HB 138
SPECIAL STUDY #5

The Nature of Injury Related Autopsies in Ohio

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EXECUTIVE SUMMARY

Background. Special project #5 relates to autopsy considerations of trauma victims. The study was mandated, per HB 138, to examine methods to ensure that autopsies are performed on appropriate trauma victims and that autopsy data are reported to the Ohio Trauma Registry in a timely manner.

Autopsy information has long been an essential tool for quality control of medical care and for enhancing the quality of cause-of-death information reported on the death certificate. An ample body of literature shows not only the medical values of autopsy, but also its importance in bench marking the quality of cause-of-death data.

Methods and Data Sources. The Ohio Bureau of Vital Statistics supplied a copy of death certificate records for the years 1996 through 2001. Rates of death were computed using the 2000 US Census SF1. Surveys were sent to Ohio's 85 coroners and one medical examiner. Sixty responded (70%) to the survey. Following the same format, surveys were sent to 177coroners from nearby states with 81 (46%) responding. Fifty nine Ohio emergency services/trauma medical directors were surveyed with 36 (61%) responding. The Executive Board of the Ohio State Coroners Association provided input at various stages of the project.

Results.

- *According to State of Ohio death certificate data from 1996 to 2001, about 60 percent of unintentional injury deaths have an autopsy. A similar 60 percent of intentional self-injury deaths are autopsied. About 98 percent of intentional deaths (homicides) are autopsied. Ohio coroners, other state coroners, and trauma medical directors did not identify any mechanism of injury that always requires an autopsy.*
- *The Ohio coroners' survey revealed that, based on those patients who they deemed appropriate for an autopsy, only about two percent of the injury deaths did not receive an autopsy because of a barrier. The greatest barriers were cost, family opposition, and personnel (can't find pathologists and other office personnel to assist the coroner's work).*
- *Both the Ohio coroners and the non-Ohio coroners consider trauma medical directors and EMS personnel infrequent users of autopsy data. The trauma medical directors expressed the opinion that both they and the EMS personnel were very frequent users of autopsy information.*
- *The greatest discrepancy between coroners and trauma medical directors was that the trauma medical directors felt an autopsy was substantially more appropriate in motor vehicle crashes than the coroners. About two thirds of motor vehicle crash victims have an autopsy.*
- *The trauma medical directors identified "missed diagnoses that only an autopsy can reveal" as an important reason for conducting autopsies.*
- *Ohio death certificate information indicated that there has been a significant increase in unintentional injuries in the past few years. Much of the injury data included in the*

death certificate is missing (e.g. 59% of ICD9-10 data). Lack of relevant fields and missing data make it difficult to evaluate the cause of the increase in injury deaths.

- *Many Ohio coroners expressed non-support for the creation of a new form and process to report autopsy injury data to the Ohio Trauma Registry.*
- *About 40 percent of the coroners usually or always prepare their reports on manual typewriters.*

Conclusions.

- Representatives from the Ohio Trauma Registry should be active participants in determining data elements on the Ohio Death Certificate. Whatever fields are chosen to be included on the death certificate, it is critical that the fields be completely and accurately filled in.
- In addition to the death certificate, the coroners presently complete a report that describes the autopsy findings. While the majority of Ohio coroners are not in favor of a standardized format, the non-Ohio coroners and the trauma medical directors find this a reasonable request. Rather than adding additional work, a report that provided standard autopsy information of the body areas studied would be useful to those reading the reports as well as providing information sufficient to determine injury cause and severity codes. Improved coroner documentation and subsequent coding would allow objective assessment and reliable trending of population data.
- Resources need to be provided to coroners to enable them to complete reports with tools that are designed to disseminate the information in an efficient and complete manner.

OBJECTIVES

Special project #5 relates to autopsy considerations of trauma victims, specifically methods to ensure that autopsies are performed on appropriate trauma victims and that autopsy data are reported to the Ohio Trauma Registry (OTR) in a timely manner.

The report objectives for this Special Study are as follows.

