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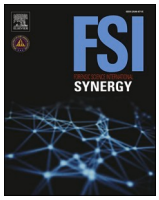

Technology use among the nation's medical examiner and coroner offices: Data from the 2018 Census of Medical Examiner and Coroner Offices

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ABSTRACT

Technology uses among medical examiner and coroner (MEC) offices in the United States are not well characterized, yet technology is essential to job-performing duties. Resources, operational infrastructure, and MECs' policies and procedures that affect technology use should be better understood. MEC offices need access to technologies like internet, case management systems (CMSs), databases, and advanced imaging to perform their basic duties. A current state of the technologies MEC offices use to complete a death investigation is presented by analyzing data from the 2018 Census of Medical Examiner and Coroner Offices. This analysis shows the New England division reported the most internet and CMS access. Many offices reported limited access to, and low participation in, databases for assessing and sharing case data. Offices serving populations >250,000 have more access to the internet, CMSs, databases, and advanced imaging. Although MEC office technology use has improved over time, it is still disparate.

1. Introduction

Although computerized technologies continue to advance in many workplaces, medical examiner and coroner (MEC) offices often struggle to adapt to new technological innovations because of low funding, staffing challenges, limited resources, and decentralization of the U.S. MEC system [1–3]. With the continued rise in violent deaths [4,5], fatal overdoses [6], other accidental deaths [7], and mass fatality incidents (e.g., environmental disasters, mass shootings, pandemics) [8], among other deaths in the United States, access to and ease of implementing technologies in medicolegal death investigations has become increasingly important for overburdened MEC offices. Moreover, sharing of MEC information using data modernization and technology advancements is crucial to understanding the circumstances of a death, and thereby contribute knowledge to help sustain safe communities and to assess, develop policy, and ensure positive health outcomes through services to protect and promote the health of all people in all communities [3,9–19]. MECs nationwide investigate roughly 600,000 deaths annually and play a vital role in public health and safety, offering information about the cause and manner of death when a person dies suddenly or unexpectedly [18]. Disparate use of technologies by MEC offices is often due to the individual office's governing agency, organizational structure, or competing resource needs [1–3,18]. Technologies that benefit MEC investigations include the internet, case management systems (CMS), data collection programs and surveys, databases, and advanced imaging such as magnetic resonance imaging (MRI) and computed tomography (CT).

One basic, essential technology for data exchange is the internet. Computers and internet access can aid in medicolegal death investigations, but access to these basic technologies can be limited for some MEC offices. Stable, reliable internet provides timely access to crucial information, enhances workplace productivity, and documents a

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decedent's activities and relationships before death (i.e., proof of integration and inclusion in society). Examples of aiding a death investigation include looking for next of kin, identifying decedents, finding information to contact physicians or hospitals for medical history, locating information about the decedent through social media (e.g., suicide note, tattoos), or accessing a professional organization's distribution list to query findings, such as an unfamiliar substance in toxicology [20] [1]. It is important for public health and safety professionals, like MECs, to have internet access to perform their duties, yet data show that healthcare and law enforcement professionals also have disparate use of the internet. In 2006, Podichetty et al. reported that although 97.0 % of the healthcare professional respondents had access to the internet, 14 % reported having internet access solely at home, 11 % solely at their office, and 72 % at home and in the office [21]. By 2017, 9 out of 10 U S. healthcare systems and providers offered an online patient portal [22]. According to the 2020 Law Enforcement Management and Administrative Statistics survey, 47 % of sheriffs' offices used data for targeted enforcement, and 65 % of offices with fewer than 24 deputies had a website, an increase from the 40 % of these offices that reported having a website in 2016 [23]. Specific characteristics of internet use (e.g., location of internet access, agency websites) are unknown for MECs on a national scale.

Historically, some MECs have not used other basic technologies, such as computerized CMSs, to manage their data more efficiently and effectively. For example, Indiana did not implement a CMS for its coroners until 2014 [24]. According to a 2022 survey report from the National Forensic Laboratory Information System (NFLIS) [25], 79 % of MEC offices had CMSs, 20 % kept records manually, and 1 % used a variety of systems. The percentage of MEC offices with a computerized, networked CMS was lowest for those serving small jurisdictions (20 %, <25,000), highlighting gaps in technology access among MEC offices serving small, medium, and large jurisdictions [25]. Although small jurisdictions' needs may differ from those of larger jurisdictions (>250,000), larger offices use a CMS for tasks such as accurate record keeping, consistent policy and procedures, case tracking and reporting, and data querying and sharing [26]. Without a CMS, these types of tasks must be done manually and are time intensive.

Participation in national data collection efforts also remains historically low among MEC offices [27]. For instance, participation in the National Missing and Unidentified Persons System (NamUs)—a free national information clearinghouse and resource center to help identify missing, unidentified, and unclaimed cases in the United States—remains voluntary, federally unmandated, and legislatively required by only 16 states [26,28]. Although lack of participation could be due to a lack of qualifying cases, it is part of a pattern of varying or low participation in data collection efforts. MEC database participation may also include the National Crime Information Center (NCIC), which requires participating agencies to be governed by a local, state, or federal criminal justice agency; thus, NCIC use by MECs is not widespread [29].

MEC offices nationwide also lack advanced imaging technology that allows three-dimensional visualization of the body's internal organs and structures. MRI and CT are the most-used diagnostic tools in clinical settings. CT is more readily employed among MEC offices but is still not as mainstream as two-dimensional x-ray imaging [30,31]. CT and MRI are not as universally accepted as, and most likely less accepted than, the internet [1,30,31]. MRI remains underutilized by MEC offices and is accessed almost exclusively through collaborating with a partner agency [26]. MECs face difficulties implementing current advanced imaging systems; they may find it hard to adapt to additional emerging technologies that can improve the effectiveness, speed, or accuracy of death investigations.

With increased attention to further funding and development for MEC office technology needs, it is crucial to determine MEC offices' existing technology use and access levels. As summarized, MEC offices have historically displayed low access to technology that would enhance their ability to investigate cases. The most recent Bureau of Justice Statistics (BJS) 2018 Census of Medical Examiner and Coroner Offices (CMEC) survey included questions related to access to various technologies [32]. This secondary analysis examines publicly available data from the 2018 CMEC to determine (1) MEC offices' current technology access levels (2) whether demographic variables (i.e., geographic division: New England, Middle Atlantic, South Atlantic, East North Central, East South Central, West North Central, West South Central, Mountain, Pacific, and population size: small-less than 25,000, medium- 25,000 to 249,999, large- 250,000 or more), affect access levels, and (3) the frequency of MEC offices owning or having access to specific technologies.

2. Methods

2.1. Measures

The 2004 and 2018 CMECs were designed to focus on the U.S. medicolegal death investigation system, providing a national picture of MEC offices, including personnel, expenditures, workloads, capabilities, procedures, and resource needs [26,27]. An important objective of the CMEC is to enumerate technologies that MEC offices used to enhance data collection, storage, reporting, and retention, as well as record information exchange. Responses to this survey were grouped by the U.S. Census Bureau's nine geographic divisions, which separate the 50 states and the District of Columbia for statistical purposes [33]. New England division state agencies manage county or local MEC budgets, technologies, and practices [32]. This analysis provides a timely update regarding the scope of technology use by MEC offices since BJS's seminal 2007 report, which analyzed 2004 CMEC data [26,27].

