Assessment of Kentucky's Computerized Death Certificate Record System for use in the Surveillance of Injuries and Violence

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Summary of findings and recommendations

- Efforts to improve data quality should focus first on the funeral directors, coroners/medical examiners and physicians who initially collect the personal information and certify the causes of death.
- Causes of death are often not specified to the maximum level possible. This might be due to insufficient data being collected and reported, or it could be due to reported data not being utilized in coding the cause.
- How should resources be divided between efforts to improve the existing system and development of supplemental, primary sources? The answer depends on a judgment of how much quality improvement of the existing system is realistically possible.
- Year-to-year system stability is critical for surveillance. There was slippage in reporting of 'Location of injury', 'Place of Injury', and the specificity of underlying cause of death for motor vehicle traffic crashes (MVTC's), starting in 2002 and 2003. These kinds of instabilities make it difficult to detect trends.
- Out-of-state deaths of Kentucky residents are incompletely reported. We should consider whether to include such cases in surveillance. If the answer is yes, we should consider whether it is possible to impute out-of-state deaths to counties, so that impact on geographic analyses will be minimized.
- A basic question is whether to wait for a complete file to become available, or work with provisional files instead? If it is decided to work with provision files, what should be the cutoff date, e.g. August 1 of each year?
- Through the National Center for Health Statistics (NCHS) and the SuperMICAR process, the Kentucky Office of Vital Statistics (KOVS) has access to complete, computerized supplemental cause of death information for all deaths in a very timely fashion. This information is basic to surveillance for traumatic brain injuries and other injury conditions. We recommend that KVSO make available the TRANSAX files to be integrated with the main computerized death record.

INTRODUCTION

Computerized records generated by administrative state data systems are a major source of public health surveillance data. Administrative data has been defined as "information collected by government, for some administrative purpose (e.g. keeping track of the population eligible for certain benefits, paying doctors or hospitals), but not primarily for research or surveillance purposes (Spasoff, 1999)." Such data systems have both strengths and weaknesses in terms of their use in public health surveillance and research.

The computerized death certificate databases generated by KOVS are the main source of data on injury mortality from all causes within the state. The primary purpose of this assessment was to identify both the benefits and drawbacks of using these computerized databases to conduct surveillance of fatal injuries.

The Centers for Disease Control and Prevention (CDC) have published guidelines for the evaluation of public health surveillance systems (CDC 2001). Those guidelines outline several desirable characteristics of such systems, including simplicity, flexibility, data quality, acceptability, sensitivity, predictive value positive, representativeness, timeliness and stability. Due to time and resource limitations, a thorough evaluation of all these facets was not possible. Instead, we focused on documenting the system's operation and assessing the quality of the data it produces.

Background

In the United States, responsibility for death registration rests at the state level. Through cooperative agreements with CDC-NCHS, all jurisdictions voluntarily participate in, and report their data to, the National Vital Statistics System (NVSS). The foundation of NVSS is the Model Vital Statistics Act (MVSA), which provides for a standard death certificate and uniform registration and data collection procedures to be followed by participating jurisdictions. The MVSA was enacted in 1907, and has been revised several times since then (Hetzel 1997). It is NVSS that enables us to compare mortality rates for Kentuckians with those for other states and the U.S. as a whole.

In Kentucky, the statute governing death certificate registration is KRS 213. This statute mandates that funeral directors, or the persons acting as such, file a death certificate for each death that occurs in the Commonwealth. It also outlines in general terms the responsibilities of funeral directors, local registrars, the State Registrar, and those who certify the causes of death (physicians, coroners, etc.), in the processing of the death certificate. NCHS provides a standard death certificate form and publishes detailed guidance for its completion by funeral directors (CDC 2004) and medical certifiers (CDC 2004).

METHODS

Data sources

The computerized death certificate data for 1999 to 2003 used in this report came from two sources. KOVS maintains the official state death certificate database, and also transmits a file annually to NCHS for use in NVSS. NCHS reformats some fields and adds others, most notably up to twenty supplemental cause of death codes, and merges the records with those from other states. These NCHS multiple cause of death (MCOD) files provide additional information that cannot be obtained from the state files, and we used them for certain analyses.

We defined an injury-related death as one having an underlying cause of death code in the ranges V01-Y36, Y85-Y87 or Y89. This definition, as well as the framework for classifying cases by mechanism and manner of injury based on the underlying cause of death, was taken from CDC's *Recommended Framework for Presenting Injury Mortality Data* for ICD-10.

Interviews and correspondence

Most of the information on the operation of the system – the collection of data, registration of certificates, coding, data entry, and computerization – was obtained through interviews with management and staff at the Cabinet for Health and Family Services, specifically KVSO; the Surveillance and Health Data Branch; and the Office of Information Technology.

Several current and former staff at the Kentucky Injury Prevention and Research Center have worked with both hard-copy and computerized death certificates data on various projects. Some of the information about the quality and accuracy of the computerized death records was based on their work.

RESULTS

System operation

There are a few critical points along the path of a death certificate from creation to computerization, where errors can be made in data entry or opportunities to capture relevant information for injury surveillance can be missed. Overall the process can be thought of in three phases: data collection, data entry, and creation of the computerized death record. These phases, and the important processes that take place in each phase, are described in the following discussion.

Data collection

As specified in KRS 213.076, the funeral director, or person acting as such, is responsible for collecting the 'demographic' data. The coroner, medical examiner, or attending physician is responsible for certifying the cause of death and collecting a number of other pieces of information, including several that provide details about injury-related deaths. See Appendix A for a sample death certificate form.

According to KOVS, although some coroners are also funeral directors, in most instances the funeral director is not a coroner. Therefore, any efforts at understanding or improving death certificate data quality on must include funeral directors, not only coroners.

Typically the funeral director transmits the completed certificate to the Vital Statistics Office.

Inspection: KOVS inspects new certificates upon receipt, examining the following:

- Completeness of data
- Current version of certificate
- On at least 25% cotton bond paper
- If all required signatures are present and in black ink
- Overall acceptability of the certificate

According to KOVS, the most common reasons that certificates are returned or not accepted are:

- Missing required signature(s);
- Certificates are bent, torn, spindled, mutilated or stained;
- Missing required information (e.g. – SSN, cause of death, diabetes questions, manner of death, etc.);
- Certificate is not on cotton bond paper;

- Correction fluid has been used on the certificate

KOVS estimates that about 40 to 50 certificates per month, or 480 to 600 per year, are returned for correction. They report that it is very rare for a rejected certificate to not be resubmitted.

