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John and Jane Doe: The Epidemiology of Unidentified Decedents

ABSTRACT: The number of people who cannot be identified at the time of death, sometimes referred to as John or Jane Does, is unknown, and little is known about them as a group. The study's objectives were to estimate the number of annual unidentified deaths, to identify demographic characteristics associated with dying unidentified, to determine whether the rates of such deaths vary geographically or over time, and to better characterize the causes of death. This was a population-based surveillance study of data collected from death certificates from 1979 to 2004 in the U.S. Subjects were selected by the absence of name, date of birth, and Social Security Number on their certificates. Main outcome measures were distributions by age, sex, and underlying cause of death and rates by sex, race, year, and state of death. An average of 413 unidentified persons died each year. The peak year was 1987 with 691 deaths, a rate of 28.5 per 10 million people. The rate declined to 9.7 per 10 million in 2004. Most unidentified decedents were male (80.6%). Unidentified death rates were highest among black people and in the Southwest. Among deaths for which the cause was known, 82.7% were due to injuries. Among injury deaths, 31.8% were homicides. Improvement in identification technology may have reduced rates of unidentified death since the 1980s. In addition, variations in rates of unidentified decedents may reflect changes in risk factors such as homelessness and substance abuse.

KEYWORDS: forensic science, forensic anthropology, wounds and injuries, DNA, unidentified decendents

Every year, some people die who are not identified. Unidentified decedents are traditionally assigned names of John or Jane Doe while their identities are sought. In such cases the decedents' ages and family, medical, and social histories are also unknown. Because little is known about them, the causes and circumstances of their deaths often remain unclear despite the best efforts of law enforcement and forensic scientists.

Almost nothing is known about these individuals as a group. Even the number of decedents each year is a subject of speculation both in the U.S. (1,2) and abroad (3). Knowing the most common causes of death of unidentified decedents could assist health care and law enforcement personnel develop intervention strategies to reduce deaths among populations most at risk for dying unidentified (e.g., homeless persons) (4). Additional information about the size of the unidentified decedent population could help in designing and evaluating national tracking systems for such deaths (1) and in measuring the need for state-of-the-art techniques, such as DNA analysis, for identifying decedents (5).

At least three factors prevent accurate characterization of unidentified decedents as a group. First, no standard for completing the name fields on death certificates of unidentified decedents exists. Each jurisdiction decides how to complete these fields, and not all jurisdictions use the terms John or Jane Doe. Therefore, unidentified decedents cannot be readily selected from state or national death certificate databases. Second, although voluntary reports can be made to the Federal Bureau of Investigation's National Crime Information Center (6) or, since 2006, to the National Association of Medical Examiners Unidentified Decedent Registry (7), databases derived from such passive reporting systems may miss many cases. Finally, the annual number of these deaths is small, so few local jurisdictions can accumulate enough death data to study (8).

This study attempted to circumvent these problems. A multiyear national database that had accumulated enough death data to study was used. The number of unidentified decedents was estimated by exploiting the fact that essentially all decedents have death certificates. A method was developed to identify decedents by compiling an exhaustive set of terms that was used in lieu of valid names on death certificates. The study's objectives were to provide a better estimate of the number of annual unidentified deaths, to identify demographic characteristics associated with dying unidentified, to determine whether the rates of such deaths vary geographically or over time, and to better characterize the causes of death.

Methods

The Centers for Disease Control and Prevention's (CDC) National Center for Health Statistics (NCHS) receives death certificate information from the vital registrars in all states and U.S. territories. Death certificate information includes the decedent's name (first and last), date of birth, Social Security Number (SSN), and the cause, place, and date of death. To create a database of information on unidentified decedents, NCHS searched more than 50 million death certificate records in the National Death Index file (9) for the years from 1979 to 2004. An unidentified decedent was

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defined as a person whose name, date of birth, and SSN was missing from the death certificate. For example, name was considered missing if coded as missing or left blank, or if the entry was a descriptive term commonly used in lieu of a name. One hundred and eighty-four descriptive terms used when names were missing were found by searching the first name field, and 167 were found for the last name field. Such terms included, "infant, baby, boy, girl, adult, male, female, black, white, John Doe, Jane Doe, unknown, unidentified, skeleton, remains" and many other variants. Because the names, "John, Jane, Doe, Black, and White," can be legitimate names, they were only considered unknown if the combination of first and last names was synonymous with "unknown." For example, "male white" was defined as unknown, whereas "John White" and "Robert Doe" were not. Decedents listed as John or Jane Doe were not considered unidentified if a SSN or date of birth was recorded. Using this approach, we initially classified 10,287 records as those of unidentified decedents between 1979 and 2004.