The present analysis draws from the data collection that RTI International performed for BJS to conduct the 2018 CMEC (contract number: 2017-MU-CX-K052). This article assessed the 2018 CMEC to determine how MECs are using various technologies within their offices. To ascertain the extent of MEC office technology needs in the United States, the present analysis chiefly drew from Sections A (Administrative), E (Records and Evidence Retention), and F (Resources and Operations) from the 2018 CMEC survey. Sections B (Budget and Capital Resources), C (Workload), and D (Specialized Death Investigations) were minimally analyzed and only when the results needed further discussion. Approval from the Office of Management and Budget and RTI's Institutional Review Board were obtained before data collection activities began.

2.2. The 2018 Census of Medical Examiners and Coroners Offices

BJS and RTI designed the 2018 CMEC questionnaire in coordination with forensic expert panel review and cognitively tested the 2018 survey across a selected pool of MECs before its administration. RTI used a mixed-mode data collection approach of mail, email, web, and computer-assisted telephone interviewing response options [26]. To encourage participation, BJS and RTI also fielded a short version of the survey in the latter months of data collection alongside the full version. This short version included a small number of critical items. BJS and the RTI project team identified a list of critical questions from the long instrument that reflected BJS's primary goals for the 2018 CMEC data collection [34]. 81.4 % (1341) of respondents completed the long

[1] Abbreviations: BJS, Bureau of Justice Statistics; CDC, Centers for Disease Control and Prevention; CMEC, Census of Medical Examiner and Coroner Offices; CMS, case management system; CODIS, Combined DNA Index System; CT, computed tomography; FARS, Fatality Analysis Reporting System; MEC, medical examiner and coroner; MRI, magnetic resonance imaging; NamUs, National Missing and Unidentified Persons System; NCIC, National Crime Information Center; NFLIS, National Forensic Laboratory Information System; NVDRS, National Violent Death Reporting System; PDMP, Prescription Drug Monitoring Program; SUDORS, State Unintentional Drug Overdose Reporting System.

version of the survey, and 18.6 % (307) completed the short version, achieving an overall 80.7 % response rate. More information about the data collection methodology can be found in the 2021 report [26]. For the present analysis, the 2004 and 2018 CMEC public data set were obtained through the National Archive of Criminal Justice Data [32,33].

2.3. Data analysis

The data collection team assessed the survey data for missing or out-of-range data (e.g., missing or misplaced zeroes), recoding the data when necessary (e.g., numerical data were partitioned into quantiles). To take question nonresponse into account—which, for the 2018 CMEC, was less than 25%—the data collection team administered data quality follow-ups (DQFUs) with survey respondents. Approximately 4–6 weeks after the survey's launch, the analysis team began ongoing review of data from submitted critical questions for consistency and completeness. Checks were run on each submitted survey to examine internal consistency and outliers and to compare survey data with historic data. Thresholds were set for suspicious data. For example, an MEC office reporting a higher accepted caseload than the reported caseload was flagged for DQFU. Via email and telephone, DQFU staff followed up on cases that had critical questions that failed these checks [26]. After conducting these follow-ups, BJS used hot deck imputation, an analysis technique when individual values are secondary to inferences of a larger population's parameters. In other words, hot deck imputation replaces a missing value of one respondent with the value from a similar respondent from the same data set. Imputations were performed for only the critical items on the abbreviated form overall [35]. For the purposes of this paper, only four measures had imputed values for missing data in the public data file, including access to the internet (Question 14, item missing rate: 2.0 %), CMS status (Question 14, item missing rate: 0.0 %), participation in computerized data collections (Question 17, item missing rate range: 0.0%–0.03 %), and access to databases (Question 16, missing rate range: 1.3%–1.5 %). The BJS report and data set offer more information about the imputation procedures used for the 2018 CMEC administration [26,32].

Adjustments were also made to account for unit nonresponse. A nonresponse rate was calculated using a propensity weighting method [36]. This method uses a logistic regression model to calculate offices' probability of responding to the survey based on (1) office type, (2) jurisdiction size (i.e., population), (3) U.S. region, (4) level of government, and (5) interaction of office type and jurisdiction size. Because two versions of the survey were used, the total number of offices may vary between tables.

To analyze the data and calculate standard errors and weighted estimates, the team used IBM SPSS 29 statistical software with the Complex Samples Package. MEC offices are grouped by technology characteristics, office characteristics, and policies or procedures around technology usage. All data in these analyses draw from frequencies or percentage frequencies and measures of central tendency (e.g., means, medians), and cross-tabulations are also presented.

3. Results

The 2018 CMEC asked MEC offices questions about internet access, CMSs, participation in computerized data collections, and access to databases, and determined the prevalence of advanced imaging technologies (i.e., CT, MRI) that some MEC offices are integrating.

3.1. Internet

As shown in Table 1, 75.0 % of MEC offices (1528 respondents) overall reported having access to the internet separate from personal devices. When breaking out internet access based on populations served, MEC offices displayed ranges from 64.8 % for those serving small populations (fewer than 25,000) to 97.7 % for those serving large jurisdictions with populations over 250,000.

Table 1
Offices with access to the internet separate from personal devices, by population served: 2018.[a]

Population served (*n*)	Percent (*n*)
Total (2,036)	75.0 % (1528)
250,000 or more (244)	97.7 % (238)
25,000 to 249,999 (908)	79.0 % (717)
Fewer than 25,000 (884)	64.8 % (573)

[a] This question was asked on only the long-form CMEC (Question F1) and includes item nonresponse imputations.
Source: Bureau of Justice Statistics, 2018 Census of Medical Examiner and Coroner Offices (CMEC).

Looking at the nine U.S. census geographic divisions, 100.0 % of MEC offices in the New England division and 94.3 % in the Pacific division had employer-provided internet access. MEC offices with the lowest rate of employer-provided internet access were in the East South Central division (66.7 %), followed by the West North Central division (67.4 %) (Table 2). Between 76.1 % and 82.6 % of MEC offices in the five remaining divisions had employer-provided internet access.

3.2. Case management systems

As shown in Table 3, offices that served larger populations were more likely to report having a CMS. A CMS was reported by 27.6 % of offices serving small populations, 48.6 % of offices serving medium-sized populations (between 25,000 and 250,000), and 87.6 % of offices serving large populations (over 250,000). Overall, less than half (43.3 %) of all MEC offices reported that they had a CMS, and of those offices that did have a CMS and reported additional details about it, nearly all were networked (i.e., information on all cases is available to all authorized users) (89.1 %, data not shown). Compared to 1998 offices responding to the 2004 CMEC, the overall percentage of offices reporting having a CMS (30.9 %) increased by 40.1 %. Offices having a CMS by jurisdiction size also increased when compared to the 2004 CMEC: small (15.5 %), medium (33.4 %), and large (83.6 %), with the percentage for large jurisdictions increasing the least (data not shown).

