



## Understanding unidentified human remains investigations through the United States census data

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### ABSTRACT

Each year, thousands of unidentified human remains (UHR) cases are reported in the U.S. Technological advances have greatly enhanced the forensic community's capacity and capability to solve UHR cases, but little is known about the extent to which these resources are used by medical examiners and coroners (MECs). Using public datasets, the study purpose is to describe the current state MEC system with respect to UHR cases, the resources used to investigate these cases, and the evidence retention policies in place. There was an overall decline in UHR cases reported between 2004 and 2018. Less than half of MECs in both study years reported having established written final disposition and evidence retention policies for UHR cases. National missing persons databases were underused. This study provides an important window into the present state of UHRs being handled by our Nation's MEC offices and the resources available to solve these difficult cases.

### 1. Introduction

When human remains are discovered, it becomes the responsibility of medical examiners and coroners (MEC) to identify the decedent with investigative assistance from law enforcement. The amount of time it takes to identify an individual depends on variables such as the condition of the body and the amount of time that has passed since death [1]. If human remains are discovered from a recently deceased individual, they have a greater chance of a timely identification through visual confirmation by a relative or through more rapid forensic identification techniques, such as fingerprint or dental comparisons. These techniques are the first line of identification prior to using more expensive, time-intensive forensic and investigative analyses and ultimately lead to most unidentified human remains (UHR) case resolutions. In instances when those methods are unsuccessful, DNA identification is an invaluable means to directly compare or search against family reference samples uploaded into the missing person (MP) index of the Federal Bureau of Investigation's (FBI's) Combined DNA Index System (CODIS).

When these traditional identification methods fail, forensic genetic genealogy (FGG) is most recently proving to be a powerful tool for identifying UHRs. Modern-day advances in technology have allowed for a higher success rate in developing sufficient profiles from highly degraded remains containing a low quantity of human DNA. Current

DNA processing requires small fractions of what was required to obtain a DNA profile as recent as 10 years ago. This advanced forensic testing, combined with the application of traditional genealogical analyses, has provided MECs with the ability to develop investigative leads in cases previously thought to be unsolvable. MECs, in conjunction with law enforcement, can submit genetic data from a decedent into select direct-to-consumer (DTC) and 3rd party databases such as FamilyTreeDNA and GEDmatchPro to be compared against genetic profiles of consenting consumers in hopes of revealing a familial relationship. Private companies such as Parabon NanoLabs, Bode Technology, and Othram work with law enforcement to identify decedents through the application of FGG. In recent years, websites such as Othram's [www.DNASOLVES.com](http://www.DNASOLVES.com) have assisted cold case investigations submitted directly by law enforcement and death investigation agencies and have provided opportunities for crowd sourcing of funds to support the associated costs of FGG for UHRs. As of November 10, 2021, DNASolves and Othram have aided in the resolution of 39 UHR cases, illustrating the impact FGG has on cold case investigations [2].

Perhaps the most significant means of resolving UHR cases has been the implementation and expansion of the FBI's Next Generation Identification (NGI) database. NGI is managed by the FBI Criminal Justice Information Services (CJIS) and serves as "the world's largest electronic repository of biometric and criminal history information [3]." The term

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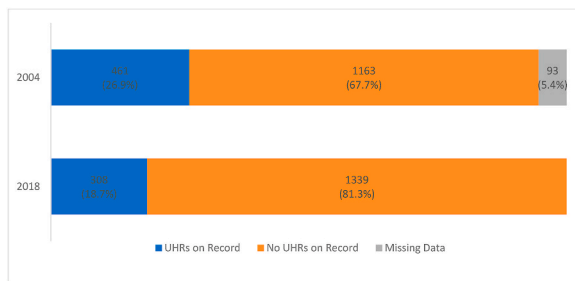
**Table 1**  
Crosswalk of the Measures used from the 2004 and 2018 CMECs Used in the Present Study.

Measure	2004 Item	2018 Item
Number of agencies reporting UHR cases on record	D3-A	D2
Number of UHR cases on record	D3-A	D3-A
Classification of UHR in final disposition	D3-C	D5
Oldest UHR case on record	D3-A	D4
Policy for final disposition of UHRs after specified period	D1	D1
Policy for retaining evidence/records pertaining to UHRs	D2	E3-D/E
Participation in national databases (NamUs, CODIS, NCIC)	D4/D5/D7	F8 A/C/D

**Table 2**  
Number and percentage of CMEC participants' self-reported agency type, 2004 and 2018<sup>a</sup>.

	State medical examiner office	District/regional medical examiner office	County medical examiner office	City medical examiner office	District/Regional coroner office	County coroner office	Other	Total
2004	24 (1.4%)	33 (1.9%)	266 (15.5%)	3 (0.2%)	24 (1.4%)	1366 (79.6%)	1 (0.1%)	1717 (100.1%)
2018	23 (1.4%)	24 (1.5%)	295 (17.9%)	4 (0.2%)	9 (0.5%)	1292 (78.5%)	0	1647 (100.0%)

<sup>a</sup> Percentages may not add up to 100.0% due to rounding.



**Fig. 1.** Number of agencies reporting having unidentified human remains cases on record at Yearend 2004 and 2018.

biometrics, as it pertains to NGI, includes palmprints, fingerprints, iris scans, and facial recognition. In support of UHR cases, MECs and investigators can request searches using advanced algorithms to query fingerprints of deceased individuals against criminal and civil files. Beginning in 2017, a partnership between the National Missing and Unidentified Persons System (NamUs) and NGI has allowed for friction ridge impression records from missing and unidentified persons collected by NamUs to be entered into the NGI database. As a result of this expansion, 312 identifications of UHRs have been made, 34 of which were confirmed as victims of homicide [4].