NCHS identified an additional 1375 possible unidentified decedent records with incomplete name, date of birth, or SSN information. After preliminary analysis, we included 461 of these decedents in the study because they closely resembled the other unidentified decedents with respect to the age and cause-of-death fields. Among these were 63 decedents who had valid first names (but no last name or SSN), unknown or estimated ages (i.e., ages that were multiples of five) and causes of death (i.e., primarily injuries) similar to those of decedents missing all three identifiers. The other 398 decedents that we included all had January 1 birthdays without year of birth, name, or SSN. Almost all records of this type were from California. The ages at death appeared to be estimated; the deaths occurred primarily from injury. We excluded the remaining 914 possible unidentified decedent records, which had only dates of birth or only last names. These decedents typically were older adults who died at home or in hospitals, and were clustered in a few states whose counts of unidentified decedents would have been disproportionately high if they had been included. The final study population included 10,748 deaths.

Age was unknown for 59.3% of unidentified decedents. For the 40.7% of decedents with age specified on the death record, the age was presumably estimated by the coroner, medical examiner, or other certifying physician using a variety of techniques (10). The distribution of ages in years showed digit preference for ages that ended in zero or five. For example, there were large peaks in the age distribution at 20, 25, and 30. Therefore, instead of using traditional age groups, for example 20–24 years, we used 18–27 years; this age group's boundaries corresponded to the "valleys" in the age distribution and it more likely contained the true ages of people whose age had been estimated at 20 or 25.

Race and ethnicity determinations were also made by coroners and medical examiners and relied primarily on appearance and forensic anthropologic techniques (11). When coroners and medical examiners recorded "unknown race" prior to 1992, NCHS combined such decedents in the "other race" category. After 1992, NCHS introduced a flag for unknown race, which made possible a count of such decedents. Hispanic ethnicity was not recorded on the death certificates of all states until 1997. In rare cases, the coroner or medical examiner could not determine the sex of the decedent. In those cases, NCHS randomly assigned sex when the data were coded, so the sex of no decedent was coded as unknown in this dataset. In an unknown number of cases, the date of death had to be estimated based on findings at the scene and the autopsy. In some cases, the estimated year of death may have been prior to the year the death became known. The decedent's state of residence was assumed to be the state in which the death occurred.

The medical examiner, coroner, or certifying physician is responsible for determining the cause of a person's death. The underlying cause of death was coded in accordance with the International Classification of Diseases (ICD)-9 used from 1979 to 1998 (12) and ICD-10 used from 1999 to 2004 (13). We grouped causes of death so that deaths in each category are comparable across the entire period of the study. We defined deaths of unknown cause as those assigned ICD codes for symptoms, signs, and ill-defined conditions (780–799 in ICD-9 and R00–R99 in ICD-10). We subdivided deaths from injury, grouping comparable categories in ICD-9 and ICD-10. Finally, we identified comparable codes in ICD-9 and ICD-10 for specific mechanisms of homicide and suicide.

No cause-of-death code was available for a small number ($n = 275$) of the 10,748 unidentified decedents because either a cause-of-death investigation was unresolved or the state had filed a new certificate with a different certificate number to amend information from the original certificate. These 275 deaths could only be used to calculate state- and year-specific rates; the remaining 10,473 were available for other analyses. Analyses by age were restricted to the 4262 deaths with an estimated age. Distributions by cause of death were restricted to the 8177 deaths for which a known cause of death was recorded.

We calculated crude rates by sex, race, state of occurrence, and year using U.S. Census bridged-race population figures (14). Age-adjusted and age-specific rates could not be calculated because of missing age data. Population files for 1979 and 1980 with the same racial classification used on the death certificates are not available from the U.S. Census Bureau, so race-specific rates were limited to the years from 1981 to 2004.

Results

Over the 26 years of study, death certificates for 10,748 unidentified decedents were filed in the U.S.; for a rate of 16.1 per 10 million people and an average of 413 deaths per year. The unidentified decedent rate varied over time (Fig. 1), with highest rates from 1986 to 1991. The peak year was 1987 with 691 deaths and a rate of 28.5 per 10 million people. The rate without NY, a state that accounted for about a fifth of all deaths, showed a similar pattern with a smaller peak in 1987.