As far as we were able to determine, there is no simple answer to the question of which data elements are required to be filled out on the certificate. The NCHS standards request that all information on the death certificate be completed, but as will be shown later, the boxes related to injury-related deaths are not filled out for all injury cases. The only items currently required by Kentucky law (KRS 213.078) are the diabetes questions.

Data entry

Coding and data entry processes for causes of death: KOVS nosologists determine the ICD-10 codes for the underlying and supplemental causes of death, based on the narrative text that was supplied by medical certifier and the funeral director, and write the ICD-10 codes on the paper certificate. There is series of ICD-10 instruction manuals that define the standards by which the nosologists code the causes of death. These handwritten codes will eventually be computerized and submitted to NCHS (batches are sent twice monthly).

In a parallel process which began in 2003, the nosologists key the same narrative text, from which they derived the codes, into the SuperMICAR software system supplied by NCHS. These SuperMICAR records are transmitted to NCHS, where more software applies logic to automatically translate the narrative text into an underlying cause of death and up to twenty supplemental causes of death. These records are then returned to KOVS in the form of flat text files known as TRANSAX files.

NCHS compares the SuperMICAR entries with the (computerized) handwritten codes, and notifies KOVS of any discrepancies in need of correction. This provides a quality check on the cause of death coding.

Another important implication for injury surveillance of the use of the SuperMICAR is that timeliness of access to supplemental causes of death can potentially be vastly improved. Complete supplemental cause of death data are necessary for, among other things, accurate tracking of traumatic brain injury-related deaths. To date our only access to these codes has been through the NCHS-MCOD files, which are typically released anywhere from eighteen months to two years after the end of the calendar year. (For example, the 2003 MCOD files were released in January, 2006.) Given that our other major injury surveillance databases are usually available six to eight months after the end of the calendar year, having access to the TRANSAX files would bring injury mortality data into the same timeframe.

Data entry process for 'demographic' information: Copies of certificates are sent to Kentucky Correctional Industries in volumes of 500 certificates. KCI has its own data entry software which was developed in-house. Based on interviews with the Office of Information Technology (OIT) at the Cabinet for Health and Family Services, there may be little or no editing built into that software. KCI workers keypunch most of the 'demographic' data elements from the death certificate.

Not all of the 'demographic' data elements from the certificate are keypunched by KCI, so there are parts of the hard-copy certificate that are not reflected in the computerized death record. One example for injury purposes is the box titled, "Describe how the injury occurred."

Creation of the computerized death record

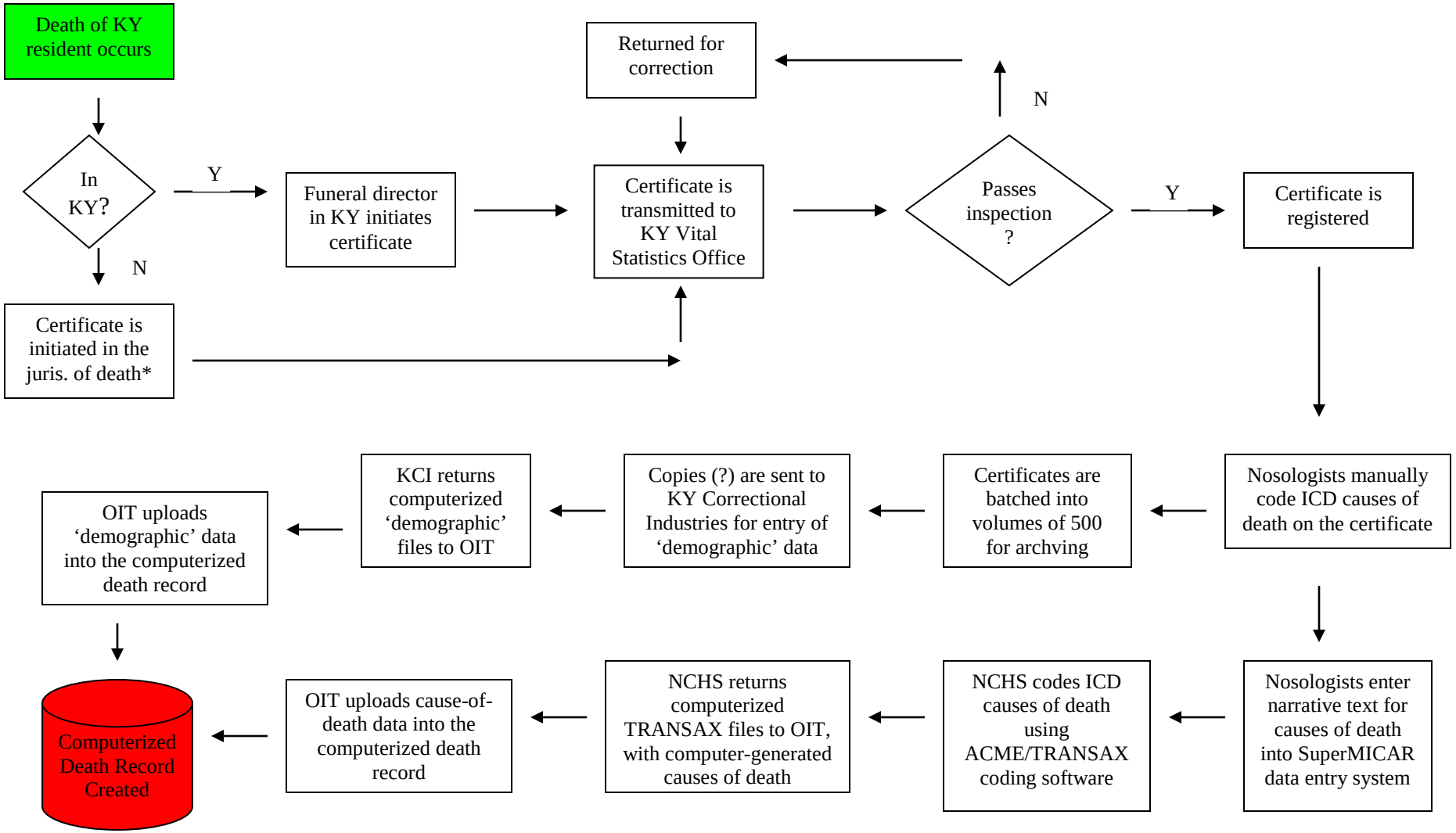
The computerized death record is compiled by OIT from two sources: the demographic data files from KCI and the TRANSAX files from NCHS.

Create initial record with demographic data from KCI files: When OIT receives a volume of records back from KCI, the records are batch processed into the current year's mainframe "A1" computer database. A number of edits are applied to the records before they are loaded into the A1 file. Vital Statistics Office receives a report of the errors that were found, and makes corrections to the records through an online editing application.