Although identifications are frequently established with the previously noted forensic methodologies, there are nationwide computerized criminal justice information systems that also provide great value to both active and long-term UHR investigations. The National Crime Information Center (NCIC) is a “computerized index of missing persons and criminal information and is designed for the rapid exchange of information between criminal justice agencies [5].” The database is administered by the FBI through the CJIS division and is linked through regional or state computer systems across the country [5]. Initially developed in 1967, NCIC was adapted in 1975 to allow the entry of missing persons and adapted again in 1983 to accommodate UHR cases. With the addition of these indices, users can query the system in search of potential matches between MP and unidentified decedents using descriptive information and biometric data such as fingerprints and dental records. NCIC is restricted to local, state, and federal criminal justice agencies; however, because of their vital involvement in MP and UHR investigations, a select few MEC offices have been granted query, entry, and record modification capabilities. MEC offices nested within

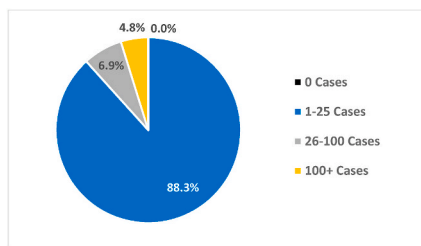
law enforcement agencies, such as those within sheriff’s departments in California, may have easier access to NCIC because of their jurisdictional relationship.

In 2007, the National Institute of Justice (NIJ) established NamUs. NIJ’s goal for NamUs was to create a national clearinghouse for MP and UHR cases that would strengthen communications between agencies and the public so that pertinent case information could be shared to help families of victims search for their loved ones. Through NamUs, records for missing, unclaimed, and unidentified persons are entered by law enforcement, MECs, family members, victim advocates, and the public to aid in the investigation of cases, particularly for long-term cases. NamUs offers these stakeholders, who may not have access to NCIC or other databases for allied forensic practitioners, a national database to aid in UHR investigations, as well as free forensic services, including traditional DNA analysis, FGG,<sup>1</sup> anthropology, odontology, and fingerprint analysis [6]. With many agencies having limited resources to dedicate to forensic services, NamUs has become invaluable to the criminal justice community by facilitating these services and providing access to trained experts. Although the public may access published case information, firewalls protect sensitive law enforcement and personally identifiable information (PII) so that those records are only visible to individuals sponsored by a criminal justice agency [7]. As of November 3, 2021, 5141 UHR cases entered into NamUs have been resolved, with NamUs playing a direct role in the identification of 2325 of the decedents [8].

Similar to NamUs, the National Center for Missing and Exploited Children (NCMEC) serves as a nationwide clearinghouse and resource center for families, law enforcement and other professionals involved with missing and unidentified child investigations. Since 2011, NCMEC has designated a specialized team to provide resource assistance to law enforcement and MECs seeking to identify unknown deceased children. Operating as a private, nonprofit 501(c)(3) corporation, NCMEC leverages biometric collection, advanced forensic testing, NamUs, NCIC, and an internal database comprised of missing child cases to develop investigative leads regarding potential identifications. As of October 2021, NCMEC has assisted with 184 identifications, with the oldest resolved case dating back to 1963 [9].

The implementation of these widely used databases, coupled with recent advances in forensic technologies, has provided opportunities to increase the chances of successful resolutions for UHR cases. Despite

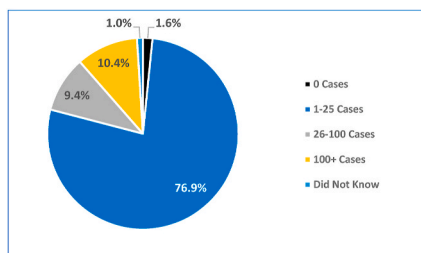
<sup>1</sup> See here: <https://namus.nij.ojp.gov/#dbcv3>.



1. Percentages may not add up to 100.0% due to rounding.  
 2. Percentages are based on 461 (26.9%) of agencies reporting having UHR cases on record at the end of 2004.

**Fig. 2.** Unidentified Human Remains Cases on Record at Year-end 2004<sup>1,2</sup>

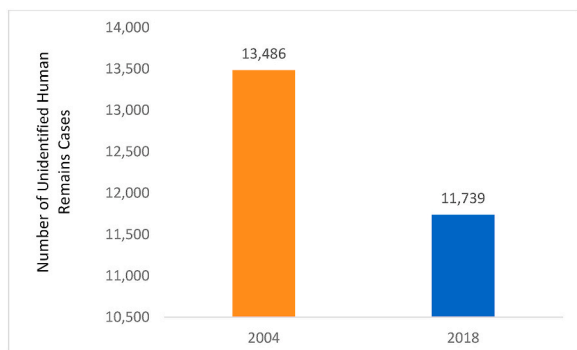
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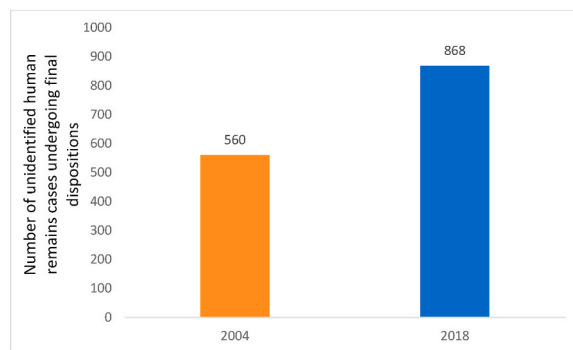
**Fig. 3.** Unidentified Human Remains Cases on Record at Year-end 2018<sup>1,2</sup>

1. Percentages may not add up to 100.0% due to rounding.
2. Percentages are based on 308 (18.7%) of agencies reporting having UHR cases on record at the end of 2018.