Of the unidentified decedents from 1979 to 2004, 80.6% were male. Unidentified death rates by race, limited to the 1981–2004

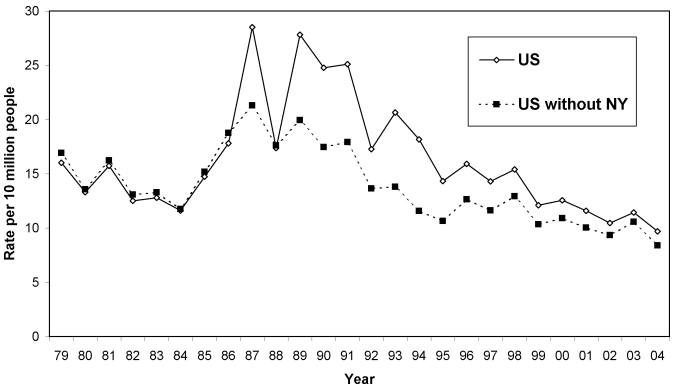


FIG. 1—*Rate of unidentified decedents per 10 million people by year, U.S. and U.S. without New York State, 1979–2004.*

period, were highest among blacks (Table 1). The black male rate was 1.9 times the white male rate, while the black female rate was 2.4 times the white female rate. During the years in which ethnicity coding included all states, 1997–2004, Hispanics of all races constituted 15.3% of all unidentified deaths; a death rate of 14.3 per 10 million persons of Hispanic origin.

Of the 10,473 decedents from 1979 to 2004, only 4262 (40.7%) had an estimated age recorded. Almost half, 46.6%, of these decedents were estimated to be between 18 and 37 years old. The distribution of deaths by sex and age group showed the largest numbers in the 18–27 years age group among females and the 28–37 years age group among males (Fig. 2). Infants made up 7.2% (n = 306) of all deaths with age data available, while children 1–17 years accounted for 1.2% (n = 51).

Unidentified decedent death rates showed wide geographic variation (Fig. 3), with higher rates in states with major metropolitan areas and a cluster of high rates in the Southwest. New England and the upper Midwest had very few unidentified deaths, while the District of Columbia had the highest rate of 79.5 per 10 million people. Almost all the New York State deaths were registered in New York City.

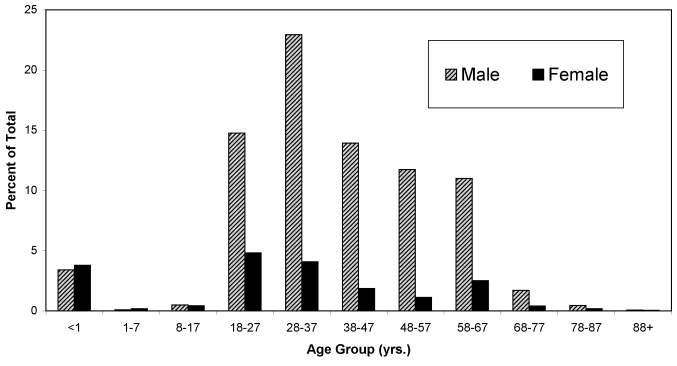
TABLE 1—*Unknown decedent rates per 10 million by sex and race, U.S., 1981–2004.**

Race	Male	Female	Total
White			
Rate	23.7	5.3	14.3
Number	6022	1402	7424
Black			
Rate	46.2	12.5	28.5
Number	1709	512	2221
Native American			
Rate	21.2	–**	13.1
Number	58	14	72
Asian or Pacific Islander			
Rate	11.0	2.4	6.6
Number	112	26	138
Unknown			
Rate	NA	NA	NA
Number	2	0	2
Total			
Rate	26.0	6.1	15.8
Number	7903	1954	9857

NA, not applicable.

*Table excludes 616 deaths, 5.9% of 10,473 deaths available for study that occurred in 1979 or 1980. The table is restricted to data from years with available race-specific populations.

**Rates based on fewer than 20 decedents are unstable and are not shown.



* Figure excludes 6,211 deaths, 59.3% of the 10,473 deaths in the study, which did not have an estimated age.