1.1 To identify which injury types are deemed appropriate for autopsy by surveying:
- Ohio's 86 county coroners and one medical examiner
- A sampling of county coroners/medical examiners in contiguous states
- Hospital emergency and/or trauma medical directors in Ohio

1.2 And of those injury types deemed appropriate for autopsy who did not get an autopsy, to identify what are the most common barriers to achieving the autopsy

2.1 To assess which medical stakeholders in the community routinely utilize autopsy reports and for what purpose

2.2 To conduct a random sampling of those stakeholders in order to assess areas of the reports in which they perceive that their needs are not being met

3.1 To evaluate what trauma autopsy data is utilized by trauma care providers (trauma medical directors and trauma nurse coordinators/managers) from American-College-of-
Surgeons-verified trauma centers in the state of Ohio

3.2 To do the same with a sampling of recognized injury prevention programs around the State of Ohio (Safe Communities of the Governor's Highway Safety Office, MADD, etc. who might use autopsy data)

4.1 To survey at a regional meeting the 86 county coroners and one medical examiner in Ohio as well as a sampling of trauma physicians from around Ohio for suggestions on how autopsy data might be submitted to the OTR

4.2 To assess the current required method of submitting coroners' data to the OTR (death certificate data via the Ohio Department of Health Vital Statistics Division) for compatibility with submitting autopsy data

LITERATURE REVIEW

Background. Autopsy information has long been an essential tool for quality control of medical care and for enhancing the quality of cause-of-death information reported on the death certificate. An ample body of literature shows not only the medical values of autopsy, but also its importance in bench marking the quality of cause-of-death data.

Performance Improvement. Autopsies provide feedback for the education of medical personnel. Boers discusses how the autopsy is an important adjunct in the education of the physician (Boers, 1989). Boers found 41% of patients autopsied had erroneous diagnoses that might have influenced management of the patient. In 28% of patients, an autopsy offered no additional information about one or more diagnoses. Both the proportion of errors and the proportion of uninformative autopsies increased with

decreasing clinical certainty about the diagnosis. They concluded that autopsy offered useful information in most cases, and limiting the number of autopsies by only selecting certain cases is probably not justified because errors are likely to have occurred across the board.

A study of house staff in two New York City Urban hospitals revealed 86% of the respondents felt autopsies were not done often enough and needed to be increased (Wilkes, Link, Jacobs, Fortin, & Felix, 1990). A majority of medical house staff (78%) felt they needed more instruction on how to ask for an autopsy, and 34% had never received feedback from the pathology department on autopsy results. Most pathology residents (94%) felt the autopsy rate was too low. The most common reasons the pathologists cited for the low rate were reluctance of clinicians to request permission and clinicians' fears of being sued for malpractice.

Stothert (Stothert, Gbaanador, & Herndon, 1990) examined the difference between clinical impressions and autopsy findings in a group of patients dying on a university surgical service after blunt injury, penetrating injury, or thermal burns. Of 215 patients dying between the years 1984 and 1988, 212 were included in the study (autopsy rate, 98.6%). Major discrepancies in clinical diagnosis versus the anatomic diagnosis at autopsy occurred in approximately 30% of patients. The incidence of errors in diagnosis, which may have influenced survival in these groups of injured patients, was 5.1%.

Autopsy is one method of performance improvement in a burn center. Fish et al (Fish, Hartshorne, Reay, & Heimbach, 2000) tested the hypothesis that autopsy diagnosis would not alter clinical diagnosis. A chart review of all deaths (N = 94) occurring during a 6-year period (1989-1994) was performed. The clinical diagnoses from the hospital charts and autopsy reports for the patients were reviewed, and diagnostic discrepancies were classified as class I or class II errors. Class I diagnostic errors might have altered the clinical outcome. Class II errors were attributable to the burn injuries but were believed to have had little impact on the clinical outcome. The overall autopsy rate was 93.6% (n = 88). Clinical diagnostic errors were found in 16 (18%) of 88 patients. Five class I errors were found in 4 patients (4.5%), and 15 class II errors were found in 13 patients (14.7%).

In a study in The Netherlands Barendregt (Barendregt, de Boer, & Kubat, 1993) reviewed the records of 56 patients who died of severe trauma or its complications from 1977 to 1987. The clinical and autopsy findings corresponded in 31 patients (55%). The autopsy brought to light errors in diagnosis or treatment that might have affected survival in eight cases (14%). The most common missed diagnoses were bronchopneumonia and severe hemorrhage, whereas the most common cause of death was sepsis. Age, length of stay in the hospital, and time between admission and operation were not correlated with the accuracy of diagnosis or adequacy of treatment.

Table 1. Studies demonstrating correspondence between clinical diagnosis and autopsy findings: Percent of cases in which the outcome for the patient would have changed if the physician had known what the autopsy revealed.

Study	Nature of injury	Number in study	Percent of cases with clinical impact
Fish et al., 2000	Burns	88	4.5%
Stothert et al., 1990	Blunt, penetrating, burns	212	5.1%

Barendregt et al., 1993	Severe Trauma	56	14%
Asnaes, Frederiksen, & Fenger, 1983	Accidental deaths	266	4.5% missed trauma
Boers et al, 1988	General medical problems	143	41%

Public Health. A purpose of autopsy reports is the ability to conduct epidemiological studies and monitor the rise and fall of various types and location of traumatic injuries.