**Fig. 4.** Number of unidentified human remains cases on record at year-end 2004 and 2018.

this, decedents can remain unidentified for years and even decades [1]. In 2020, 800 unidentified records were entered into NCIC, and 704 records were canceled or cleared by the submitting agency. For the reporting year of 2020, 8284 unidentified records were maintained in NCIC [10]. As of August 2021, NamUs contained records from 13,784 unresolved unidentified cases [8]. The lack of retention policies, limited resources for forensic methodologies, the lack of mandatory reporting to national databases, and the perceived underreporting of missing persons have all been cited as explanations for the lack of identifications and UHR case resolutions [11,12]. National statistics show why thousands of UHR cases remain unresolved with regard to evidence retention in particular. In 2005, the Bureau of Justice Statistics (BJS) conducted the first Census of Medical Examiner and Coroners' Offices (CMEC) by



**Fig. 5.** Number of unidentified human remains cases undergoing final disposition at year-end 2004 and 2018.

evaluating administrative, financial, and operational data from 2004 in an effort to provide a national landscape of the medicolegal death investigation (MDI) community [13]. According to the 2004 CMEC, only half of the reporting agencies were estimated to have policies in place for retaining records related to UHRs such as x-rays, fingerprints, or DNA [13]. Without policies in place to retain reports and associated evidence, case records can be destroyed, limiting opportunities for future investigation and advanced forensic testing [12]. Further, an analysis of 236 identifications of child remains from 2000 to 2020 conducted by NCMEC supports the idea that missing persons are underreported, thereby inhibiting successful case resolutions by traditional investigative means. Law enforcement, medical examiners and coroners typically rely on forensic databases such as CODIS and NGI and missing persons databases such as NCIC and NamUs to provide investigative leads. These databases are populated based on the availability of missing persons reports. However, if no such report is filed, the data needed to yield an investigative lead are unavailable. In instances when a report is filed, the lack of data entry on behalf of law enforcement agencies leads to limited case exposure and delays in successful outcomes. In an analysis of 236 identifications of child remains from 2000 to 2020, NCMEC reported that only 53% had a missing persons report on file with a law enforcement agency and, 25% were never entered into NamUs or NCIC or reported to NCMEC, despite having a report on file with law enforcement [1].

UHR cases impact MECs nationwide; however, the true scope of the problem is unknown because of a lack of legislation mandating the reporting of UHR cases to national databases. The use of the unidentified person index of NCIC is voluntary, and only 10 states (Arkansas, Illinois, Michigan, New Mexico, New York, North Carolina, Oklahoma, Tennessee, Washington, and West Virginia) have legislation that requires cases be entered into NamUs {National Missing and Unidentified Persons System (NamUs), n.d. #21}. Because entering UHR cases into NCIC is not mandatory [14] and current legislation in most states does not mandate entry into NamUs, the reported numbers most likely do not account for the full breadth of UHRs across the country, making it difficult to understand the true scope of the problem.

Further complicating the national picture of UHR cases is that few basic national data collections have holistically focused on the MEC community. The 2004 CMEC was a landmark national study at the time. Although other data collections have been conducted in recent years, such as those conducted by the Drug Enforcement Agency [15], BJS' final report for the CMEC [13] remains the *only* comprehensive source of basic administrative, financial, and operational data about the U.S. MDI system, including information about UHR cases. The 2007 report made clear that the MDI systems varied widely across all measures, including jurisdiction size and type, caseload, staffing, procedures performed, record retention, use of national databases, operations, and budget. Because of these variations, the MDI has been described as a "patchwork" by those who work within it [16], in the scientific literature [17,

18], and in popular media [19]. BJS conducted the second CMEC in 2019, referencing the 2018 calendar year.

Thus, the present study aims to use the 2004 and 2018 CMEC data to understand the MECs' role in UHR investigations, their evidence retention policies, and their agency resources for UHR cases. Because the allied medicolegal death investigation community is crucial to UHR cases, having a fuller picture of their role, processes, procedures, and resources can help identify needed resources, efficiencies, and future best practices that can lead to additional identifications.

## 2. Methods

The 2004 and 2018 CMECs were designed to focus on the U.S. MDI system, providing a national picture of MEC offices, including personnel, expenditures, workloads, capabilities and procedures, and resource needs. A key objective of the CMEC was to enumerate specialized death investigations handled by MECs, including UHRs and policies and procedures related to their processing. Given the paucity of information that has been published since BJS' seminal 2007 report [13] on UHRs, this study will provide a timely update regarding the scope of UHRs, how MECs handle these cases, and what resources are being used and compare how much has changed within these aspects, with similar measures pulled from the 2004 CMEC.

The present study draws from the data collections that RTI International performed for BJS to conduct the 2018 CMEC (contract number 2017-MU-CX-K052) and the 2004 CMEC (contract number: 2005-MU-MU-K011). For both collections, approvals from the Office of Management and Budget and RTI's Institutional Review Board were obtained before any data collection activities began.

### 2.1. 2004 CMEC

RTI performed both the 2004 (in 2005) and 2018 (in 2019) CMECs. RTI designed both census questionnaires in coordination with a forensic expert panel review, pilot tested it to select MEC offices (for the 2004 administration only), and cognitively tested the 2018 survey across selected pool of MECs for the 2018 administration. RTI used a mixed-mode data collection approach that included mail, email, web, and computer-assisted telephone interviewing response options for both administration years. Louisiana was excluded from the 2004 CMEC because of the devastation of Hurricane Katrina. More information about the data collection methodology for both years can be found in the 2007 report [13] and in the 2021 report [20]. For the present analysis, the 2004 and 2018 CMEC public datasets were obtained through the National Archive of Criminal Justice Data at the University of Michigan. The 2004 CMEC administration achieved an 86% response rate, whereas the 2018 CMEC administration achieved an 81% response rate.

### 2.2. Measures

The purpose of this study is to review the 2004 and 2018 CMECs to determine how agencies are managing UHRs and what resources they use to resolve cases. The 2004 and 2018 CMEC public datasets were used and can be obtained through the [National Archive of Criminal Justice Data](#).