Append cause-of-death data from TRANSAX files: As with the KCI files, there is a continuous stream of TRANSAX cause-of-death files coming back from NCHS. Generally the KCI portion of a record comes in first, and the TRANSAX portion is appended when received. Occasionally a TRANSAX record is received before the initial (demographic) record has been created. In such cases the TRANSAX record is processed into a hold file. Subsequent jobs will check records in the log file to see if their matching KCI records have been loaded; when they are, the TRANSAX record is then appended.

Not all data elements from the TRANSAX file are appended to the computerized record. In particular, only the underlying cause of death and the first three supplemental causes are appended.

Processing of the death certificate for Kentucky residents, and creation of the computerized death record



*Copies of certificates for out-of-state, or 'in-transfer', deaths may be transmitted to the KY-VSO, but there is no federal requirement that this be done, nor is there a timeline specifying when it must be done. Whether, and when, to transmit the records is entirely at the discretion of the VSO in the state where the death occurred.

System quality control/quality assurance

Do the reported data accurately represent what actually occurred?

The first potential source of error in death certificate data is in the collection of information by the funeral director and medical certifier. This is a difficult area to assess, as we generally don't know what "really" happened, only what was reported. One thing we can do is document the systems that are in place to ensure data quality.

Standards, training and auditing: Guidelines exist for physicians and coroners to follow in certifying the cause of death, as specified in the *Physician's Handbook on Medical Certification of Death*. Nosologists also have the ICD standards, as noted above, to guide them in coding causes of death.

According to OVS, "There are some training opportunities for nosologists, but they do not occur very often. The training is offered by NCHS and usually takes place out of state, so travel can be an issue on this training. We do request a certain amount of background knowledge dealing with medical terminology or previous experience in a health-services related field."

Also, "There is no formal training performed by OVS for the funeral directors. OVS staff offer guidance and assistance to the funeral directors and coroners in completion of the death certificates and the OVS Field Representatives attend the KY Funeral Director's Association conference each year to provide assistance." The licensure board for funeral directors would be aware of any training requirements that may exist.

The process by which NCHS compares the hand-coded causes of death with the codes generated through the SuperMICAR system (described above) provides a kind of auditing system for the nosologists. No similar check exists for the information recorded by funeral directors and medical certifiers.

Possible biases in reporting of the underlying cause of death: Rosenberg and Kochanek made the following observations on the validity and reliability of the cause of death information reported on the death certificate:

> "Many studies have been published on the validity of cause of death [as] reflected in the NCHS annotated bibliography of 128 such studies carried out over a period of 23 years, with an update published in 1991.
>
> Some of these studies raise troubling questions regarding the medical certification of death, but these have been largely in the area of natural causes, or deaths related to disease processes of relatively long duration. For injuries, the cause of death tends to be more clear-cut and immediate in its fatal action. Nevertheless, *questions of validity do often arise regarding manner of death, that is, whether the injury was accidental, suicidal,*

> *or homicidal*. Only in-depth studies can shed light on this and, even in some cases, the basic records will not reveal what the medical certifier has chosen not to report." (Emphasis added)

Misclassification of occupational fatalities in Kentucky: The Fatality Assessment Control and Evaluation (FACE) project at KIPRC has conducted hard-copy, death certificate-based surveillance of work-related deaths in Kentucky since 1995. FACE staff review a variety of data sources to identify work-related deaths, including coroner's reports and newspaper articles, in addition to death certificates. They also conduct follow-up interviews with employers and family members.

In a manuscript that was in-process as of this writing, it was reported that for self-employed persons who were identified by FACE as fatally injured while working, the death certificate box titled "Injured at Work" was checked "No" in 25% of cases. For persons who were not self-employed, the reporting of "Injury at Work" was more accurate: the box was incorrectly checked "No" in 16% of cases. The conclusion is that strictly death-certificate based surveillance would underreport occupational fatalities. The same source reported that the "Usual Occupation" and "Usual Industry" boxes misidentified the actual occupation and actual industry at the time of death in 10% and 9% of cases, respectively (Bunn 2006).

Are the captured data accurately transferred to the computerized record?

Another potential source of error lies in the transfer of data from the paper certificate to the computer. There are several points in the process where collected or keypunched data are inspected or edited for accuracy and completeness. The KCI data entry software contains edits, and the OIT software that uploads the KCI computerized records to the mainframe database performs additional edits. However, edits can't catch every kind of mistake. Even something is simple as incorrectly keying a male as a female can slip through the edits.

We are unaware of any comprehensive and systematic studies in Kentucky of agreement between and the hard-copy certificates and the computerized death records. However, several KIPRC surveillance projects have experience working directly with the paper certificates, and we've summarized some of their findings.

Data accuracy in violent deaths: The Kentucky Violent Death Reporting System (KVDRS) has compared a convenience sample of 213 computerized violent death records with hard-copy certificates. The disagreements they found are summarized in Table 1.

Table 1. Disagreements between computerized violent death records and hard-copy death certificates

Data element	Number of disagreements	Percentage disagreed	Comments
Education	Many	-	Stopped counting because pervasive. Change in coding scheme in 2005?
County of residence	17	8.0%	
Type of location	14	6.6%	
Place of death	6	2.8%	Sometimes evident from address description on hard-copy, but absent on computerized record (?)
County of death	5	2.3%	
Social Security Number	4	1.9%	All one-digit differences
ZIP code	3	1.4%	
Resident address	3	1.4%	
Time of injury	1	0.4%	
Ethnicity	1	0.4%	

Completeness of computerized data for injury deaths

Incomplete data appears to be a much greater obstacle than accuracy, when it comes to using the computerized death records for injury mortality surveillance. The system provides the means for specifying valuable information on the circumstances and factors contributing to injury-related and violent deaths, but that capacity is currently underutilized. Also, tracking of deaths of Kentucky residents that occur out of state is largely beyond our control, and is a source of missing cases that has the potential to affect geographic analyses, since it disproportionately affects counties on or near borders.

Unreported deaths

In large-scale surveillance it is practically impossible to capture all cases of interest. When dealing with death certificates there is at least one well-known source of unreported cases.

Out-of-state deaths: Kentucky's computerized death files will generally not capture all out-of-state deaths of Kentucky residents (also referred to as 'in-transfer' cases). These may results from Kentuckians who were injured in another state and also died there, or from persons who were injured in Kentucky, transported out-of-state for medical treatment, and died in the other state (often at a hospital). The official death certificate is created and processed by the jurisdiction in which the death occurred. Under the federal NVSS system, there is no requirement that deaths of residents of other states be reported to the OVS in the decedent's state of residence.