Workplace injuries. Research in the cause and type of accidents in the workplace is one area where the completeness of autopsy data has made epidemiological studies possible. Conroy and Russell discuss the National Institute for Occupational Safety and Health's (NIOSH) Division of Safety Research use of medical examiner and autopsy reports as an important source of epidemiological information (Conroy & Russell, 1990). They note medical examiners and coroners have the legal authority and responsibility to investigate all externally caused deaths, so those records can be used in surveillance of work related deaths. Another use of autopsy records is to validate cases identified by other case ascertainment methods, such as death certificates. Using medical examiner/coroner records allows for rapid identification of work-related deaths without waiting several years for mortality data from state offices of vital statistics. Finally, the records are a valuable source since they contain detailed information on the nature of the injury, external cause of death, and results of toxicological testing, which are often not available from other sources.

Conroy and Russell point to a study in Maryland that reviewed autopsy reports and found the majority of the deaths involved either hazards which were not addressed by the Occupational Safety and Health Act of 1970 or workers in categories who were excluded by law from regulation under this act (Baker, Samkoff, Fisher, & Van Buren, 1982). These injuries would be missed in studies of the NIOSH database. In a separate study in a county in Pennsylvania it was found that death certificates only identified 57% of all occupational deaths found by the county coroner from 1979 through 1982 (Robinson, Kuller, & Perper, 1988). A limitation of the coroner information for occupational epidemiological research is the lack of coding of occupation by standard method on the reports (e.g. Bureau of Census Occupation coding). Russell (Russell, 1989) combined the coroner information with workers' compensation records and identified 96% of all externally caused occupational deaths. Parkinson et al (1986) investigated all fatal workplace accidents occurring in Allegheny County, Pennsylvania in 1983 and 1984 for cause of accident, preventability, type of industry, number of employees, and the involvement of alcohol or drugs. Approximately 40% of the accidents were not within the jurisdiction of the Occupational Safety and Health Administration (OSHA) and therefore were not reported to or not investigated by OSHA. More than 60% of the fatal accidents investigated by OSHA resulted in one or more citations, and all but one accident was judged preventable. Drugs were not found at autopsy in any of the accident victims, and a significant alcohol level was found in only one victim. Nearly 80% of the fatal accidents investigated occurred at locations with fewer than 100 employees. Again there was an underreporting of occupational deaths when reviewing records other than coroner reports. Autopsy reports may also include what the person was doing at the time of death as opposed to death certificates that simply list the usual occupation.

Type of information to collect. In 1986, the Centers for Disease and Prevention established the Medical Examiner and Coroner Information Sharing Program (MecISP) with four primary goals: (1) To improve the quality of death investigations in the United

States and to promote more standardized practices concerning when and how to conduct these investigations; (2) to facilitate communication among death investigators, the public health community, federal agencies, and other interested groups; (3) to improve the quality, completeness, management, and dissemination of information regarding investigated deaths; and (4) to promote the sharing and use of medical examiner/coroner death investigation data. Major MecISP projects have included periodic production of a directory of death investigators in the United States and Canada; creation of standard and generic death investigation report forms; development of death investigation data sets; and collection of death investigation data from medical examiner/coroner offices. MecISP also conducts site visits to assist in office computerization; supports educational meetings and the development of training materials for death investigators; facilitates ongoing projects of relevant professional organizations; contributes publications to the death investigation literature; conducts surveillance of selected types of deaths; and responds to specific inquiries from medical examiners and coroners about administrative and practical death investigation issues (Hanzlick, 1997).

States with centralized information systems have the greatest potential for surveillance studies. It is important that death certificate numbers and other identifying numbers are included on the reports so that the information can be linked with other systems. The National Association of Medical Examiners (N.A.M.E.) conducted a survey to evaluate the current status of medical examiner office computerization in the United States. Responses were received from 80 unique reporting areas, including 75 medical examiner offices, which represented approximately 30% of the 258 medical examiner jurisdictions in the country. A total of 58 responders (65%) indicated that their office was automated. At least 38 states had one or more automated death investigation office. Electronic data exist for approximately 145,000 deaths per year, or approximately 30% of all deaths certified by medical examiners and coroners annually and approximately 6% of all deaths per year in the United States. Although computerized offices vary substantially in size and in their choice of hardware and software, a typical computerized office (a) was in a single county with 1,000-6,000 death reports per year; (b) kept electronic records on all cases reported; (c) used an IBM or compatible personal computer or PC network with off-the-shelf software; (d) stored data on cause of death, manner of death, how injuries occur, and toxicology results; and (e) was interested in sharing its data. Considerable electronic death investigation data exists that can provide timely and valuable information for mortality and public health studies (Hanzlick, 1994).