The common measures from 2004 to 2018 for UHRs were compared between 2004 and 2018 to determine whether any significant changes have taken place in policy or practice during the 14-year gap. To ascertain the extent of UHRs in the United States, the present study chiefly drew from both Sections D and E of the 2004 and 2018 CMEC surveys.<sup>2</sup> [Table 1](#) provides a crosswalk of the measures across both surveys.

<sup>2</sup> Please see BJS' website: <https://bjs.ojp.gov/data-collection/census-medical-examiner-and-coroner-mec-offices#surveys-0>.

### 2.3. Data analysis

The survey data were assessed for missing or out-of-range data (e.g., missing or misplaced zeroes) and recoded as necessary (e.g., numerical data were partitioned into quantiles or, for purposes of comparison in the case of the 2018 CMEC data, categories based on how the 2004 CMEC data was partitioned). In addition, for the 2018 CMEC data, the rate of question nonresponse was less than 25%, including across the variables listed in [Table 1](#). To remedy this modest question nonresponse, the data collection team conducted data quality follow-up with the survey respondents. When the data were still outstanding, following these efforts, the team used a hot deck imputation technique. Hot deck imputation is a technique in analysis when individual values are secondary to inferences of a larger population's parameters. Simply put, it replaces a missing value of one respondent with the value from a similar respondent from the same dataset. More information about the imputation procedures used for the 2004 and 2018 CMEC administrations can be found in the BJS reports [13,20].

All data in these analyses draw from frequencies or percentage frequencies. Measures of central tendency (e.g., averages, means, medians) and cross-tabulations are also presented. The data were analyzed with SAS ENTERPRISE GUIDE software, version 7.15 (Cary, NC), to group results by general MEC characteristics, UHR characteristics (UHR cases, oldest case on record), and policies/procedures around evidence retention and recordkeeping. Between the 2004 and 2018 study years, a chi-square test was used to determine significant differences in whether an agency had at least one UHR case on record. For continuous variables, due to the zero-inflated non-normal distribution of UHR records and the potential influence of extreme outliers, Mann-Whitney U tests were conducted to determine whether there were any statistically significant differences between the number of UHR cases on record in 2004 and 2018, and the number of cases going to final disposition during the two surveyed years. For the inferential testing, any cases with missing values were excluded. Specifically, for the UHR cases on record variable, 93 cases in 2004 were excluded. In 2018, 17 cases were excluded, as agencies acknowledged providing an estimate rather than the known number of UHR cases on record. Agencies that were missing the number of cases undergoing final disposition were also excluded, including 94 agencies in 2004 and 82 agencies in 2018.

## 3. Findings

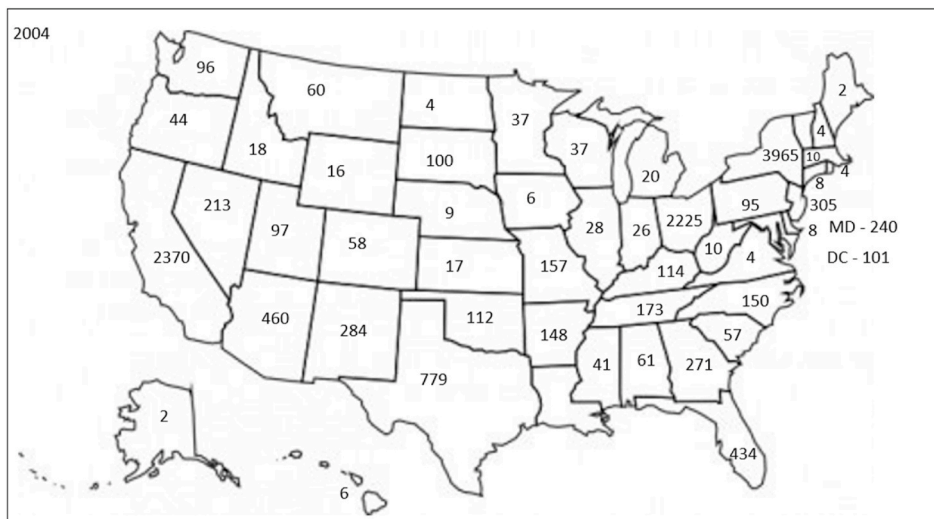
In 2004, RTI contacted 1998 MECs, and 1717 participated in the CMEC, providing information on the management of UHR cases. In 2018, 1648 agencies responded, with one omitted for low item completion. In both years, most agencies identified themselves as county coroner offices ([Table 2](#)).

Of the 1717 responding agencies, 461 (26.9%) reported having UHR cases on record at the end of 2004, and 308 agencies (18.7%) reported having UHR cases on record at the end of 2018 ([Fig. 1](#)). A Chi Square Test was conducted to assess the statistical significance of the difference in percentages of agencies reporting having UHR cases on file across the two surveyed years. The number of agencies reporting having UHR cases on file was statistically significantly lower in 2018 compared to 2004 ( $\chi(1, N = 3271) = 42.66, p < .001$ ).

Most of the responding agencies in both years reported having between 1 and 25 UHR cases on file. Of the 461 agencies reporting having possession of UHRs at the end of 2004, 88.3% reported having 25 or fewer UHR cases ([Fig. 2](#)). In 2018, 76.9% of the 308 reporting agencies reported 25 or fewer UHR cases ([Fig. 3](#)).

Of the agencies reporting in both 2004 and 2018, approximately 1% reported having more than 100 UHR cases on record. In 2018, agencies were asked to provide information on their oldest UHR case on record, and 31.2% (n = 96) of the 308 responding agencies reported having a file over 30 years old.