We estimated the number of intransfer cases not received by KY-VSO from 1999 to 2003 by the following method. Through NVSS, NCHS receives death certificate records from all jurisdictions in the U.S. Therefore the NCHS public use files represent the most complete source of death records on Kentuckians who died in other states. Using these files for 1999 to 2003 as a gold standard, we simply subtracted the number of out-of-state deaths reported by KY-VSO from the number reported by NCHS. (Before doing this we verified that most of the cases reported by KY-VSO were also reported by NCHS, so that the difference between the two does represent unreported cases.) Table 2 shows the results. The number of unreported intransfer cases varied from 36 in 2003 to 76 in 2000, and averaged 55 cases over the five years. Note these numbers were obtained using complete files. If we decide to work with provisional files in order to increase timeliness of surveillance data, the number of unreported intransfer cases may increase, and Table 2 gives an upper bound for that number (between 200 and 300 cases between 1999 and 2003). The impact of these missing cases on any analyses should be carefully assessed, particularly if provisional files are used. Alternatively, it may be decided that out-of-state

deaths are not relevant to surveillance and prevention efforts in Kentucky, and that the case definition should not include them.

Table 2. Analysis of injury death records captured by KY-OVS and NCHS

	1999		2000		2001		2002		2003	
	KY	NCHS	KY	NCHS	KY	NCHS	KY	NCHS	KY	NCHS
Total reported injury deaths	2,674	2,673	2,733	2,790	2,883	2,956	3,079	3,068	3,306	3,339
KY residents	2,446	2,452	2,523	2,587	2,670	2,744	2,859	2,870	3,059	3,095
Died-in-state	2,273	2,231	2,379	2,367	2,484	2,488	2,634	2,602	2,805	2,805
Died out-of-state	173	226	144	220	186	256	225	268	254	290
Out-of-state res. who died in KY	228	221	210	203	213	212	220	198	247	244
Diff. in KY res. who died out-of-state	48	---	76	---	70	---	43	---	36	---

Table 3. Injury deaths by state of residence and state of death (KY-OVS computerized death records, 1999-2003)

	Number	Percent
KY residents who died in Kentucky	12,575	86.0%
KY residents who died in other states (“intransfers”)	982	6.6%
Residents of other states who died in Kentucky	1,118	7.6%
Total reported injury deaths by KY-VSO	14,675	100.0%

Table 4. Estimated number of out-of-state deaths of Kentucky residents that were not reported to KY-OVS, 1999-2003

Year	Number	Total injury deaths reported by KY-VSO	Percentage of all injury deaths reported by KY-VSO
1999	48	2,674	1.8%
2000	76	2,733	2.8%
2001	70	2,883	2.4%
2002	43	3,079	1.4%
2003	36	3,306	1.1%

Unreported in-state deaths: There may also be in-state deaths that go unreported. These can be investigated through linking state hospital discharge and death certificate files, to identify hospital patients who died in Kentucky, but for which no corresponding death record can be found. We have done so in the past, but not in a rigorous way, so we did not report those result here. The extent of unreported in-state deaths is not known at this time.

Incompletely reported injury-related data elements on computerized records

A second form of incompleteness is the failure to include all relevant information about the cases that *are* reported. For computerized death records, this primarily occurs for one of two reasons: either the information was not initially collected or specified by the funeral director or the medical certifier, or the information was collected but not transferred from the death certificate into the computerized record. The existing capacity for capturing injury mortality data on death certificates, AND on the computerized death records, is considerably underutilized, primarily for the former reason.

Incomplete data collection: Each death certificate is inspected upon arrival at KOVS. As noted above, if it does not pass inspection it is returned for correction. According to to KOVS: "Attempts to collect the information if it is not present have resulted in a backlash in the past and the Office of Vital Statistics does not have the authority to enforce the collection of this data. We offer guidance to the persons completing the certificates and we have [made improvements]. We try to emphasize to them that if the manner of death is marked anything other than natural that [the injury-related] fields must be completed."

As this comment indicates, there are several boxes on the death certificate that provide space to report information about injury-related and violent deaths, and none of them is currently utilized to full capacity, particularly on the computerized record:

- Underlying cause of death
- Supplemental causes of death
- Manner of death
- Date of injury
- Time of injury
- Injury at work
- Describe how the injury occurred
- Place of injury
- Location of injury

As shown in the following tables, 'Date of Injury', 'Hour of Injury', 'injury at Work', 'Place of Injury', and 'Location of Injury' are incompletely recorded. From 1999 to 2003, 'Date of Injury' was missing on 31% of cases (Table 5); 'Hour of Injury' was unspecified on 47% of cases (Table 6); 'Injured at Work?' was unspecified on 27% of cases (Table 7); 'Place of Injury' was unspecified on 51% of cases (Table 8); 'Manner of Death' was unspecified in 15% of cases (Table 10). Moreover, collection of some variables is getting worse: 'Location of Injury' was reported as 'unknown' in about 13% of cases from 1999 to 2001; this increased to 27% in 2002 and 86% in 2003 (Table 9). Completion of the underlying cause of death is enforced 100%, but as discussed below it is often less specific than it could be. 'Describe How the Injury Occurred' seems to be well-reported, but it is not

included in the computerized record. Whether it contains information that would be helpful if it were included is not known at this time.

According to the CDC/NCHS guidance, collection and specification of these data are primarily the responsibility of the medical certifier, which in cases of injury is usually a coroner or medical examiner. If this in fact is the case in Kentucky, then efforts to improve the completeness of injury-related data will need to focus on those persons.

Table 5. Date of Injury

Reported Value	1999	2000	2001	2002	2003	Total
Valid date	69%	71%	71%	68%	65%	69%
Missing	31%	29%	29%	32%	35%	31%

Table 6. Hour of Injury

Reported Value	1999	2000	2001	2002	2003	Total
Valid hour	52%	55%	57%	53%	51%	53%
Unspecified	48%	45%	43%	47%	49%	47%
Missing	0%	0%	0%	0%	0%	0%

Table 7. Injured at Work?