Kung and Hanzlick reviewed four hundred ninety four printed death investigation records from 224 medical examiner/coroner (ME/C) offices throughout the United States. Their intent was to determine the level of agreement between multiple records abstractors who extracted defined data elements from printed ME/C death investigation records, as well as to identify data items for which improved reporting could facilitate the effective use of ME/C reports and data.(Kung, Hanzlick, & Spitler, 2001) Trained abstractors were asked to extract information for 110 data elements from 494 investigative reports. Additional data elements for each toxicology work-up were abstracted from toxicology laboratory reports. Six-digit Abbreviated Injury Scale (AIS) codes were further abstracted for each injury as described in autopsy reports. The ability of multiple abstractors to identify each

data element and identically abstract the data was assessed using Kappa statistical methods. The level of agreement for many data elements was very good (>0.9), but for some data elements agreement was marginal to poor, especially for items related to toxicology, the nature of specific injuries, and dates/times of the occurrence of death and injury. Many data items could be easily abstracted from ME/C records. However, some data items seemed difficult to abstract reliably in all cases. Kung suggested that standardizing the report formats used by ME/Cs and/or standardizing the electronic storage of ME/C data would make the abstraction of such data easier and improve the usefulness of ME/C data.
Abbreviated Injury Score (AIS) and Injury Severity Score (ISS) scores are useful in documenting the severity of the trauma to the patient. The autopsy can provide the most accurate assessment of this measurement. Adams presented (Adams & Carrubba, 1998) situations in which autopsy AIS scores were low and did not seem to reflect the lethal outcome. In these situations the lethal mechanism was purely physiologic and without a striking morphologic derangement, as in instances of cerebral or cardiac concussion, compression of the neck, occlusive airway hemorrhage, and visceral herniation into an adjacent body cavity. Scores were similarly low when therapy was delayed or adverse. They concluded that low AIS and ISS scores in a fatality from blunt or penetrating trauma may be useful for retrospective clues to the presence of purely physiologic death mechanisms or therapeutic problems.

Riddick et al point out that medical examiners and coroners have a unique database about trauma victims. Many, if not most, died at the scene or in transit to a hospital, never had their injuries documented by trauma surgeons, and so never enter into a local or regional trauma registry (Riddick, Long, Copes, Dove, & Sacco, 1998). Trauma registries have assisted in assessing the magnitude of traumatic injuries in the community and in evaluating the community's emergency medical systems. Without information about those who are dead at the scene or who die in transit, these trauma registries are incomplete and the evaluations based on them inaccurate. The data of about the 50% of trauma victims never enter the medical system. Such information is present in the death investigation and autopsy reports in the various medical examiner/coroner offices in the country.

Types of injuries. There have been a number of studies covering a variety of injury types using autopsy data to supplement the study or to serve as the exclusive source for information, as illustrated in Table 2.

Family History and Other Concerns. Autopsy may clear up concerns over the general circumstances of death. Intentional versus unintentional causes of death can typically be determined including homicide, suicide or “accident,” as well as medical misdiagnosis and overwhelming natural causes from the traumatic event. The autopsy can also uncover medical problems unrelated to the cause of death. Family history information can be provided from either end of the generation spectrum. Genetically related cardiovascular problems or pre-cancerous conditions in children who are victims of a fatal traumatic death can provide a family history of problems for their parents as well as other siblings. An excellent series compiled by Hoyert (Hoyert, 2001) from case reports

in the Archives of Internal Medicine gives an example of a routine autopsy uncovering a potential genetic problem with breast cancer unrelated to the cause of death. The information was shared with the family through the family physician.

Table 2. A list of some of injury types using autopsy data.