Nationally, an average of two out of five MEC offices had a CMS (Fig. 1). The percentage of MEC offices that had a CMS varied geographically, from as low as only 22.6 % of offices in the West North Central division to 100.0 % in the New England division. Less than 50 % of MECs in the South Atlantic, East South Central, West South Central, and East North Central divisions reported that they had a CMS, although the last two divisions had CMSs at a rate higher than the national average (43.3 %). About three-fourths of MEC offices (76.4 %) in the

Table 2
Offices with access to the internet separate from personal devices, by U.S. census geographic division: 2018.[a]

Division (*n*)	Percent (*n*)
Total[b] (2036)	75.0 % (1242)
New England (6)	100.0 % (6)
Middle Atlantic (129)	82.6 % (107)
South Atlantic (251)	79.1 % (199)
East North Central (451)	76.8 % (346)
East South Central (329)	66.7 % (219)
West North Central (393)	67.4 % (265)
West South Central (163)	78.3 % (128)
Mountain (206)	76.1 % (157)
Pacific (108)	94.3 % (102)

[a] This question was asked on only the long-form CMEC. Includes item nonresponse imputations.
[b] Puerto Rico is included in the total but is not included in a division.
Source: Bureau of Justice Statistics, 2018 Census of Medical Examiner and Coroner Offices (CMEC).

Table 3
Offices with a case management system, by population served: 2018.

Population served (*n*)	Offices with a case management system (*n*)
Total (2,037)	43.3 % (882)
250,000 or more (229)	87.6 % (201)
25,000 to 249,999 (865)	48.6 % (420)
Fewer than 25,000 (943)	27.6 % (261)

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

Pacific division had a CMS, followed by over three-fifths (61.1 %) in the Middle Atlantic division and just over half (51.5 %) in the Mountain division. Offices having CMS by U.S. census geographic divisions generally followed a similar trend in 2004: Pacific (70.5 %), New England (66.7 %), Mid Atlantic (41.5 %), South Atlantic (40.2 %), Mountain (35.4 %), East North Central (32.2 %), East South Central (24.4 %), West South Central (18.9 %), and West North Central (14.3 %). The response of the geographic regions of East South Central and West South Central were affected by Hurricane Katrina just before the 2004 census began.

3.3. Participation in data collection

The CMEC queried MEC office participation in data collection efforts (i.e., digitized databases), including the Combined DNA Index System (CODIS), the Fatality Analysis Reporting System (FARS), NCIC, NamUs, the National Violent Death Reporting System (NVDRS), the State Unintentional Drug Overdose Reporting System (SUDORS), and state and local data collections. These are systems accessed via computers with internet access; having a CMS from which to draw the data can make participation less burdensome. Participation in various efforts varied by population served, as seen in Table 4, with MEC offices serving large populations more likely to participate in all queried data collections (ranging from 37.6 % to 89.2 %), and MEC offices serving small populations less likely to participate (ranging from 14.8 % to 53.5 %)—except in NCIC data collections, where MEC offices serving medium-sized populations participated least. For the purposes of this analysis, we consider data collection efforts to include NamUs—a computerized system that aids in investigations through access to reports of missing persons and provides information to the public and law enforcement on an MEC office's unidentified and unclaimed decedents. MEC offices contributed data to two of NamUs's three sections; participation ranged from 24.6 % for MEC offices serving small populations to 89.2 % for MEC offices serving large populations. Participation in CODIS ranged from 14.8 % for MEC offices serving small populations to 55.0 % for MEC offices serving large populations. Overall, participation in state or local data collections was highest (62.4 %) followed by NamUs (37.3 %), NVDRS (35.6 %), and FARS (30.5 %). One in five MEC offices reported participating in CODIS or NCIC.

When examined by U.S. census geographic division, CODIS participation ranged from 11.5 % in the East South Central division to 61.1 % in the Pacific, and NCIC participation ranged from just 7.5 % in the Middle Atlantic to 57.8 % in the Pacific (Table 5). The National Highway Traffic Safety Administration collects data through its FARS; overall,

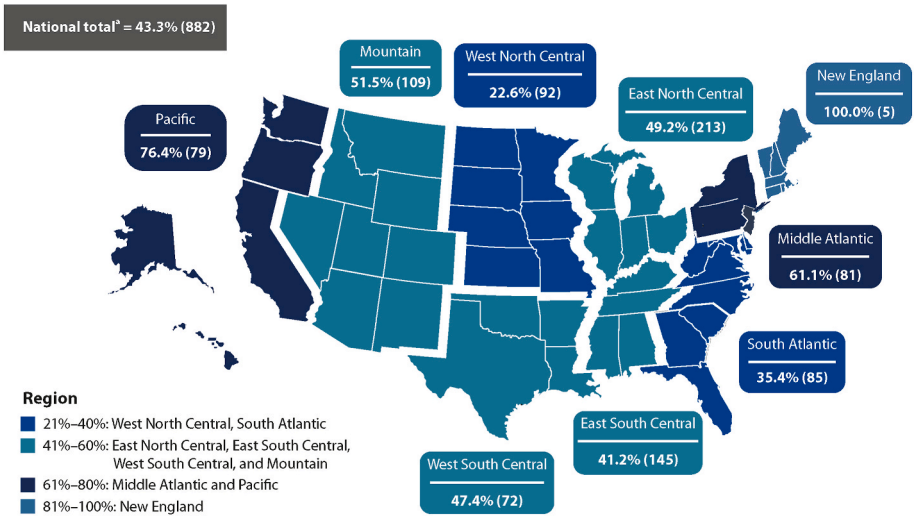

Fig. 1. Offices with a case management system, by U.S. census geographic division: 2018. [a]Puerto Rico is included in the total but is not included in a division. Source: Bureau of Justice Statistics, 2018 Census of Medical Examiner and Coroner Offices (CMEC).

Table 4
Offices participating in selected data collections, by population served: 2018.[a,b]

Population served (*n*)	CODIS	FARS	NCIC	NamUs	NVDRS	SUDORS	State or local data collection
Total (2,037)	20.0 % (407)	30.5 % (621)	20.3 % (413)	37.3 % (759)	35.6 % (725)	25.3 % (515)	62.4 % (1271)
250,000 or more (229)	55.0 % (126)	40.3 % (92)	37.6 % (86)	89.2 % (204)	63.2 % (145)	43.9 % (100)	88.2 % (202)
25,000 to 249,999 (865)	16.3 % (141)	30.9 % (267)	15.4 % (133)	37.4 % (323)	37.3 % (323)	25.8 % (223)	65.3 % (564)
Fewer than 25,000 (943)	14.8 % (140)	27.7 % (261)	20.6 % (194)	24.6 % (231)	27.3 % (257)	20.3 % (191)	53.5 % (505)

CODIS = Combined DNA Index System; FARS = Fatality Analysis Reporting System; NamUs = National Missing and Unidentified Persons System; NCIC = National Crime Information Center; NVDRS = National Violent Death Reporting System; SUDORS = State Unintentional Drug Overdose Reporting System.

[a] "Don't know" was a response option.

[b] Due to rounding, details may not sum to totals, and totals may differ from text.

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; NVDRS: https://www.cdc.gov/violenceprevention/about/timeline.html; SUDORS: https://www.cdc.gov/drugoverdose/od2a/pdf/SUDORS-Fact-Sheet.pdf.

fewer than one-third (30.5 %) of MEC offices reported participation in this effort (although some may do so indirectly through their appointed state agency). MEC offices in New England participated at the greatest rate (80.0 %) and those in the South Atlantic the lowest (17.9 %).