Reported Value	1999	2000	2001	2002	2003	Total
Yes/No	71%	75%	73%	74%	73%	73%
Unspecified	29%	25%	27%	26%	27%	27%
Missing	0%	0%	0%	0%	0%	0%

Table 8. Place of Injury

Reported Value	1999	2000	2001	2002	2003	Total
Specific place (home, road, etc)	54%	56%	54%	2%	34%	39%
Other	17%	15%	17%	0%	3%	10%
Unspecified	29%	29%	29%	96%	63%	51%
Invalid code	0%	0%	0%	2%	0%	0%
Missing	0%	0%	0%	0%	0%	0%
Total	100%	100%	100%	100%	100%	100%

Table 9. Location of Injury

Reported Value	1999	2000	2001	2002	2003	Total
Valid city/county	85%	87%	88%	73%	14%	66%
Unknown	15%	13%	12%	27%	86%	33%
Unspecified	0%	0%	0%	2%	2%	1%

Table 10. Manner of Death

Reported Value	1999	2000	2001	2002	2003	Total
Acc/Hom/Sui	83%	81%	83%	83%	84%	83%
Undetermined or pending	2%	3%	3%	2%	1%	2%
Unspecified	15%	16%	14%	15%	15%	15%
Missing	0%	0%	0%	0%	0%	0%

Lack of specificity in the underlying cause of death: The underlying cause of death is always reported, but it is often not specified with sufficient detail for prevention purposes. The ICD-10 classification system, which is currently used in the U.S. for coding death certificates, provides the capability of indicating the cause of death with a high degree of specificity. Unfortunately, in many cases key details are unspecified in the underlying cause of death as actually coded. (KOVS could offer no definite reasons for this. It could be that the necessary information is not specified by the medical certifier; or it could be that the information is specified but not utilized for coding.)

For example, in MVTC deaths, the ICD-10 scheme allows a coder to specify the mode of transport – i.e., whether the decedent was a motor vehicle occupant, motorcyclist, pedal cyclist, pedestrian, etc. However, from 1999 to 2003 the mode of transport on ICD-10 underlying cause of death codes for MVTC's was designated as 'Unspecified' in 40% of cases. Furthermore, the percentage 'Unspecified' increased from 29% in 1999 to 54% in 2003 (Table 11). In the case of MVTC deaths, there is an alternative source of data available in the national Fatality Analysis and Reporting System (FARS) system. However, for many causes, death certificates are the only readily available source of surveillance information.

Table 11. Reported mode of transport in MVTC deaths, based on underlying cause of death code (1999-2003)

Reported Value	1999	2000	2001	2002	2003	Total
Motor vehicle	59%	58%	52%	38%	33%	48%
Motorcycle	4%	5%	8%	5%	5%	5%
Pedal cycle	1%	0%	1%	1%	0%	0%
Pedestrian	7%	7%	6%	6%	7%	7%
Other	0%	0%	0%	0%	0%	0%
Unspecified	29%	30%	31%	50%	54%	40%

Similarly, for poisoning deaths the ICD-10 scheme allows a coder to specify, at least in general terms, what kind of substance was involved. Yet the type of substance was 'Unspecified' in more than 60% of drug-related poisoning deaths from 1999 to 2003 (Table 12).

Table 12. Reported substance category in drug-related poisoning deaths, based on underlying cause of death code (1999-2003)

Reported Substance Category	1999	2000	2001	2002	2003	Total
Nonopioid analgesics, antipyretics and antirheumatics	3%	4%	2%	1%	1%	2%
Antiepileptic, sedative-hypnotic, antiparkinsonism, and psychotropic drugs (not elsewhere classified)	7%	4%	5%	6%	5%	5%
Narcotics and psychodysleptics, not elsewhere classified	28%	31%	31%	31%	31%	30%
Other drugs acting on autonomic nervous system	0%	0%	0%	0%	0%	0%
Unspecified drugs, medicaments, and biological substances	62%	60%	63%	66%	63%	63%

Injury-related boxes on the certificate that are not transferred to the electronic file:

'Describe how the injury occurred': This data element is not present on the computerized records. However, according to colleagues who conduct injury surveillance projects based on copies of the paper certificates, it *is* recorded on the certificate for the majority of injury-related deaths (T. Bunn, S. Walsh, personal communications). Depending on what is typically written there, this data element may contain helpful information about the circumstances surrounding the injury. However given that the computerized cause of death codes are so often non-specific, it seems likely that the 'Describe how the injury occurred' box, like the other injury-related boxes, is not being used to its fullest potential. If that is the case, an opportunity exists to push for better use of this data element so that more detailed information will be available for cause-of-death coding.

Supplemental causes of death: Regardless of how many supplemental causes of death may be coded on the certificate by the nosologist, at most three are currently transferred to the computerized death record. As with intransfer deaths (above), the NCHS-MCOD files represent a gold standard of complete data that enables us to determine how much information we are missing on the KY-VSO computerized records. We found that from 1999 to 2003, 25 percent of MCOD records included more than three supplemental causes of death (both entity- and record-axis codes). In other words, 25% of the KY-VSO computerized records were incomplete with respect to supplemental causes of death.

These supplemental causes are very useful in identifying the presence of certain conditions such as traumatic brain injury, or the involvement of substances such as prescription or illicit drugs, or alcohol. However, without access to all available supplemental causes, computerized record-based surveillance will

undercount such conditions and contributing factors. Again we face a situation where timeliness is greatly compromised, because we have to wait approximately two years after calendar year-end before the MCOD files become available.

DISCUSSION

In the previous section we presented our findings about Kentucky's computerized death records system. In this section we discuss some of the implications that those findings have for the design and operation of a comprehensive injury and violence surveillance system based on those records. There are several opportunities for improvement of data capture and data entry processes. There are also some key decisions that will need to be made with respect to basic epidemiological issues and dissemination of surveillance data.

Timeliness vs. completeness

Delays for intransfer deaths: It is not possible at this time to do timely surveillance for injuries and violence (defined here as results published within one year after calendar year-end) *and* keep our results consistent with official state Vital Statistics publications. This is because the Surveillance and Health Data Branch does not create their official statistical file until all expected in-transfer records (for Kentuckians who died out-of-state) have been received from other states. This is usually at least eighteen months after calendar year-end, and generally less then two years. If we wait until they determine their final dataset before we publish results on injuries, our results will be considerably delayed.

A compromise solution is to declare a cutoff date, a point at which we think that the computerized records are complete enough for our purposes – i.e., work with a "provisional" data set rather than waiting for the "final" from KOVS. July 1 of each year seems like a reasonable choice, as nearly all of the previous year's in-state deaths are typically processed by that time, as well as the majority of intransfer cases. However, we will lose some cases in this way, mostly intransfers, and the percentage of intransfer cases truncated will vary from year to year. As discussed under 'Unreported Deaths', the number of unreported intransfer cases appears to be small enough that it should be negligible.

Case definition

There are three subsets of cases that make up our population of interest, as noted in Table 13. We will need to decide which to include or exclude from our case definition. Kentucky residents who died in Kentucky clearly will be included.