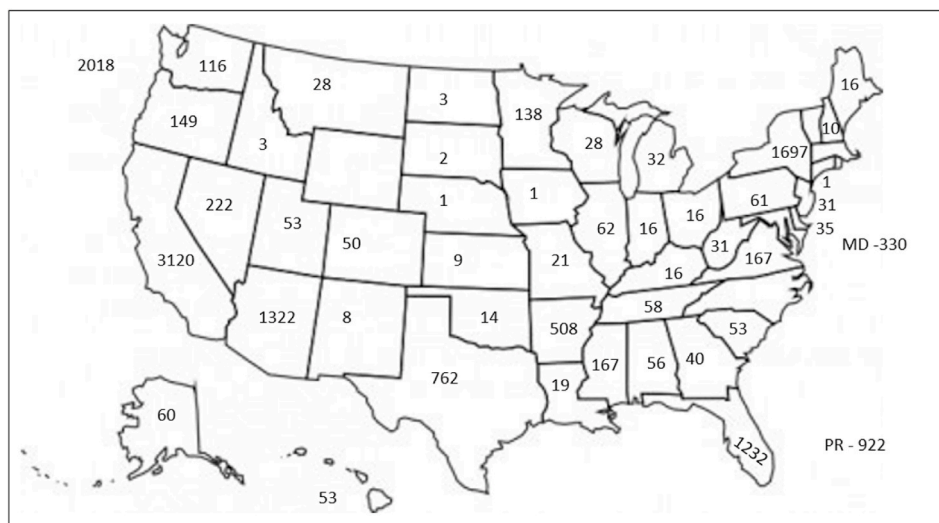
Of the 22 agencies that reported having more than 100 UHR cases on



1. Numbers of UHRs for Louisiana and Vermont are unavailable.

Fig. 6. Number of Unidentified Human Remains Cases by State in 2004<sup>1</sup>

1. Numbers of UHRs for Louisiana and Vermont are unavailable.



1. Numbers of UHRs for Massachusetts, North Carolina, Rhode Island, Vermont, Wyoming, and the District of Columbia are unavailable.

Fig. 7. Number of Unidentified Human Remains Cases by State in 2018<sup>1</sup>

1. Numbers of UHRs for Massachusetts, North Carolina, Rhode Island, Vermont, Wyoming, and the District of Columbia are unavailable.

file at the end of 2004, six identified as state medical examiner offices. Of the remaining 16 agencies, six identified as county medical examiner offices, six identified as county coroners, and four identified as city or district/regional medical examiner offices. Further, 82% (n = 18) of these responding agencies reported serving a population of 1,000,000 or more, with most (n = 14) accepting between 1000 and 4999 death cases in total during 2004.

Of the 20 agencies that reported more than 100 cases on record at the end of 2018, 50% identified as county medical examiner's offices (n = 10). Five of these agencies identified as state medical examiner offices, four as county coroner offices, and one as a city medical examiner office. Of the responding agencies, 18 (90%) stated they served populations of over 1,000,000. Ten of these agencies reported accepting between 1000 and 4999 death cases, and eight accepted between 5000 and 9999 cases during the reporting year.

In total, responding agencies reported having 13,486 UHR cases on record at the end of 2004 (Fig. 4). In addition, 560 UHR cases were reported to have undergone final disposition within the 2004 calendar year (Fig. 5). Responding agencies in three states (California, New York, and Ohio) reported having over 1000 UHR cases each, making up 63.47% of all reported cases remaining on file at the end of 2004 (Fig. 6).

Responding agencies reported 11,739 UHR cases on file at the end of 2018 (Fig. 4) with 868 undergoing final disposition within the calendar year (Fig. 5). In 2018, responding agencies in Arizona, California, Florida, and New York reported having over 1000 unidentified cases, making up 62.8% of all reported cases (Fig. 7).

A Mann-Whitney test was conducted to assess the statistical significance of the difference in number of UHR cases on file at year-ends 2004 and 2018. Agencies reported a significantly higher number of UHR cases in 2004 compared to 2018 ( $U(N_{2004} = 1,624, N_{2018} = 1630) =$

**Table 3**Agency response to established final disposition and evidence retention policies for UHRs, CMEC 2004 and 2018<sup>a</sup>.

	2004			2018		
	Yes	No	No Response	Yes	No	No Response
Written policy for final disposition (e.g., burial, cremation) of UHRs after a specified period	602 (35%)	1047 (61%)	68 (4.0%)	572 (34.7%)	639 (38.8%)	436 (26.5%)
Written retention schedule for reports pertaining to UHRs (including x-rays, fingerprints, DNA)	804 (46.8%)	834 (48.6%)	79 (4.6%)	687 (41.7%)	789 (47.9%)	171 (10.4%)
Written retention schedule for UHRs	N/A	N/A	N/A	644 (39.1%)	838 (50.9%)	165 <sup>b</sup> (10.0%)

<sup>a</sup> Percentages may not add up to 100.0% due to rounding.<sup>b</sup> These agencies indicated they did not know whether their agency had a policy for UHRs.**Table 4**Agencies reporting UHR cases and their response to established policies related to UHRs in 2018<sup>a</sup>.

	Yes		No		Don't Know	No Response
	Number of agencies	Average number of cases	Number of agencies	Average number of cases		
Written policy for final disposition (e.g., burial, cremation) of UHRs after a specified period	174 (56.5%)	56.3	81 (26.3%)	13.3	12 (3.9%)	41 (13.3%)
Written retention schedule for reports pertaining to UHRs (including x-rays, fingerprints, DNA)	214 (69.5%)	53.1	76 (24.7%)	10.9	18 (5.8%)	0
Written retention schedule for UHRs	199 (64.6%)	54.6	96 (31.2%)	13.4	13 (4.2%)	0

<sup>a</sup> Percentages may not add up to 100.0% due to rounding.1,186,128.5,  $z = -7.0$ ,  $p < .001$ ).

The potential difference in the number of UHR cases undergoing final disposition in 2004 and 2018 was also assessed, but no significant differences were found ( $U(N_{2004} = 1,623, N_{2018} = 1562) = 1,266,607.5$ ,  $z = -0.07$ ,  $p = .943$ ).