For the queried Centers for Disease Control and Prevention (CDC) data collections, only 35.6 % of MEC offices participated in NVDRS, which collects information on violent deaths, and 25.3 % of MEC offices participated in SUDORS, which collects information on drug-related deaths. Participation in NVDRS ranged from as low as 13.9 % in the West South Central division to 100.0 % in New England, with the Mountain division being the only other division in which more than 50 % of MEC offices participated. For SUDORS, participation ranged from 14.2 % in the West North Central division to 80.0 % in New England, with no other division having over 40 % participation. For unspecified state and local data collections, participation ranged from 46.5 % (West South Central) to 100.0 % (New England).

Only 37.3 % of responding offices reported participation in NamUs. Participation ranged from 22.2 % of MEC offices in the West North Central division to 100.0 % of offices in New England. In addition to New England, only the Pacific and Mountain divisions had greater than 50 % of offices participating in NamUs.

3.4. Access to databases

As seen in Table 6, access to and participation in various databases that add depth to investigations (e.g., information about names and fingerprints, known relationships such as gang affiliations, markings or tattoos, controlled substance prescriptions) and allow MEC offices to share data were examined. Despite MECs commonly having the responsibility to identify decedents, only 69.3 % of MEC offices reported access to fingerprint databases (directly or through a partner agency), with MEC offices serving larger populations more likely to have access, both directly and indirectly (84.4 %). MEC offices serving large populations were about twice as likely to report direct access to criminal history databases than offices serving small populations (28.6 % vs. 14.3 %), and offices serving medium-sized populations were least likely to report direct access (12.0 %). Overall, the percentage of MEC offices that had access to criminal history databases ranged from 68.8 % for offices serving small populations to 82.1 % for offices serving large populations. MEC offices serving small populations were also less likely to have direct access to prescription drug monitoring programs (PDMPs; 21.6 %), whereas just over half (50.3 %) of offices serving large populations had direct PDMP access. Overall, 60.5 % of MEC offices reported access to PDMPs, directly or through a partner agency.

Almost three-fourths (71.2 %) of MEC offices had access to criminal history databases, ranging from 55.2 % of offices in the Middle Atlantic (6.2 % reported direct access, 49.0 % indirect access) to 93.6 % of offices in the Pacific (69.0 % reported direct access, 24.7 % indirect access) (see Table 7). No MEC offices in New England reported direct access to criminal history databases, but 80.0 % had access through a partner agency. All MEC offices in New England had access to fingerprint databases through a partner agency. Over 85 % of MEC offices in the Pacific and Mountain divisions had access to fingerprint databases, compared with lowest access at 54.4 % in the West South Central and 58.5 % in the Middle Atlantic divisions. Direct access to fingerprint databases was low across all divisions, with only the Pacific division reporting that over 35.9 % of MEC offices had direct access. The percentage of MEC offices with access to PDMPs ranged from less than half (44.9 %) in the West South Central division to 100.0 % for MEC offices in New England. More than two-thirds of offices in the East North Central (72.8 %), Mountain (71.1 %), and East South Central (66.2 %) divisions had PDMP access either directly or through a partner agency. Total access was evenly split between direct access (28.8 %) and access through a partner agency (31.7 %) for all divisions. MEC offices in New England reported the greatest percentage of direct access to PDMPs (60.0 %), followed by the East North Central division (40.9 %).

3.5. CT and MRI access

The CMEC also asked MEC offices about more advanced technologies, specifically access to CT and MRI (Table 8). MEC offices serving large populations were more likely to have direct access to CT (7.4 %), but they were less likely than MEC offices serving smaller populations to have access through a partner agency and less likely to have any access overall. Although 17.1 % of state medical examiners reported direct access to CT, with an additional 38.9 % having access through a partner agency (data not shown), only 3.4 % of MEC offices overall had direct access to CT, and 46.9 % had access through a partner agency. Few MEC offices had direct access to MRI, and access through a partner agency mirrored that of CT, with offices serving medium-sized populations reporting the greatest percentages of direct (2.2 %) and indirect (48.2 %) access. Overall, about 1.8 % of MEC offices reported direct access to MRI, and 42.2 % reported access through a partner agency.

The variability of access to CT can be seen when offices were examined by geographic division (Table 9). Access to CT through a partner agency was reported by 50 % or more of offices in 4 of 9 divisions (New England, Middle Atlantic, East North Central, and Mountain), whereas no offices in the New England division reported direct

Table 5
Offices participating in selected data collections, by U.S. census geographic division: 2018.[a,b,c]

Division (*n*)	CODIS	FARS	NCIC	NamUs	NVDRS	SUDORS	State or local data collection
Total (2,037)	20.0 % (407)	30.5 % (621)	20.3 % (413)	37.3 % (759)	35.6 % (725)	25.3 % (515)	62.4 % (1271)
New England (5)	40.0 % (2)	80.0 % (4)	40.0 % (2)	100.0 % (5)	100.0 % (5)	80.0 % (4)	100.0 % (5)
Middle Atlantic (132)	15.3 % (20)	22.7 % (30)	7.5 % (10)	39.0 % (52)	38.1 % (50)	30.9 % (41)	71.2 % (94)
South Atlantic (240)	15.0 % (36)	17.9 % (43)	16.0 % (38)	34.1 % (82)	37.9 % (91)	24.8 % (60)	56.3 % (135)
East North Central (433)	20.3 % (88)	40.3 % (175)	12.8 % (55)	42.8 % (185)	48.9 % (212)	36.1 % (157)	73.9 % (320)
East South Central (353)	11.5 % (40)	20.9 % (74)	16.3 % (57)	27.3 % (96)	29.6 % (104[d])	23.4 % (82[d])	54.2 % (191)
West North Central (406)	13.7 % (56)	34.3 % (140)	22.0 % (89)	22.2 % (90)	21.5 % (87)	14.2 % (58)	54.2 % (220)
West South Central (151)	17.7 % (27)	25.9 % (39)	11.3 % (17)	30.3 % (46)	13.9 % (21)	16.7 % (25)	46.5 % (70)
Mountain (211)	34.9 % (74)	39.5 % (83)	39.2 % (83)	55.3 % (117)	52.8 % (111)	29.5 % (62)	74.2 % (156)
Pacific (104)	61.1 % (63)	32.1 % (33)	57.8 % (60)	82.9 % (86)	41.5 % (43)	24.1 % (25)	74.6 % (77)

CODIS = Combined DNA Index System; FARS = Fatality Analysis Reporting System; NamUs = National Missing and Unidentified Persons System; NCIC = National Crime Information Center; NVDRS = National Violent Death Reporting System; SUDORS = State Unintentional Drug Overdose Reporting System.

[a] "Don't know" was a response option.

[b] Due to rounding, details may not sum to totals, and totals may differ from text.

[c] Puerto Rico is included in the total but is not included in a division.

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; NVDRS: https://www.cdc.gov/violenceprevention/about/timeline.html; SUDORS: https://www.cdc.gov/drugoverdose/od2a/pdf/SUDORS-Fact-Sheet.pdf.