Table 13 suggests that a very high percentage of the injuries that led to death in these cases occurred in Kentucky. The other two subsets are a bit less straightforward.

Table 13. Three categories of fatal injury cases, based on state of residence and state of death (1999-2001)

	Injured in KY		Injured in another state		State of injury unknown		Total reported deaths	
	Num	**Pct**	**Num**	**Pct**	**Num**	**Pct**	**Num**	**Pct**
KY residents who died in Kentucky	6,315	88%	25	0%	797	11%	7,136	100%
KY residents who died in other states ("intransfers")	53	10%	210	42%	240	48%	503	100%
Residents of other states who died in Kentucky	460	71%	136	21%	55	8%	651	100%

Kentucky residents who died out-of-state represented 7.6% of all injury-related deaths reported by KVSO from 1999 to 2003 (Table 3). However, available data from 1999 to 2001 suggest that most of the injuries that led to those deaths occurred out-of-state (Table 13). We discussed some issues with these kinds of cases in the preceeding section. Some thought should be given to whether these cases should be included in the case definition at all – especially if we decide to work with a provisional data set. The primary benefit of omitting them would be to eliminate variability that could result from year-to-year inconsistencies in their reporting. On the other hand, not counting them would underrepresent Kentucky's injury mortality rates when compared to national rates.

The third subset is residents of other states who died in Kentucky, which comprised 7.4% of all deaths reported by KY-VSO from 1999 to 2003. Strictly speaking, we should not include these cases in any analyses involving the comparison of death rates (by county, mechanism, etc.), since our measure of exposure will be based on Kentucky population data only. On the other hand, as shown in Table 13, the majority of the injuries that led to these deaths occurred in Kentucky. From a practical prevention standpoint this makes them no less relevant than the deaths of Kentucky resident that occurred out-of-state (and arguably *more* relevant).

Delays for supplemental cause of death data: Another issue related to timeliness concerns the supplemental cause of death data. Even if we declare a cutoff date for injury surveillance, we still will not have complete data on supplemental causes of death until the NCHS makes available its MCOD files. As with intransfers, this typically also occurs between eighteen months and two years after calendar year-end. This delay will affect any conditions for which surveillance relies on the supplemental causes of death – at present, most notably traumatic brain and spinal cord injuries, and acquired brain injuries.

KY-VSO does receive the necessary data from NCHS in a timely fashion, through the SuperMICAR coding system and the TRANSAX files. This delay can be avoided if KY-VSO and/or KIPRC can find a way to utilize the TRANSAX files to update the computerized death records with complete supplemental cause of death data. This would require either an expansion of the central, computerized file layout, and modification of the processing job to transfer all causes; or the release of the TRANSAX files to KIPRC for linkage to the computerized records that KIPRC already receives.

Absent either of these solutions, we will continue to have two timelines for injury mortality surveillance: a longer one for any conditions requiring access to the supplemental causes of death, and a shorter one those that are defined in terms of the underlying cause of death.

Incomplete/unreported injury data

Overall, incomplete data appears to be a greater issue than accuracy, when it comes to using death records for injury mortality surveillance. Missed cases are one completeness issue, but not the biggest. The system provides the means for specifying valuable information on the circumstances and factors contributing to injury-related and violent deaths, but that capacity is currently underutilized. Furthermore, recent trends for several injury-related variables show large increases in the percentage of unspecified values. In general, injury-related boxes on the death certificate could be more fully utilized by funeral directors and medical certifiers – particularly the box titled 'Describe How the Injury Occurred.' Better use of this data element could improve specificity of coding for the underlying cause of death.

If it is deemed possible to improve this situation through education, enforcement, and other means, then doing so should be made a high priority within the state injury plan. However, if the reality is that these data may never be reliably captured through the death certificate system, we may want to consider a different approach to statewide injury surveillance, as described below.

Two-tiered approach to surveillance

Based on my experiences to date, the strength of administrative data sets – such as those based on death certificates – for surveillance purposes lies in high-level overviews based on a select number of relatively complete and reliable variables (e.g. age, sex, county of residence). Efforts to drill deeper into these datasets on specific topics often reveal serious shortcomings in the data (the most common being lack of specificity), and generally yield disappointing results in terms of information for prevention purposes. This is understandable, since by definition

'administrative data sets' were not created for the purpose of supporting surveillance and prevention research.

A two-tiered system would use the computerized death records primarily for overall prioritization and monitoring of demographic and geographic trends at a macro level, and secondarily as a sampling frame for in-depth, primary data collection. The latter would focus on the circumstances of injury, presence of risk and protective factors, etc., and would likely need to be targeted at a limited number of focus areas identified by the macro level analysis. Statewide inferences could then be made based on the sample. Of course priorities may change over time. CDC's surveillance guidelines for Central Nervous System Injury provide a working model for such a system (Marr and Coronado 2004).

Dissemination strategy

Mortality surveillance presents a challenge that does not exist for morbidity surveillance, which is typically based on hospital discharge and emergency department records. We can publish data on injury morbidity data without much concern about consistency, because there is little or no officially published data on the subject from other sources.

For injury mortality, however, there may already be sources of official statistics. We need to consider the potential side-effects of disseminating information that does not agree with existing sources. Motor vehicle crashes offer the most obvious example. Kentucky State Police collects data on all fatal traffic crashes that occur on Kentucky roadways. The Kentucky Transportation Cabinet and Kentucky Transportation Center produce official statewide fatality counts through the annual Kentucky Traffic Collision Facts books. For several reasons, it is not possible to synchronize the death certificate-based MVTC data 100% with crash report data. There will always be variances. The question then arises, in what way – if any – do we make available our injury surveillance data on MVTC's to the public, when it will certainly disagree with statistics derived from crash reports?

Another example is provided in the areas of all-terrain vehicle (ATV) deaths, which are tracked at the state level by the Kentucky Department for Public Health, and at the national level by the Consumer Product Safety Commission. Those efforts are not limited to death certificates, but include newspaper clippings and other sources for counting ATV-related deaths. This means they are unlikely to agree with strictly death certificates-based surveillance as to the number of cases that occurred in a given year.

NCHS makes available data on injury-related deaths by many causes through their Web-based Injury Statistics Query and Reporting System (WISQARS), which is based on death certificate records reported to them from the states.

Again, for a number of reasons there will always be discrepancies between WISQARS counts and those we calculate based on the State death record files. Also the Kentucky Department for Public Health publishes official counts of injury-related deaths through their annual Kentucky Vital Statistics reports, which will not exactly agree with our injury surveillance counts if we set an early cutoff date in order to improve the timeliness of our reporting.