MEC respondents were asked to indicate whether their agencies had policies in place regarding the final disposition of UHRs after a specified period of time and for the retention of records related to UHRs, such as x-rays and dental records (Table 3). In both study years, just over one third (35% in both 2004 and 2018) of MECs reported having a written policy in place for final disposition of UHRs after a specified period. A lower percentage of 2018 MEC respondents (42%) than 2004 MEC respondents (47%) indicated that they had a written retention schedule for UHR evidence. In 2018, fewer than three in five agencies (39.1%) indicated they have policies in place regarding the retention of UHRs after a specified period (note that this question was not asked in the 2004 census).

Of the 308 responding agencies that reported having possession of UHR cases at the end of 2018, 174 reported having a policy for final disposition (60.84%) and had an average of 56.3 UHR cases on file at the end of the reporting period. Moreover, across this subset of MECs, 81 agencies reported that they did not have a policy for final disposition and averaged 13.3 unidentified cases. Table 4 illustrates similar patterns with policies on retention of reports and on retention of UHRs.

In 2004, most agencies reported they rarely or never used missing persons databases, NCIC or CODIS during their investigations (Table 5).

In 2004, agencies were asked to provide information about their level of access to NCIC. Across the responding agencies, 61 reported having direct entry capabilities and 77 agencies reported having direct query capabilities. Moreover, 532 agencies indicated they have indirect access to NCIC through a local law enforcement liaison. Some agencies had multiple access capabilities; for example, some of the agencies that had direct entry capabilities also had direct query capabilities. Taking this into account, 599 responding agencies reported having access to NCIC in some capacity, and over half of these agencies ( $n = 338$ , 56.4%) reported using the database often or somewhat often. However, only 4.9% of responding agencies ( $n = 97$ ) reported using CODIS very often

or somewhat often.

Similarly, in 2018, most responding agencies reported they do not use NCIC or CODIS (Table 6). One key difference between the 2 census years was the reported use of NamUs, which was established in 2007, 2 years after the 2004 CMEC was fielded.

In 2018, 12.6% of responding agencies reported having an originating agency identifier (ORI). An ORI is a unique alphanumeric identifier issued by the FBI CJIS that validates an agency's "legal authorization to criminal justice information" and gives them direct access to NCIC [21]. Access levels were not assessed, and as such, specific entry, query, and modification capabilities are unknown. Across the responding agencies in 2018, 645 did not have an ORI, 478 did not know whether they had an ORI, and 318 did not answer this question.

Of the 308 responding agencies that reported still having UHRs in their possession at the end of 2018, 119 reported using NCIC (38.6%) and had an average of 62.2 unidentified cases on December 31, 2018. An additional 150 responding agencies indicated they did not use NCIC; these responding agencies averaged 27.3 unidentified cases at the end of 2018. Finally, 39 responding agencies indicated that they did not know whether their agency used NCIC.

Over four in five responding agencies that reported having UHRs in their possession at the end of 2018 (81%; 249 agencies) also reported using NamUs (Table 7). These 249 agencies reported an average of 45.9 UHR cases on file at the end of 2018. An additional 40 responding agencies reported they did not use NamUs; these agencies reported an average of 14.7 UHR cases at the end of 2018. An additional 19 responding agencies that reporting having UHRs on record at the end of 2018 did not know whether they used NamUs.

Almost half (48.4%) of the agencies that reported having UHRs in their possession at the end of 2018 also reported using CODIS. Those agencies reported an average of 63.8 UHR cases. An additional 126 agencies reported they did not use CODIS and averaged 18.4 UHR cases at the end of 2018. Finally, 33 responding agencies did not know whether their office participated in CODIS.

**Table 5**  
Agencies reported use of databases in 2004<sup>a</sup>.

	Missing Persons Databases <sup>b</sup>	NCIC	CODIS
<b>Very Often</b>	79 (4.0%)	142 (7.1%)	25 (1.3%)
<b>Somewhat Often</b>	108 (5.4%)	196 (9.8%)	72 (3.6%)
<b>Rarely or Never</b>	960 (48.0%)	1317 (65.9%)	1409 (70.5%)
<b>No Response</b>	851 (42.6%)	343 (17.2%)	492 (24.6%)
<b>Total</b>	1998 (100.0%)	1998 (100.0%)	1998 (100.0%)

<sup>a</sup> Percentages may not add up to 100.0% due to rounding.

<sup>b</sup> Missing Persons Databases was not defined in the survey.

#### 4. Discussion

**Table 6**  
Agencies reported use of NamUs, NCIC, and CODIS databases in 2018<sup>a</sup>.

	NamUs <sup>b</sup>	NCIC	CODIS
<b>Yes</b>	645 (39.1%)	354 (21.5%)	353 (21.4%)
<b>No</b>	782 (47.5%)	1061 (64.4%)	1083 (65.8%)
<b>Don't know</b>	219 (13.3%)	232 (14.1%)	211 (12.8%)
<b>No Answer</b>	1 (0.1%)	0	0
<b>Total</b>	1647 (100.0%)	1647 (100.0%)	1647 (100.0%)

<sup>a</sup> Percentages may not add up to 100.0% due to rounding.

<sup>b</sup> NamUs was created in 2007, after the 2004 census data was collected.

MEC offices are on the frontlines of handling UHR cases, often working alongside law enforcement during the early stages of an investigation and retaining the UHR cases and records for many years. With thousands of UHR cases being reported each year, recent technological forensic and information sharing advances should facilitate the solve rate of these cases. However, the present study, which provided a view of the state of UHRs in the United States using census data, shows that, although the overall national UHR caseload may have declined, most MECs do not have written procedures for evidence retention policies for these cases and lack important access to key national databases in general. These findings show clear paths for policy development and future research.