Table 6
Offices with access to selected database types, by population served: 2018.[a]

Population served (*n*)	Criminal history database			Fingerprint database			Prescription drug monitoring program		
	Direct access	Access through partner agency	Total with access	Direct access	Access through partner agency	Total with access	Direct access	Access through partner agency	Total with access
Total (2,037)	15.0 % (305)	56.3 % (1146)	71.2 % (1451)	7.6 % (155)	61.7 % (1256)	69.3 % (1411)	28.8 % (587)	31.7 % (647)	60.5 % (1233)
250,000 or more (229)	28.6 % (66)	53.5 % (122)	82.1 % (188)	18.7 % (43)	65.6 % (150)	84.4 % (193)	50.3 % (115)	24.0 % (55)	74.3 % (170)
25,000 to 249,999 (865)	12.0 % (104)	59.0 % (510)	71.0 % (614)	5.9 % (51)	63.4 % (548)	69.3 % (599)	31.0 % (268)	33.2 % (287)	64.2 % (555)
Fewer than 25,000 (943)	14.3 % (135)	54.5 % (514)	68.8 % (649)	6.5 % (61)	59.1 % (557)	65.6 % (618)	21.6 % (204)	32.2 % (304)	53.8 % (508)

[a] Puerto Rico is included in the total but is not included in a division. Due to rounding, details may not sum to totals and totals may differ from text.
Source: Bureau of Justice Statistics, 2018 Census of Medical Examiner and Coroner Offices (CMEC).

Table 7
Offices with access to selected database types, by U.S. census geographic division: 2018.[a]

Division (*n*)	Criminal history database			Fingerprint database			Prescription drug monitoring program		
	Direct access	Access through a partner agency	Total with access	Direct access	Access through a partner agency	Total with access	Direct access	Access through a partner agency	Total with access
Total (2,037)	15.0 % (305)	56.3 % (1146)	71.2 % (1451)	7.6 % (155)	61.7 % (1256)	69.3 % (1411)	28.8 % (587)	31.7 % (647)	60.5 % (1233)
New England (5)	0.0 % (0)	80.0 % (4)	80.0 % (4)	0.0 % (0)	100.0 % (5)	100.0 % (5)	60.0 % (3)	40.0 % (2)	100.0 % (5)
Middle Atlantic (132)	6.2 % (8)	49.0 % (65)	55.2 % (73)	1.6 % (2)	56.9 % (75)	58.5 % (77)	31.3 % (41)	20.8 % (28)	52.2 % (69)
South Atlantic (240)	6.9 % (17)	65.1 % (156)	72.0 % (173)	5.9 % (14)	63.4 % (152)	69.4 % (167)	14.1 % (34)	36.0 % (86)	50.1 % (120)
East North Central (433)	12.1 % (53)	62.9 % (273)	75.0 % (325)	5.3 % (23)	68.9 % (298)	74.2 % (321)	40.9 % (177)	31.8 % (138)	72.8 % (315)
East South Central (353)	5.6 % (20)	57.1 % (201)	62.7 % (221)	3.5 % (12)	56.6 % (200)	60.1 % (212)	32.7 % (116)	33.5 % (118)	66.2 % (234)
West North Central (406)	17.3 % (70)	51.5 % (209)	68.8 % (279)	6.6 % (27)	59.9 % (243)	66.5 % (270)	25.9 % (105)	28.0 % (114)	54.0 % (219)
West South Central (151)	4.1 % (6)	55.9 % (85)	60.0 % (91)	3.8 % (6)	50.5 % (77)	54.4 % (82)	19.3 % (29)	25.6 % (39)	44.9 % (68)
Mountain (211)	28.4 % (60)	60.2 % (127)	88.6 % (187)	15.7 % (33)	70.8 % (149)	86.5 % (182)	26.5 % (56)	44.7 % (94)	71.1 % (150)
Pacific (104)	69.0 % (72)	24.7 % (26)	93.6 % (97)	35.9 % (37)	53.4 % (55)	89.3 % (93)	24.2 % (25)	26.7 % (28)	50.9 % (53)

[a] Puerto Rico is included in the total but is not included in a division. Due to rounding, details may not sum to totals, and totals may differ from text.
Source: Bureau of Justice Statistics, 2018 Census of Medical Examiner and Coroner Offices (CMEC).

Table 8
Offices with access to CT and MRI, by type of access and population served: 2018.[a]

Population served (*n*)	CT			MRI		
	Direct access	Access through a partner agency	Total with access	Direct access	Access through a partner agency	Total with access
Total (2,036)	3.4 % (69)	46.9 % (955)	50.3 % (1024)	1.8 % (37)	42.2 % (859)	44.0 % (896)
250,000 or more (244)	7.4 % (18)	36.3 % (89)	43.8 % (107)	1.5 % (4)	29.5 % (72)	31.0 % (76)
25,000 to 249,999 (908)	2.3 % (21)	53.3 % (484)	55.6 % (505)	2.2 % (20)	48.2 % (437)	50.3 % 457
Fewer than 25,000 (884)	3.3 % (30)	43.3 % (382)	46.6 % (412)	1.6 % (14)	39.5 % (349)	41.1 % (363)

CT = computed tomography; MRI = magnetic resonance imaging.
[a] This question was asked on only the long-form CMEC. Due to rounding, details may not sum to totals, and totals may differ from text.
Source: Bureau of Justice Statistics, 2018 Census of Medical Examiner and Coroner Offices (CMEC).

access. Of offices in the West South Central division, 20.2 % had access through a partner agency, but only 2.3 % had direct access, for a total of 22.6 % with any access. The East South Central division had the highest percentage of offices with direct access to CT (5.5 %), but only 35.8 % of offices had access through a partner agency, for a total of 41.2 % with any access. Overall, the East North Central division had the most offices with any access (68.0 %); the other divisions with over half of offices having any access were Pacific (52.0 %), New England (65.6 %), Middle Atlantic (60.7 %), and Mountain (63.8 %).

Access to MRI followed a similar pattern; through a partner agency, MEC offices in the West South Central division had the lowest access through a partner agency (17.3 %), with a greater percentage of offices in the West North Central (40.2 %), Pacific (45.7 %), Mountain (52.9 %), Middle Atlantic (53.5 %), and East North Central (61.2 %) divisions reporting access. The percentage of offices with any access to MRI was 44.0 % and ranged from just 17.3 % in the West South Central division to 62.9 % in the East North Central division.