FIG. 2—*Estimated distribution of unidentified decedents* by sex and age group, U.S., 1979–2004.*

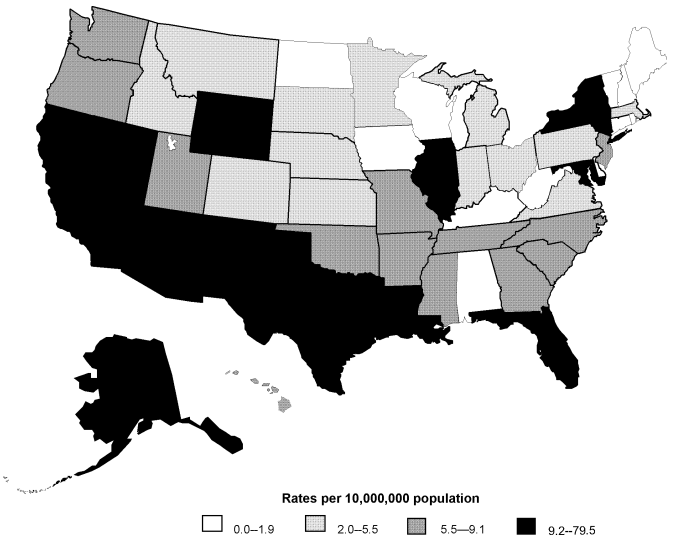


FIG. 3—*Rate of unidentified decedents per 10 million people by state, U.S., 1979–2004.*

The cause of death was recorded with one of the codes for unknown cause (i.e., with 780–799 in ICD-9 or R00–R99 in ICD-10) for 24.5% of the 10,473 decedents. This percentage was similar across sex and race groups. The distribution of causes of death, when known, was similar for those with and without estimated ages (Table 2). The leading cause of death for unidentified decedents was injury, accounting for 82.7% of deaths of known cause. The second leading cause was circulatory disease, primarily cardiovascular disease. The third leading cause was digestive disease, primarily cirrhosis of the liver. The fourth leading cause was respiratory disease, primarily pneumonia. Among infants, noninjury deaths were primarily because of perinatal conditions such as prematurity. The distribution of causes of death by year (not shown) shows a peak in the late 1980s for both injury and noninjury causes of death.

The distribution of causes of injury for unidentified decedents was similar for those with and without estimated ages (Table 3). Approximately, half of the injury deaths were deemed unintentional and a third were deemed homicides. The leading mechanisms of unintentional injury were transportation-related trauma and drowning. Transportation-related trauma primarily involved pedestrians hit by trains and automobiles. Environmental exposure included heat and cold exposures in approximately equal numbers. In general, homicides accounted for a declining fraction of deaths with age, while suicides and pedestrian deaths accounted for increasing fractions.

Among homicides, the leading specified mechanisms were firearm (40.1%) and stabbing (13.8%). Females died most often of strangulation, whereas males died most often of gunshot wounds. Among suicides, the leading mechanisms were hanging/suffocation (27.9%) and firearm (19.2%). Choice of mechanism did not vary by sex. The poisoning deaths were primarily because of opiate and cocaine use.

Among males, homicide accounted for 26.5% of all injury deaths (results not shown). Drowning accounted for 17.2%. Among Hispanic males during the years 1997–2004, when ethnicity data were available, drowning caused 32.3%, and homicide caused 20.5% of injury deaths. Among all females, homicide accounted for 55.9%

TABLE 2—*Estimated percent distribution of unknown decedents by age group and cause of death, U.S., 1979–2004.**

Age Group (Years)	Number of Deaths	Cause of Death (percent)					
		Circulatory Disease	Respiratory Disease	Digestive Disease	Injury	All Other	Total
<1	204	0.5	1.0	0.0	66.2	32.4	100.0
1–7	5	0.0	0.0	0.0	100.0	0.0	100.0
8–17	29	0.0	0.0	0.0	100.0	0.0	100.0
18–27	728	1.6	0.4	0.3	95.1	2.6	100.0
28–37	970	2.8	1.1	1.8	88.7	5.7	100.0
38–47	562	9.8	3.0	6.0	70.1	11.0	100.0
48–57	451	21.1	3.8	6.7	56.3	12.2	100.0
58–67	424	30.9	5.0	2.4	54.7	7.1	100.0
68+	111	40.5	7.2	7.2	27.0	18.0	100.0
Total	3484	10.5	2.3	2.9	75.5	8.8	100.0
Unknown age	4418	5.7	1.2	1.3	88.4	3.3	100.0
Total	7902	7.8	1.7	2.0	82.7	5.8	100.0

*Table excludes 2571 deaths, 24.5% of the 10,473 deaths available for study, because their cause of death was recorded as unknown, i.e., with 780–799 in ICD9 or R00–R99 in ICD10.