One of our foremost concerns in developing an integrated, statewide approach to injury prevention and surveillance is coordination. This includes looking for ways to synchronize not only our efforts, but also our messages whenever possible. The issue of dissemination deserves a good deal of attention, so that our efforts complement and support those of our partners and other stakeholders, rather than confusing or diluting them. There may some information that we will want to compile from death certificate records for internal planning purposes, but that we do not publish in order to avoid confusion with other sources. At the least, for any statistics or indicators we publish we should be aware of potential conflicts with other published numbers, and provide an explanation for the difference.

Managing system changes

Comparability of surveillance data over time depends on well-defined and stable data collection and processing operations. It needs to be clearly recognized that changes to the underlying processes have implications for the surveillance systems that are built on them.

Internal changes: Permanent changes in, or short-term deviations from, usual data collection, data entry, coding, or other operations will affect the results produced by surveillance systems that are fed by the death certificates data. At a minimum, persons responsible for those surveillance systems should be notified when changes or deviations occur. Ideally they should be informed before they occur, and offered an opportunity to provide feedback and as to how the changes will impact surveillance.

External changes: Changes at the federal level, such as to the death certificate form or the coding system (ICD-9 to ICD-10) also occur periodically and are not under our control. Such changes need to be carefully managed nonetheless, so as to minimize their impact on surveillance systems.

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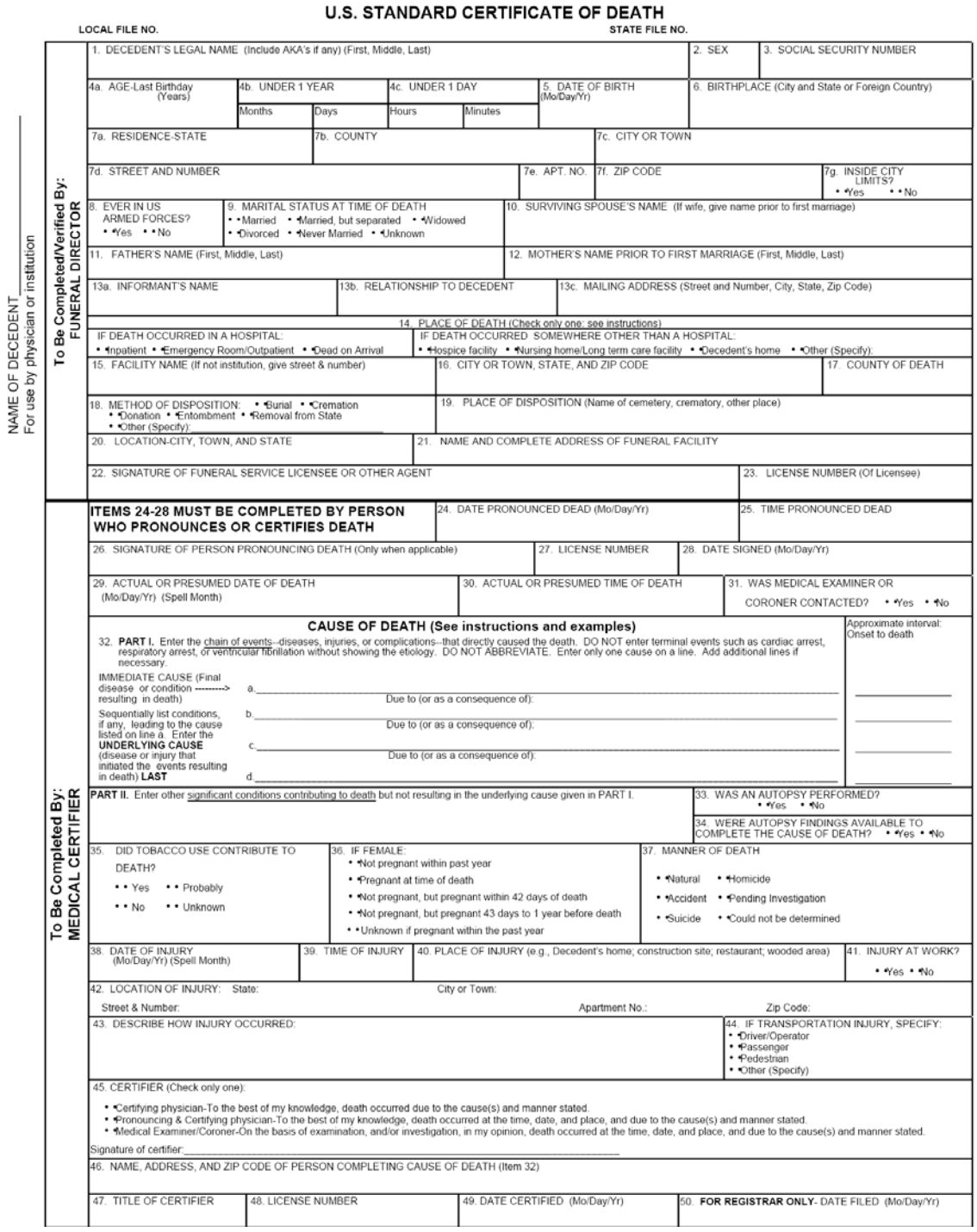
APPENDIX A



U.S. STANDARD CERTIFICATE OF DEATH

LOCAL FILE NO. STATE FILE NO.

NAME OF DECEDENT
For use by physician or institution

To Be Completed/Verified By: FUNERAL DIRECTOR

1. DECEDENT'S LEGAL NAME (Include AKA's if any) (First, Middle, Last) | 2. SEX | 3. SOCIAL SECURITY NUMBER

4a. AGE-Last Birthday (Years) | 4b. UNDER 1 YEAR (Months, Days) | 4c. UNDER 1 DAY (Hours, Minutes) | 5. DATE OF BIRTH (Mo/Day/Yr) | 6. BIRTHPLACE (City and State or Foreign Country)

7a. RESIDENCE-STATE | 7b. COUNTY | 7c. CITY OR TOWN

7d. STREET AND NUMBER | 7e. APT. NO. | 7f. ZIP CODE | 7g. INSIDE CITY LIMITS? • Yes • No

8. EVER IN US ARMED FORCES? • Yes • No

9. MARITAL STATUS AT TIME OF DEATH • Married • Married, but separated • Widowed • Divorced • Never Married • Unknown

10. SURVIVING SPOUSE'S NAME (If wife, give name prior to first marriage)

11. FATHER'S NAME (First, Middle, Last)

12. MOTHER'S NAME PRIOR TO FIRST MARRIAGE (First, Middle, Last)

13a. INFORMANT'S NAME | 13b. RELATIONSHIP TO DECEDENT | 13c. MAILING ADDRESS (Street and Number, City, State, Zip Code)