When examined in aggregate, a little over one third of MECs indicated that they had written policies related to UHR evidence retention and schedule. However, when subsetted to MECs with UHR cases on record, a substantially higher proportion endorsed having such UHR evidence retention policies (70%). Although it appears that having a UHR caseload leads to the necessity of policy implementation in general, 30% of the MECs with UHRs reported having no such written policies in place. Agencies being able to share case information and evidence increases the potential for UHR identifications, and without evidence retention, cases will likely remain unsolved. Despite the finding that agencies with policies tend to have higher UHR caseloads, it is difficult to determine the effectiveness of policy implementation on UHR investigations. Additional research is needed to determine how the implementation of a policy impacts a specific agency's actual UHR caseload over time (i.e., does policy implementation decrease the

number of UHRs by requiring agencies to retain reports and evidence or do such policies lead to increased caseloads by prohibiting premature case closure). Future research should also determine whether enacted policies related to UHRs tend to be proactive or reactive; how long evidence should be expected to be retained; and what types of evidence are needed to take advantage of recent forensic and analytical advancements known to lead to identifications. In the meantime, MECs that currently lack policies related to written disposition and evidence retention are encouraged to work as a community to develop best practices, model policies, and share policies with agencies that lack them. The National Institute of Standards and Technology (NIST) provides guidance to policymakers and forensic leadership on biologic evidence preservation that could be a starting resource for some MEC offices [12].

The use of missing persons databases is known to play a role in UHR identifications. Yet, the present findings show that MECs generally underuse these databases. When examined by MECs reporting UHR cases at the end of 2018, 81% of agencies reported using NamUs, almost half reported using CODIS, and 38.6% reported using NCIC. Further, agencies reporting a usage of the various databases average more UHR cases than those who do not. These findings seem sensible, as only agencies investigating UHR cases would need to access these databases. The high percentage of agencies reporting the use of NamUs likely lends to the database's ease of use, access, and value to UHR investigations. With NamUs, MECs have direct access to a robust national missing persons database that can be used without reliance upon law enforcement and can share UHR case information with other MEC offices, forensic agencies, law enforcement, and the public to increase the likelihood of submitting investigative leads, as well as conduct proactive investigative searches for potential matches to missing persons.

Of concern are those agencies reporting UHR caseloads without the acknowledged use of relevant databases. Roughly half of the agencies reporting UHR cases at the end of 2018 reported that they do not use NCIC with an average of 27 UHR cases. Despite its potential value, the underuse of NCIC can potentially be explained due to access restrictions. Only 12% of responding agencies reported having an ORI, which gives them direct access to NCIC in 2018. Without an ORI, MECs are reliant upon law enforcement to provide access to the database, often making it a difficult and inefficient use of investigative time. Of the agencies reporting UHR cases in 2018, 126 reported they do not use CODIS, which has proven to be instrumental in providing investigative leads. Some of these agencies may be the same agencies lacking retention policies, resulting in little to no evidence to submit for CODIS upload. Limited staffing, training and awareness, and budgets are additional reasons why missing persons databases may be underused. Further research is needed to understand why agencies with UHR cases on file are not using relevant missing persons databases in their investigations and how the use of such databases would impact their caseload.

From a policy perspective, if we want to see an appreciable drop in UHR cases in future years, it is time for the U.S. Department of Justice to grant MECs direct access to key databases (e.g., NCIC). Yet, even with increased use of and access to national missing person databases, a dire reality among MECs persists: less than one third (32%) have computerized networked systems, 30% have partially computerized systems with some manual recordkeeping, and 31% have a manual

**Table 7**  
Access to NamUs, NCIC, and CODIS databases by number and mean average UHR cases, 2018<sup>a</sup>.

	Yes		No		Don't Know	
	Number of agencies (Percent)	Average number of cases	Number of agencies (Percent)	Average number of cases	Number of agencies (Percent)	Average number of cases
<b>NCIC</b>	119 (38.6%)	62.2	150 (48.7%)	27.3	39 (12.7%)	20.5
<b>NamUs</b>	249 (81.0%)	45.9	40 (13.0%)	14.7	19 (6.0%)	12.8
<b>CODIS</b>	149 (48.4%)	63.8	126 (40.9%)	18.4	33 (10.7%)	12.3

<sup>a</sup> Percentages may not add up to 100.0% due to rounding.

recordkeeping system (DEA, 2018; BJS, 2021). This extremely low proportion of MECs lacking basic information infrastructure will substantially challenge any efforts to solve UHR cases in particular, and death investigation cases in general, for many years to come.

The third major finding—the statistically significant decrease in the number of UHR cases between 2004 and 2018—bears further discussion. One possibility for the decrease in the number of reported UHR cases, as evidenced by four state-wide medical examiner systems, is that fewer UHRs were recovered during the 14-year gap than during the years leading up to the 2004 survey. However, a more likely explanation is that identifications are becoming more frequent and are occurring earlier in the investigation. In recent years, technological advancements such as NGI's expanded algorithms for comparing unknown decedents' fingerprints have greatly increased the chances of obtaining a timely case resolution [3]. If MECs can identify UHRs more quickly, their overall caseload would not be impacted by a growing number of residual, unsolved cases. In addition to recently recovered UHRs, the findings of this study suggest that most agencies reporting UHRs are managing cases that are decades old. Cold case resolutions have also been greatly augmented with technological advancements, such as NGI's advanced algorithm that can analyze fingerprints that were previously insufficient for comparison and DNA technologies that can yield comparable profiles from highly degraded samples that were once deemed insufficient for analysis [4]. These advanced techniques yield resolutions in cases previously thought to be "unsolvable," thereby reducing overall UHR caseloads [4]. The actual impact of these advancements cannot be gauged from the present study, as agencies were not asked to provide information on specific forensic analyses used in their investigations. More research is needed to fully assess the specific impact of advanced forensics on the reported decline in UHR cases.