4. Discussion

The 2018 CMEC showed that access to technologies among MEC offices is as disparate as the variations in office structure and other resourcing. Despite prior studies showing the effectiveness and usefulness of technologies in death investigation and related functions (e.g.,

Table 9
Offices with access to CT and MRI, by type of access and U.S. census geographic division, 2018.[a,b]

Division (*n*)	CT			MRI		
	Direct access	Access through a partner agency	Total with access	Direct access	Access through a partner agency	Total with access
Total (2,036)	3.4 % (69)	46.9 % (955)	50.3 % (1024)	1.8 % (37)	42.2 % (859)	44.0 % (896)
New England (6)	0.0 % (0)	65.6 % (4)	65.6 % (4)	0.0 % (0)	46.4 % (3)	46.4 % (3)
Middle Atlantic (129)	4.4 % (6)	56.3 % (73)	60.7 % (78)	3.4 % (4)	53.5 % (69)	56.9 % (73)
South Atlantic (251)	1.2 % (3)	34.7 % (87)	35.9 % (90)	0.0 % (0)	30.0 % (75)	30.0 % (75)
East North Central (451)	2.3 % (10)	65.7 % (296)	68.0 % (306)	1.7 % (8)	61.2 % (276)	62.9 % (283)
East South Central (329)	5.5 % (18)	35.8 % (118)	41.2 % (136)	3.1 % (10)	27.7 % (91)	30.8 % (101)
West North Central (393)	4.6 % (18)	42.5 % (167)	47.1 % (185)	2.6 % (10)	40.2 % (158)	42.9 % (168)
West South Central (163)	2.3 % (4)	20.2 % (33)	22.6 % (37)	0.0 % (0)	17.3 % (28)	17.3 % (28)
Mountain (206)	2.9 % (6)	60.9 % (125)	63.8 % (131)	1.1 % (2)	52.9 % (109)	54.0 % (111)
Pacific (108)	4.1 % (4)	47.9 % (52)	52.0 % (56)	2.1 % (2)	45.7 % (49)	47.8 % (52)

CT = computed tomography; MRI = magnetic resonance imaging.
[a] Puerto Rico is included in the total but is not included in a division.
[b] This question was asked only on the long-form CMEC. Due to rounding, details may not sum to totals, and totals may differ from text.
Source: Bureau of Justice Statistics, 2018 Census of Medical Examiner and Coroner Offices (CMEC).

death certification) [2,32], many MEC offices throughout the United States continue to lack access to basic technologies like internet and more advanced technologies, such as CT and MRI.

4.1. Computers, internet, and information gathering/sharing—Some answers, some questions remain

MEC internet access equates to 1 in 4 MEC offices unable to access the internet through work (i.e., 2018 CMEC question: "Does your office currently have access to the Internet separate from a personal device?"), which could hinder and delay a death investigation [33]. MEC office–-provided internet rates increased as population increased, from 64.8 % for offices serving small populations, to 79.0 % for those serving medium populations, to 97.7 % for those serving large populations. Rates followed similar patterns for database and CMS use. MEC offices in the New England division reported more access than the rest of the country, with 100.0 % having access to employer-provided internet, but notably, these MEC offices are state agencies, which have more resources and infrastructure and larger budgets [32].

The data collected for internet access among MEC offices also indicate that 25 % of MEC offices do not have a website, a next-of-kin portal, or a means to search for or share information online using a work-issued device. Additionally, with the information collected in the 2018 CMEC, unanswered questions still remain: Do MECs have access to computers at work to do non-internet tasks? Do MECs collect information for a death investigation using internet on a personal device? How do MECs access information? Do they gather decedent information beyond the scene, autopsy, and ancillary testing? Does the MEC office rely on information gathered by other agencies such as hospitals and law enforcement? Thus, although 75 % of MEC offices provide access to the internet at work, details about location of internet access, extent of agency websites, in-office computer use for non-internet tasks, and the process of collecting information for MEC offices remain unknown.

4.2. Integration of case management systems in MEC offices—A value add

The 2018 data also reflect that about 3 of 5 MEC offices (56.7 %) do not have a CMS. This may be expected for smaller jurisdictions with fewer data to manage. However, the lack of a CMS could indicate a lack of computers or the inability to easily pull data through CMS query and report functions, which complicates an MEC office's participation in data collection efforts. A lack of computerized resources affected MEC offices in all parts of the United States, except for the New England division, whose MEC offices reported 100.0 % use of CMSs. However, it is unknown whether the New England division system structure, budget arrangements, size, or other key factors uniquely impact that region's high proportion of selected technology use overall. Excluding the New England division, the percentage of offices with a CMS ranged from as low as 22.6 % (West North Central division) to just over three-quarters in the Pacific division (76.4 %), and only four divisions reported a CMS in more than half of offices (Middle Atlantic, Mountain additional two divisions). Greater population size correlated to more computer-related resources; offices with a CMS ranged from 27.6 % (small populations) to 87.6 % (large populations), and of those with a CMS, 82.3 % of MEC offices serving small populations and 97.0 % of MEC offices serving large populations had a networked system. This could indicate a higher volume of cases needing to be managed by bigger offices, and thus a greater need for a more robust CMS. However, at a time when computers are regularly integrated into everything we do, it is notable that these underfunded, resource-burdened MEC offices charged with crucial public health and public safety roles have not universally integrated computerized CMSs into their practices, even in a rudimentary form (i.e., non-networked, non-commercialized, spreadsheets, or word processor lists).

As time progresses, we can anticipate that technologies will be more integrated into MEC offices, with greater use of available resources. This advancement is seen in the increasing numbers of MEC offices with CMSs over several years. Although the 2004 CMEC asked if an office had a computerized information management system (question E3), these results were not originally available in the report [35]. However, our subsequent analysis indicated that 30.9 % of CMEC offices responding to the 2004 CMEC indicated that they had access to a computerized information management system, but not necessarily a networked system, because this characteristic was not included in the question [35]. Similarly, the 2017 NFLIS reported that 31.7 % of responding MEC offices used a computerized and networked CMS, with another 6.6 % having a non-networked system, for a total of 38.3 % having any CMS [37]. The 2018 CMEC showed a continuing upward trend with 43.3 % of offices reported a CMS overall [26] (up 5 % over a year compared with NFLIS data), and 4 years later, in 2022, NFLIS reported a total of 51.5 % of MEC offices with a CMS, up an additional 8.2 %: 35.4 % had a CMS (networked and non-networked), and another 16.1 % were fully computerized with manual duplication of records [25]. This increase is a positive trend, but a sizable number of MEC offices still lack a CMS.

4.3. Data system use and database inquiries and entries in MEC offices—improving but remaining low

Although integration of CMS technologies may be increasing, MEC offices reported low use of many of those systems to contribute to or access various data systems in 2018. Just over a third of total offices (37.3 %) in 2018 reported using NamUs. NamUs includes free forensic services, such as odontology and DNA analysis, and employs specialized

personnel to facilitate investigations. An MEC office may not use NamUs because of small caseloads or lack of eligible cases, but many offices likely are missing a valuable tool to help manage their cold cases. The NamUs database can help MECs to locate and reunite family members for disposition of the unclaimed remains. However, not using the unclaimed section of NamUs could lead to the MEC office having to spend additional time and resources to locate the next of kin.

Many MEC offices also fail to use available computerized databases, for accessing data on cases (e.g., fingerprint databases, PDMPs) and for sharing their collected data with local and state partners, as well as federal partners such as CDC (through NVDRS and SUDORS), the Federal Bureau of Investigation (through CODIS and NCIC), and the Department of Justice (through NamUs). Contributions to other data collection efforts generally did not exceed 35 %, apart from NVDRS (35.6 %) and nonspecific state and local data collection efforts (62.4 %). As with other mentioned technologies, their use generally (1) increased with jurisdiction size, and with offices serving large populations most likely to participate; and (2) was highest in the New England and Pacific divisions and lowest in the West North Central and West South Central divisions. For NCIC, which was queried in the 2004 and 2018 CMECs, overall use among all offices remained stable, with both data collections reporting that around 20 % of offices used it [26,27]. Despite use of other technologies increasing in society and among MEC offices, contributions to this effort are not reported to be significantly increasing. This could be attributed to some MEC offices having issues qualifying for NCIC access. The higher rates in the Pacific division in 2018 could be due to the high number of sheriff–coroner offices in California and prosecutor–coroner offices in Washington, which have this access by default through these other roles.