14. PLACE OF DEATH (Check only one; see instructions)

IF DEATH OCCURRED IN A HOSPITAL: • Inpatient • Emergency Room/Outpatient • Dead on Arrival

IF DEATH OCCURRED SOMEWHERE OTHER THAN A HOSPITAL: • Hospice facility • Nursing home/Long term care facility • Decedent's home • Other (Specify):

15. FACILITY NAME (If not institution, give street & number) | 16. CITY OR TOWN, STATE, AND ZIP CODE | 17. COUNTY OF DEATH

18. METHOD OF DISPOSITION: • Burial • Cremation • Donation • Entombment • Removal from State • Other (Specify):

19. PLACE OF DISPOSITION (Name of cemetery, crematory, other place)

20. LOCATION-CITY, TOWN, AND STATE | 21. NAME AND COMPLETE ADDRESS OF FUNERAL FACILITY

22. SIGNATURE OF FUNERAL SERVICE LICENSEE OR OTHER AGENT | 23. LICENSE NUMBER (Of Licensee)

To Be Completed By: MEDICAL CERTIFIER

ITEMS 24-28 MUST BE COMPLETED BY PERSON WHO PRONOUNCES OR CERTIFIES DEATH

24. DATE PRONOUNCED DEAD (Mo/Day/Yr) | 25. TIME PRONOUNCED DEAD

26. SIGNATURE OF PERSON PRONOUNCING DEATH (Only when applicable) | 27. LICENSE NUMBER | 28. DATE SIGNED (Mo/Day/Yr)

29. ACTUAL OR PRESUMED DATE OF DEATH (Mo/Day/Yr) (Spell Month) | 30. ACTUAL OR PRESUMED TIME OF DEATH | 31. WAS MEDICAL EXAMINER OR CORONER CONTACTED? • Yes • No

CAUSE OF DEATH (See instructions and examples)

32. **PART I.** Enter the chain of events--diseases, injuries, or complications--that directly caused the death. DO NOT enter terminal events such as cardiac arrest, respiratory arrest, or ventricular fibrillation without showing the etiology. DO NOT ABBREVIATE. Enter only one cause on a line. Add additional lines if necessary.

Approximate interval: Onset to death

IMMEDIATE CAUSE (Final disease or condition ---------> resulting in death) a. _____ Due to (or as a consequence of):

Sequentially list conditions, if any, leading to the cause listed on line a. Enter the **UNDERLYING CAUSE** (disease or injury that initiated the events resulting in death) **LAST**

b. _____ Due to (or as a consequence of):

c. _____ Due to (or as a consequence of):

d. _____

PART II. Enter other significant conditions contributing to death but not resulting in the underlying cause given in PART I.

33. WAS AN AUTOPSY PERFORMED? • Yes • No

34. WERE AUTOPSY FINDINGS AVAILABLE TO COMPLETE THE CAUSE OF DEATH? • Yes • No

35. DID TOBACCO USE CONTRIBUTE TO DEATH? • Yes • Probably • No • Unknown

36. IF FEMALE: • Not pregnant within past year • Pregnant at time of death • Not pregnant, but pregnant within 42 days of death • Not pregnant, but pregnant 43 days to 1 year before death • Unknown if pregnant within the past year

37. MANNER OF DEATH • Natural • Homicide • Accident • Pending Investigation • Suicide • Could not be determined

38. DATE OF INJURY (Mo/Day/Yr) (Spell Month) | 39. TIME OF INJURY | 40. PLACE OF INJURY (e.g., Decedent's home; construction site; restaurant; wooded area) | 41. INJURY AT WORK? • Yes • No

42. LOCATION OF INJURY: State: City or Town: Street & Number: Apartment No.: Zip Code:

43. DESCRIBE HOW INJURY OCCURRED:

44. IF TRANSPORTATION INJURY, SPECIFY: • Driver/Operator • Passenger • Pedestrian • Other (Specify)

45. CERTIFIER (Check only one):

• Certifying physician-To the best of my knowledge, death occurred due to the cause(s) and manner stated.
• Pronouncing & Certifying physician-To the best of my knowledge, death occurred at the time, date, and place, and due to the cause(s) and manner stated.
• Medical Examiner/Coroner-On the basis of examination, and/or investigation, in my opinion, death occurred at the time, date, and place, and due to the cause(s) and manner stated.

Signature of certifier: _____

46. NAME, ADDRESS, AND ZIP CODE OF PERSON COMPLETING CAUSE OF DEATH (Item 32)

47. TITLE OF CERTIFIER | 48. LICENSE NUMBER | 49. DATE CERTIFIED (Mo/Day/Yr) | 50. **FOR REGISTRAR ONLY**- DATE FILED (Mo/Day/Yr)

To Be Completed By: FUNERAL DIRECTOR

51. DECEDENT'S EDUCATION-Check the box that best describes the highest degree or level of school completed at the time of death.	52. DECEDENT OF HISPANIC ORIGIN? Check the box that best describes whether the decedent is Spanish/Hispanic/Latino. Check the "No" box if decedent is not Spanish/Hispanic/Latino.	53. DECEDENT'S RACE (Check one or more races to indicate what the decedent considered himself or herself to be)
• 8th grade or less • 9th - 12th grade; no diploma • High school graduate or GED completed • Some college credit, but no degree • Associate degree (e.g., AA, AS) • Bachelor's degree (e.g., BA, AB, BS) • Master's degree (e.g., MA, MS, MEng, MEd, MSW, MBA) • Doctorate (e.g., PhD, EdD) or Professional degree (e.g., MD, DDS, DVM, LLB, JD)	• No, not Spanish/Hispanic/Latino • Yes, Mexican, Mexican American, Chicano • Yes, Puerto Rican • Yes, Cuban • Yes, other Spanish/Hispanic/Latino (Specify) _____	• White • Black or African American • American Indian or Alaska Native (Name of the enrolled or principal tribe) _____ • Asian Indian • Chinese • Filipino • Japanese • Korean • Vietnamese • Other Asian (Specify)_____ • Native Hawaiian • Guamanian or Chamorro • Samoan • Other Pacific Islander (Specify)_____ • Other (Specify)_____

54. DECEDENT'S USUAL OCCUPATION (Indicate type of work done during most of working life. DO NOT USE RETIRED).

55. KIND OF BUSINESS/INDUSTRY

REV. 11/2003