One key finding that could provide insight into the decreased number of UHR cases is the increased use of missing person databases by MEC communities. In 2004, agencies were asked to report on their use of missing persons databases, although the term *missing persons databases* was not defined and could have been interpreted in various ways. In 2007, NamUs was established, providing MECs with an easily accessible missing persons database that could be used during UHR investigations without law enforcement collaboration. The 2018 CMEC survey asked agencies to report on their use of "NamUs" specifically. Although the two questions were not asked in the same manner, the increased use of missing persons databases, specifically NamUs, by the MEC community is evident. Between its inception in 2007 and 2018, NamUs registered over 36,000 users,<sup>3</sup> more than 27,000 of whom were professional users, including law enforcement and MEC staff. The remaining registered users were from the general public. The literature shows that tips to police, proactive biometric data collection, and proactive investigative measures such as searching secured (e.g., NCIC) and public missing persons databases (e.g., NamUs, NCMEC) are the leading ways UHR cases are being resolved [1]. The use of NamUs by professional and public users facilitates leads to law enforcement by providing the public with an easily accessible platform to search for potential matches between missing and unidentified persons files. NamUs also encourages proactive biometric data collection by searching for potential matches to UHRs, especially across jurisdictional lines. NamUs allows the user to track what identifying information is available and what additional forensic resources, such as access to anthropologists, odontologist, or DNA testing could improve identity data. Although the current findings show an increased use of missing persons databases, more studies are needed to show whether the use of NamUs and other missing persons databases have impacted the caseloads of the specific responding agencies across time.

Nineteen states had agency participants in both years and showed an increase in the number of reported UHR cases between 2004 and 2018. All but one of these states had fewer agency participants in 2018, and with fewer responding agencies and a higher number of reported cases, it appears as though these states experienced more UHRs; however, the specific agency response was not considered. It is possible that an agency with a large UHR case load reported in 2018 but not in 2004, thereby increasing overall state numbers. Without ensuring that the same agencies within each state responded in both years, a true representation of the perceived change in UHR numbers cannot be obtained.

In considering states operating under a state-wide medical examiner system with a single agency reporting in both years, eight states showed a true increase in reported UHR numbers. Based on the current findings, conclusions cannot be drawn as to why some agencies reported an increase in cases. One explanation is that more bodies were located between 2004 and 2018 than in the years leading up to 2004. For example, agencies responding in Arizona reported the largest increase in UHR cases, from 460 in 2004 to 1322 in 2018. This increase in UHRs may be attributed to an increase in crossings at the Mexico–Arizona borders. Beginning in 2000, the U.S. Border Patrol's Tucson (Arizona) sector of the U.S.–Mexico border saw significant increases in apprehensions and exposure deaths [22]. According to the Pima County Office of the Medical Examiner's Annual Report 2018, the medical examiner's office has seen more undocumented border crossers since 2002, with spikes in 2007 and 2010. As of December 31, 2018, PCOME reported that 1050 border crossers remained unidentified [23].

With Arizona, the supposition that more bodies were located between 2004 and 2018 seems like a sufficient argument for an increase in reported UHR cases, but this may not be true in other areas of the country. The establishment of NamUS may have led to more cases, either by encouraging agencies to become aware of UHRs that were previously unlisted in any national database or by encouraging agencies to redefine what constitutes a UHR case. For example, partial skeletal remains may not have previously been classified as a unique MEC case and therefore were not included in prior caseload counts. One additional explanation for the increased number of reported UHR cases centers on a lack of manpower and resources to adequately investigate and find case resolutions. Between 2004 and 2018, MECs saw more deaths resulting from the ongoing opioid epidemic that, for many agencies, consumed all available resources, and some states were disproportionately affected [24]. Identifications cannot be made without the capabilities to properly investigate these cases, resulting in increased caseloads over time.

The present study has some limitations that should be kept in mind. First, fewer agencies responded to the 2018 CMEC than the 2004 CMEC. Thus, the major finding that there has been a drop in the number of UHR cases in those years may be an artifact of a lower response rate. Second, the instruments in both study years did not necessarily provide definitions for some of the terms used in the stem question and in the response options, which may have led to some various interpretations in the field, particularly because MEC respondents come from many different professional experiences and educational backgrounds. The following terms that were not clearly defined in the survey and may have impacted this study: *final disposition*, *retention*, *missing persons databases*, *NCIC*, and *CODIS*. In addition, there were some deviations between the two CMECs—including skip patterns (e.g., the skip pattern of D2 in 2018 may have led to some respondents not reporting their UHR caseload), minor differences in how questions were worded, and the addition of new questions in 2018 (e.g., whether the agency had an ORI)—which complicate direct comparisons between the 2 years.

## 5. Conclusion

This study provides a much-needed high-level look at the state of UHR cases across the United States and has implications for practitioners in terms of the need for written policies and procedures for these cases. Given the nationwide impact, it is important for the MEC community to

<sup>3</sup> Per RTI International's Ms. Donia Slack, the director of the NamUs program, in October 2021. RTI International is the National Institute of Justice's contractor for the NamUs program.



take proactive steps related to policy and practice to ensure agencies can take advantage of recent technological advances that can aid in timely resolutions of acute UHR cases, as well as in the resolution of cold UHR cases. Written schedules for retention of evidence and reports, retention of UHRs and the disposition of UHRs should be considered to avoid premature loss of valuable information and evidence that may become applicable for current and/or future forensic technologies. Ensuring the use of nationwide resources such as NamUs, NCIC and CODIS, will allow agencies to share important case details that may result in the development of timely investigative leads and will provide agencies with easily searchable platforms to conduct proactive searches for potential matches. In order to take full advantage of these relevant databases, it is recognized that the computerized infrastructure for MECs needs to substantially improve across the country, and access permissions pertaining to NCIC should be reconsidered.

The present study also outlines clear paths for future research. Determining the actual upward or downward trends of UHR caseloads, and whether solve rates have been improved over time should be assessed. Future longitudinal studies should take into account policy implementation, the use of specific national missing persons databases and specific advanced forensic technologies such as FGG to determine the impact these variables have on the UHR landscape.

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