In addition to contributing to databases, many MEC offices have databases at their disposal to aid in investigations, several of which the 2018 CMEC queried. Criminal history databases can provide information on social history and next of kin and give context to findings; fingerprint databases aid in identification of decedents; and PDMPs can provide information on medical history, context to findings, and physician information so offices may be contacted for additional medical history for a decedent. Despite these databases providing a wealth of information that can be core to the function of an MEC office, access to them, even though partner agencies, was limited, with 60.5%–71.2 % having access to databases (ranging by database type) that could provide valuable information to medicolegal death investigations.

Finally, the available data from the 2018 CMEC could not examine why offices failed to use online databases, although it could be a lack of (1) relevant cases, (2) knowledge of the databases, (3) desire to participate, or (4) required infrastructure, such as the internet.

4.4. Advanced imaging technologies—supplemental autopsy tools in MEC offices

Advanced imaging technologies have been slow for adoption by U.S. MEC offices [31]. Several offices reported that they had access to CT or MRI scans through partner agencies, if not directly, with more having access to CT than to MRI. Direct access to CT was most prevalent among offices serving large populations, which presumably have larger caseloads and therefore a greater need for these tools. These tools can help inform and provide supplemental information to an autopsy in some cases—for example, in a jurisdiction working to triage certain suspected drug-related deaths, and in other jurisdictions, such tools can provide additional information to the MEC office. This information, along with autopsy and other findings, can aid in determining cause and manner of death. In other jurisdictions, advanced imaging can be useful as a substitute for autopsy in cases of cultural or religious objections to autopsy. With autopsy numbers on the rise in recent years, and with concerns of infection during the recent COVID-19 pandemic, some offices are using these technologies to mitigate the ever-growing shortage of forensic pathologists and other resource limitations [26].

4.5. Limitations of data analysis

Although this analysis of 2018 CMEC data provides a national review of MEC offices' technology access and needs, there were certain limitations. As with many voluntary surveys, respondents' demographics can vary and may not be wholly representative of all MEC offices. Similarly, state-level responses may not accurately reflect local-level practices. Also, respondents did not always respond to all questions, but imputations were made for non-responders to ameliorate this limitation. Statistical imputation is a tested, standard approach for handling item nonresponse [37]; however, it is notable that the item nonresponse for the measures used in this analysis that necessitated imputation was modest—the item nonresponse rates were 2 % or less. At least 19 % of MEC offices (389 non-responders of 2037 eligible offices) did not respond to the survey and another 15 % did not respond to technology questions that were not included in the short, critical item survey (i.e., did not respond to the technology questions only included in the long survey). Moreover, many of the 2018 CMEC questions were yes/no responses and did not provide additional context to answers that would further inform our understanding of MEC technology needs and use. Finally, it is important to note that the New England division is unique in that the responding jurisdictions were solely served by state-level offices, so there are far fewer offices within this division than others (including one state, Massachusetts, that did not provide data for the 2018 CMEC).

5. Conclusions

Just as MEC offices are a patchwork of operational types and structures, so is their access to and uses of technology. Whether it was access to internet, CMSs, or advanced imaging technologies, MEC offices serving small populations tended overall to have less technology at their disposal. Still, MEC offices serving larger populations were far from ideal in their level of access. The United States has seen improvements in the number of MEC offices transitioning to a CMS over recent years, but use of these and other technologies continues to be low.

Without access to computers, CMSs, or the internet, an investigation can be less comprehensive, and the information provided to public health, public safety, and a decedent's friends and family may be incomplete or even inaccurate. Furthermore, lack of a CMS or internet access can hinder an MEC office's ability to share actionable data—something that offices across the country of all sizes reported doing inconsistently and generally infrequently—with those who could use these data to prevent future deaths. Based on these findings and additional work in support of data modernization and data interoperability/sharing in MEC offices, future research topics to gain a better understanding of beneficial technology use could include electronic medical records databases (i.e., health information exchanges), application programming interface tools, electronic and cloud facsimile, data signing software, or query-based exchanges, as well as further understanding the capabilities and implementation of CMS functions (e.g., data abstraction and Fast Healthcare Interoperability Resources [FHIR] connectivity) [3].

In jurisdictions with less access, county managers and others making budgetary decisions should learn and address why the office of medical examiner or coroner—which serves as a neutral representative to monitor deaths and inform the health and safety of the community—lacks fundamental infrastructure (e.g., the internet, a CMS) or fails to use free resources (e.g., online databases). Since the 2018 CMEC, CDC has provided technology grants to aid MEC offices in boosting their technologies, but so many lack basic access to important resources that a small amount of grant funds is insufficient. As the federal government pushes for data modernization in public health and public safety, it is important that these often small, always crucial offices are not ignored and are modernized alongside the agencies they inform.

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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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References

[1] U.S. Department of Justice, Office of Justice Programs, National Institute of Justice, Report to Congress: Needs Assessment of Forensic Laboratories and Medical Examiner/Coroner Offices, U.S. Department of Justice, Office of Justice Programs, Washington, DC, 2019. https://www.ojp.gov/pdffiles1/nij/253626.pdf.

[2] Executive Office of the President, National Science and Technology Council, Strengthening the Medicolegal-Death-Investigation System: Improving Data Systems, Office of Science and Technology Policy, National Science and Technology Council, Washington, DC, 2016. https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/NSTC/strengthening_the_medicolegal_death_investigation_system_final.pdf.

[3] J.D. Ropero-Miller, N. Bynum, K. Keyes, E. Fornaro, M. Ascolese, Data Exchange Practices of Medicolegal Death Investigation, RTI International, Research Triangle Park, NC, 2022. https://forensiccoe.org/private/63da9032991eb.

[4] R.F. Wilson, G. Liu, B.H. Lyons, E. Petrosky, D.D. Harrison, C.J. Betz, J.M. Blair, Surveillance for violent deaths—national violent death reporting system, 42 states, the District of Columbia, and Puerto Rico, MMWR Surveill. Summ. 71 (2022) 1–40, https://doi.org/10.15585/mmwr.ss7106a1.

[5] E. Grinshteyn, D. Hemenway, Violent death rates in the US compared to those of the other high-income countries, Prev. Med. 123 (2015) 20–26, https://doi.org/10.1016/j.ypmed.2019.02.026.

[6] J.D. Ropero-Miller, L.D. Mullen, P.J. Speaker, The sentinel role of forensic toxicology laboratories to identify and act upon diverse drug threats by addressing toxicology and economic demands, Forensic Sci. Int.: Synergy 5 (2022) 100292, https://doi.org/10.1016/j.fsisyn.2022.100292.

[7] Healthline, Accidents (Unintentional Injuries), 2023. https://www.healthline.com/health/leading-causes-of-death#rising-death-rates. (Accessed 4 January 2024).

[8] E. Carroll, A. Johnson, B. Sampson, Trends in United States mass fatality incidents and recommendations for medical examiners and coroners, Acad. Forensic Pathol. 7 (2017) 318–329, https://doi.org/10.23907/2017.029.

[9] Centers for Disease Control and Prevention, 10 essential public health services. https://www.cdc.gov/publichealthgateway/publichealthservices/essentialhealthservices.html, 2023. (Accessed 16 April 2024).