Circulatory disease: ICD-9 390–459, ICD-10 I00–I99; respiratory disease: ICD-9 460–519, ICD-10 J00–J99; digestive disease: ICD-9 520–579, ICD-10 K00–K93; injury: ICD-9 800–999, ICD-10 *U01-*U03, V01–Y98.

TABLE 3—*Estimated percent distribution of injury deaths among unidentified decedents by intention, mechanism, and age group, U.S., 1979–2004.**

Age Group (Years)	Number of Deaths	Unintentional								Suicide	Homicide	Undetermined Intent
		Transportation-Related			Poison/ Overdose	Environmental	Drowning	All Other	Total			
		Railway	Pedestrian	All Other Motor Vehicle								
<1	135	0.0	0.0	0.0	0.0	5.9	0.7	1.5	8.1	0.0	81.5	10.4
1–7	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0
8–17	29	3.4	0.0	6.9	6.9	0.0	17.2	6.9	41.4	0.0	55.2	3.4
18–27	692	3.8	8.7	2.9	4.5	1.0	14.0	4.6	39.5	6.2	44.8	9.5
28–37	860	3.6	9.1	3.1	12.0	2.3	9.1	5.1	44.3	10.2	29.3	16.2
38–47	394	4.8	12.9	1.3	13.2	3.6	6.1	6.9	48.7	8.1	23.6	19.5
48–57	254	4.7	14.2	3.9	8.3	8.3	3.5	8.7	51.6	9.8	16.9	21.7
58–67	232	3.0	12.1	1.3	6.9	9.5	4.7	7.8	45.3	5.2	37.1	12.5
68+	30	0.0	23.3	0.0	0.0	26.7	0.0	23.3	73.3	6.7	6.7	13.3
Total	2631	3.6	9.9	2.5	8.6	3.8	8.6	5.9	42.8	7.7	34.9	14.6
Unknown age	3907	3.2	10.0	5.3	2.3	6.2	19.0	5.7	51.7	6.0	29.7	12.6
Total	6538	3.4	9.9	4.2	4.8	5.2	14.8	5.8	48.1	6.7	31.8	13.4

*Table excludes 3935 deaths, 37.6% of the 10,473 deaths available for study, whose cause of death was recorded as unknown or was not an injury.

of injury deaths. During the years for which autopsy information was available (1979–1994), autopsies were performed on 87.3% of the unidentified decedents.

Discussion

This descriptive study of unidentified decedents is the first of its kind in the U.S. The unidentified death rate was higher among males than females and among black people than other race groups. The study identified marked geographic variation in unidentified death rates among states and highlighted the significance of injury—both unintentional and intentional—as a cause of death in this population.

This study's estimate of the number of unidentified decedents from 1979 to 2004, 10,748, is much lower than some published estimates of 40,000 unidentified decedents (2). This study's estimate is closer to that of the 2004 Census of Medical Examiner and Coroners' Offices, which reported 13,486 unidentified decedents since recordkeeping began, going back prior to 1979 for some offices (15). On the other hand, the number of unidentified decedents in this study is larger than the number reported to the National Crime Investigation Center (NCIC). The NCIC has recorded approximately 3600 unidentified decedents with estimated date of death from 1985 to 2004 (NCIC, unpublished data), whereas this study found 8862 during those same years. Despite the differences in numbers, the time trend seen in these data is similar to the national time trend in NCIC data. Both analyses showed a net decline in annual counts since 1989, perhaps explained by improvements in identifying decedents through techniques such as DNA analysis, which was introduced in the 1990s (11); increasing numbers of forensic anthropologists and dentists in the offices of medical examiners and coroners; and improvements in federal computerized fingerprint comparison support.

Much of the variability in rates after 1986 in this study was due to variability in New York City. The higher rates in New York City and the rest of the U.S. during the 1986–1991 time period coincide with the epidemic of crack cocaine, which hit New York City particularly hard (16). Because the peak was observed for both injury and noninjury causes of death, 1986–1991 may also have been a period of higher prevalence of various forms of social disruption such as homelessness. Homeless numbers did in fact grow during the 1980s, a period also characterized by an economic recession and cuts in social programs (17,18).

