondents answered the full survey. A short version with only critical items was created to increase office response, so certain measures did not have as many respondents as others, making the data set less comprehensive for some questions.

5. Conclusions

The findings suggest that medicolegal death investigators would be better served by a national system of standalone offices functioning with autonomy, with a separate structure and authority from their governing agency, functional characteristics, and funding. Although the data seem to support moving toward standalone offices, caution should be exercised before definitive conclusions are drawn. As noted previously, the data have several limitations that make correlations difficult, such as the many contributing variables, lack of uniformity among respondents, and inconsistency in the interpretation of questions.

At minimum, these analyses demonstrate that a standalone office governance model is an important component for improving MEC operations. One reason this model may outperform others is its ability to make operating decisions without having to balance competing priorities or influences. In addition, standalone offices generally do not share resources with other entities and thus have the flexibility to adjust to fluctuations in workload or changing public needs or governance requirements quickly. These and other factors need further exploration to understand the advantages standalone offices may offer over other MEC offices. Nevertheless, the findings provide a basis for states and jurisdictions to begin making decisions about structural changes needed to improve their MEC operations.

The standalone office model addresses a significant concern raised in the 2009 NRC report [20], which called for forensic science agencies to operate independently. Other researchers have also questioned the hierarchical relationship of MEC offices and the inherent conflicts this structure creates [27]. Many MEC offices operate under public health agencies, public safety agencies, forensic departments, universities, or other types of agencies and thus have competing interests. MEC offices governed by other agencies should use the findings herein to examine the value added by operating independently. Congress and other funding entities may view standalone offices as a step in the right direction, leading them to initiate additional funding opportunities that otherwise may not exist. Also, the CMEC will draw attention to the ongoing efforts to improve the MDI system, which will further highlight resource needs.

This and other studies have demonstrated the dire state of the U.S. MDI system [5,10,14,28,29,36], particularly as it relates to basic infrastructure like computerized recordkeeping systems. Federal agencies like the Centers for Disease Control and Prevention are heeding the call and providing grant opportunities to remedy some of the problems. Although this additional funding is applauded, the MDI system requires much more. MECs can take action within their span of influence to

incorporate best practices, standardization, and other cost-effective measures. Jurisdictions should recognize the importance of death investigation in all communities, large and small, and begin working on ways to resource MECs better. Adequate resourcing will help support MECs' ability to incorporate best practices and meet industry standards and guidelines. These and other steps can ensure that all MEC offices are well positioned to support their community and fulfill their role in improving, understanding, and supporting the objectives of public health and public safety.

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CRediT authorship contribution statement

Hope M. Smiley-McDonald: Writing – review & editing, Writing – original draft, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization. **Kelly A. Keyes:** Writing – review & editing, Writing – original draft, Visualization, Conceptualization. **Sean Wire:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation. **Kathryn Greenwell:** Writing – review & editing, Writing – original draft, Investigation. **Nelson A. Santos:** Writing – review & editing, Writing – original draft. **Jeri D. Roper-Miller:** Writing – review & editing, Writing – original draft, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix

Table A.1

Governing agency metrics correlation.

	1	2	3	4	5	6	7	8
1. Population								
2. Budget	0.506							
3. Full-time staff	0.557	0.662						
4. Full-time pathologist	0.668	0.627	0.679					
5. Full-time investigator	0.360	0.385	0.802	0.368				
6. Reported cases	0.723	0.587	0.616	0.695	0.413			
7. Accepted cases	0.682	0.510	0.647	0.595	0.501	0.773		
8. Number of autopsies	0.780	0.640	0.666	0.795	0.421	0.811	0.721	

Source: Bureau of Justice Statistics, 2018 Census of Medical Examiner and Coroner Offices (CMEC).

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