[10] Forensic Technology Center of Excellence, Working Group on Data Exchange in Medicolegal Death Investigation. https://forensiccoe.org/working-group-data-exchange-mdi/, n.d. (accessed 16 April 2024).

[11] Forensic Technology Center of Excellence, Interactive Map: Medicolegal Death Investigation Data Flow, 2023. https://forensiccoe.org/tool-2023-map-mdi-dataflow/. (Accessed 16 April 2024).

[12] Forensic Technology Center of Excellence, Whitepaper: Toxicology Reporting in Medicolegal Death Investigation, RTI International, Research Triangle Park, NC, 2023. https://forensiccoe.org/private/65b94d3b3b695.

[13] Forensic Technology Center of Excellence, Whitepaper: Information Sharing between Medicolegal Death Investigation Offices and Organ and Tissue Recovery Organizations, RTI International, Research Triangle Park, NC, 2023. https://forensiccoe.org/private/65b94ca69e9b5.

[14] Forensic Technology Center of Excellence, Whitepaper: Electronic Medical Records in Medicolegal Death Investigation, RTI International, Research Triangle Park, NC, 2023. https://forensiccoe.org/private/65b94c897802b.

[15] Forensic Technology Center of Excellence, Whitepaper: Electronic Death Registry in Medicolegal Death Investigation, RTI International, Research Triangle Park, NC, 2023. https://forensiccoe.org/private/65b94c6d5d773.

[16] Forensic Technology Center of Excellence, General Provider Resources: Medical Records for Medicolegal Death Investigations Toolkit, RTI International, Research Triangle Park, NC, 2023. https://forensiccoe.org/2023-toolkit-medical-records-mdi/.

[17] Centers for Disease Control and Prevention, Modernizing medical examiner and coroner data systems. https://www.cdc.gov/nchs/comec/modernizing-mec-data-systems.htm, 2023. (Accessed 16 April 2023).

[18] E. Vernon, C. Sorrell, R. Shute, J.D. Ropero-Miller, A Landscape Study of Electronic Case Management Systems (CMS) for Medical Examiners and Coroners, RTI International, Research Triangle Park, NC, 2022. https://forensiccoe.org/electronic-case-management-system-mdi/.

[19] Health Level Seven International, Medicolegal Death Investigation (MDI) FHIR Implementation Guide, 2023. https://hl7.org/fhir/us/mdi/. (Accessed 16 April 2023).

[20] U.S. Department of Justice, Death Investigation: A Guide for the Scene Investigator, Office of Justice Programs, National Institute of Justice, Washington, DC, 2011. https://www.ojp.gov/pdffiles1/nij/234457.pdf.

[21] V.K. Podichetty, J. Booher, M. Whitfield, R.S. Biscup, Assessment of internet use and effects among healthcare professionals: a cross sectional survey, Postgrad. Med. 82 (2006) 274–279, https://doi.org/10.1136/pgmj.2005.040675.

[22] U.S. Government Accountability Office, Health Information Technology: HHS Should Assess the Effectiveness of its Efforts to Enhance Patient Access to and Use of Electronic Health Information, U.S. Government Accountability Office, Washington, DC, 2017. www.gao.gov/products/GAO-17-305?utm_source=blog&utm_medium=social&utm_campaign=watchblog.

[23] C. Brooks, Sheriffs' Offices, Procedures, Policies, and Technology, 2020—Statistical Tables, Bureau of Justice Statistics, Office of Justice Programs, U.S. Department of Justice, Washington, DC, 2023. https://bjs.ojp.gov/document/soppt20st.pdf.

[24] Indiana Department of Health, Coroners. https://www.in.gov/health/trauma-system/coroners. (Accessed 4 January 2024) n.d.

[25] Diversion Control Division, 2022 Medical Examiner and Coroner Survey Report, U.S. Drug Enforcement Administration, Springfield, VA, 2023. https://www.nflis.deadiversion.usdoj.gov/nflisdata/docs/12028NFLIS2022MECShortReport.pdf.

[26] C. Brooks, Medical Examiner and Coroner Offices, Bureau of Justice Statistics, Office of Justice Programs, U.S. Department of Justice, Washington, DC, 2018, 2021, https://bjs.ojp.gov/content/pub/pdf/meco18.pdf.

[27] M.J. Hickman, K.A. Hughes, K.J. Strom, J.D. Ropero-Miller, Medical Examiners and Coroners' Offices, Bureau of Justice Statistics, Office of Justice Programs, U.S. Department of Justice, Washington, DC, 2004, 2007, https://bjs.ojp.gov/content/pub/pdf/meco04.pdf.

[28] NamUs, Frequently asked questions. https://namus.nij.ojp.gov/frequently-asked-questions#faq-what-is-the-namus-program, 2021. (Accessed 4 January 2024).

[29] A. Rodriguez, H.M. Smiley-McDonald, M. Stirling Cummings, S. Wire, D. Slack, C. L. Williams, K.A. Keyes, J.D. Ropero-Miller, Understanding unidentified human remains investigations through the United States census data, Forensic Sci. Int.: Synergy 4 (2022) 100225, https://doi.org/10.1016/j.fsisyn.2022.100225.

[30] N. Adolphi, Developing a Postmortem CT Service: Practical Considerations for Death Investigation Agencies, in: Forensic Technology Center of Excellence, U.S. Department of Justice, National Institute of Justice, Office of Investigative and Forensic Sciences, Washington, DC, 2022. https://forensiccoe.org/private/62a8e4de64c78.

[31] D. Weiss, D. McLeod-Henning, H. Waltke, Using advanced imaging technologies to enhance autopsy practices, Natl. Inst. Justice J. 279 (2017). https://nij.ojp.gov/topics/articles/using-advanced-imaging-technologies-enhance-autopsy-practices.
[32] Bureau of Justice Statistics, Census of Medical Examiner and Coroner Offices [data set], Inter-University Consortium for Political and Social Research, 2018. https://doi.org/10.3886/ICPSR38251.v1 [distributor], 2021.
[33] U.S. Department of Justice, Census of Medical Examiners and Coroners' Offices [solicitation], Office of Justice Programs, Bureau of Justice Statistics, 2017. https://bjs.ojp.gov/sites/g/files/xyckuh236/files/media/document/cmecosol.pdf.
[34] Bureau of Justice Statistics, Census of medical examiner and coroner (ME/C) offices. https://bjs.ojp.gov/data-collection/census-medical-examiner-and-coroner-mec-offices#1-0, 2009. (Accessed 16 April 2024).
[35] H. Bai, M.H. Clark, Propensity Score Methods and Applications, SAGE Publications, Thousand Oaks, CA, 2018.
[36] Diversion Control Division, 2017 Medical Examiner and Coroner Survey Report, U. S. Drug Enforcement Administration, Springfield, VA, 2018. https://www.nflis.deadiversion.usdoj.gov/nflisdata/docs/NFLIS-MECSurveyReport.pdf.
[37] M. Khare, R.J.A. Little, D.B. Rubin, J.L. Schafer, Multiple imputation of NHANES III, ASA Proc. Sect. Surv. Res. Method. (1993) 297–302, in: http://www.asasrms.org/Proceedings/papers/1993_046.pdf.