The rates of unidentified death by sex and race are consistent with the higher rates of homelessness among males and black people (19). Rates of unidentified death by sex and race are also

consistent with the historically higher rates among males and black people for causes of death such as homicide, drug overdoses, and pedestrian mortality (20). Total injury and homicide rates are typically lower among Asian and Pacific Islanders nationwide, in agreement with the results of this study, but higher among Native Americans, contrary to the results of this study (20). However, the problem of undercounting of Native American decedents seen in the general population (21) may be more pronounced in the study population. The hair and skeletal features of Native Americans can be confused with those of Asians (11). Similarly, Hispanics are difficult to distinguish from non-Hispanic whites based on physical characteristics alone.

Geographic variation in homelessness, perhaps due to the migration of the homeless to warmer climates, may explain some of the variation in state rates. The higher rates in the Southwest may also be caused by more rapid deterioration of human remains in warmer climates (22) or prolonged body recovery times in rural areas, making identification of decedents more difficult. In addition, the occurrence of deaths among illegal immigrants along the U.S.-Mexican border (23,24) probably contributes to high rates in the border states. Variations in the resources available to coroner and medical examiner offices to identify unnamed decedents also may be a factor.

Most deaths were due to injury rather than disease. Approximately half of the injury deaths were ruled unintentional. Leading mechanisms of unintentional injury in this study, drowning and pedestrian injury, are often related to alcohol use (4,25,26). Pedestrian injuries are also related to low socioeconomic status (26). People unable to afford vehicles are more likely to travel by foot or freight train and to lack drivers' licenses that might help in identification. Mental illness may also increase the risk of unintentional injuries. A high prevalence of mental illness and substance abuse has been noted in unidentified patients seen in emergency departments (4).

Among intentional injuries, homicides outnumbered suicides, the reverse of the pattern in the general population, where suicides outnumber homicides (20). This preponderance of homicides may be in part because homicide perpetrators can remove the identification of their victims, conceal them, or move them to remote areas, leading to delay in discovery and difficulty in identification because of decomposition. It may also result in part from the difficulty in identifying abandoned newborns, whose deaths are homicides. The relatively large proportion of deaths of undetermined intent and the relatively small proportion of suicides compared with national data, may reflect the difficulty in establishing intent when records or family members are not available to verify a history of suicidal ideation or mental illness.

In spite of the disproportionate number of homicides, estimates by experts that more than half of all the unidentified dead are homicide victims (2) are probably too high. This study found that slightly more than a quarter of unidentified decedents with known causes of death were homicide victims. Because 75% of unidentified decedents had an established cause of death, this estimate is reasonably accurate for the study population as a whole. More than half of unidentified female decedents did die of homicide. Some of these women may have been unidentified because they worked in the sex industry. Homicides account for more than half of deaths among young female sex workers (27).

For all types of violence, firearms played a smaller role among unidentified decedents than in the U.S. population as a whole (20). This may reflect the contribution of firearm forensics in identifying decedents and the likelihood that gunshots will attract attention, making it easier to discover the incident and identify the victim.

An unavoidable limitation of this study is the difficulty in describing a population defined by the lack of information about it. In addition, the case inclusion criteria have not been validated, and some decedents may have been misclassified because state vital registrars vary in their use of identifiers. We looked for unexpectedly high or low state totals and other markers that may have reflected such variations in procedures, but case-by-case validation was not possible.

An additional, unquantifiable source of error may have been the identification of some study decedents after the filing of their death certificates, combined with failure to file an amended certificate. However, based on NCHS experience, such occurrences are relatively rare. NCHS has quality control procedures that are designed to query incomplete certificates and minimize unreported changes to certificates.

Given the limitations of the methods of this study, the derived data must be considered estimates of the number and characteristics of the unidentified decedent population. Moreover, while the death certificates of unidentified decedents are useful for descriptive epidemiologic purposes, they cannot be identified easily enough to use them for routine surveillance of this population. Development of a standard methodology for recording unidentified decedent information on death certificates could assist medical examiners and coroners in the identification and investigation of unidentified decedents. These improvements would provide more complete and timely information about unidentified decedents and could help resolve more missing persons investigations.

Disclaimer

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