Abuse	McCann, Reay, Siebert, Stephens, & Wirtz, 1996
Air bags	Segui-Gomez, 2000
Alcohol related injuries	Hargarten, 1999
Aviation crashes	Ast et al, 2001
Bioterrorism	Nolte, 2000
Blunt trauma	Burkhart, Gomez, Jacobson, Pless, & Broadie, 2001; Cina, Koelpin, Nichols, & Conradi, 1994; Corey, McCloud, Nichols, & Buchino, 1992; Hodgson, Stewart, & Girotti, 2000; Meislin, Conroy, Conn, & Parks, 1999; Pollock, O'Neil, Parrish, Combs, & Annest, 1993; Stothert et al, 1990
Burns	Barret, Jeschke, & Herndon, 2001
Drownings	Adams & Carrubba, 1998; Corey et al, 1992; Hall, Reyes, Meller, & Stein, 1993; "North Carolina drownings, 1980-1984," 1986
Firearm	Karger & Brinkmann, 1997; Meislin et al, 1999; Tymus, O'Brien, & Hargarten, 1996
Heat related deaths	"Heat-related illnesses, deaths, and risk factors--Cincinnati and Dayton, Ohio, 1999, and United States, 1979-1997," 2000; "Heat-related mortality--United States, 1997," 1998
Horseback riding	"Horseback-riding-associated traumatic brain injuries--Oklahoma, 1992- 1994," 1996
Occupational Injuries	Baker, Samkoff, Fisher, & Van Buren, 1982; Conroy & Russell, 1990; Kircher, Nelson, & Burdo, 1985; Parkinson, Gauss, Perper, & Elliott, 1986; Parsons & Start, 2001; Robinson et al, 1988; Slater & Harvey, 1993
Pedestrian/train	Cina et al, 1994
Seat belts	Denic et al, 1989
Sports	"Injuries associated with soccer goalposts--United States, 1979-1993," 1994; Kelly et al, 1991; Saunders & Harbaugh, 1984; "Sports-related recurrent brain injuries--United States," 1997
Sudden unexplained infant deaths	Funayama, Tokudome, & Matsuo, 1996; Iyasu, Hanzlick, Rowley, & Willinger, 1994
Traffic related deaths	Adams & Carrubba, 1998; Aleksandric, Uzelac-Belovski, Dunjic, Denic, & Pandurovic, 1989; Baker et al, 1982; Burkhart et al, 2001; Da Costa, De Sousa, Rodrigues, & Garces, 1984; Denic et al, 1989; Hitosugi & Takatsu, 2001; Kibayashi, Yonemitsu, Honjyo, & Tsunenari, 1999; Spencer, 1982
Traumatic brain injuries	Hardman, 1979; Jellinger, Paulus, Wrocklage, & Litvan, 2001

CURRENT STATUS: OHIO'S COUNTY CORONER/MEDICAL EXAMINER SYSTEM

Selection. Coroners are elected or appointed, as determined by each county.

Term. Coroner terms are four years. The next election/appointment is in November 2004.

Qualifications. The Coroner must be a physician who is licensed to practice in Ohio for a period of at least 2 years immediately preceding his or her election or appointment as Coroner, and who is in good standing in his profession; or is a person who was serving as Coroner on October 12, 1945.

Deputies. When the Coroner is absent or unable to discharge the duties of the office, the Coroner may appoint a qualified person to act as Coroner during such absence or disability. The Coroner may also appoint, in writing, one or more licensed physicians of good standing as assistants, one of whom may be designated as Chief Deputy Coroner.

Deaths Investigated. The Coroner must investigate all deaths that occur as a result of criminal or other violent means by casualty or suicide; suddenly when in apparent health; in any suspicious or unusual manner; and related to any public health threat.
Statutory References. Ohio Rev. Code Ann. Sections 149.43; 313.01 et seq.; 325.15; 2921.22(c); 3705.05, 3705.16, 3705.17.

Comments. (1) Coroners are not allowed to actively practice law while in office. (2) All Ohio counties have coroners except for Summit County which has a county medical examiner system. (3) Vinton County is the only Ohio county that does not have its own coroner/medical examiner. Vinton County is covered by the Coroner from Jackson County.

STUDY METHODS

Ohio Deaths. The Ohio Bureau of Vital Statistics supplied a copy of their death certificate records for the years 1996 through 2001. The records included cause of death, whether the coroner reviewed the case, and whether there was an autopsy. Rates of death were computed using the 2000 US Census SF1.

Ohio Coroners. Surveys were sent via the U.S. Postal Service to Ohio's 86 coroners and one medical examiner. The initial mailing included a cover letter, survey, and self addressed stamped envelope Postcard reminders were sent out about one week later. Four weeks after that a second full mailing and then another postcard mailing were sent. Prior to the mailings a presentation was given explaining the project at the annual meeting of the Ohio Coroners Association. A draft copy of the survey was distributed form comments. Eventually 60 coroners responded (69%) to the survey, though not every respondent answered all the questions.

Coroners from neighboring states. Following the same format, surveys were sent to 177 coroners from nearby states. 81 (45.8%) of 177 forms sent out were returned. The distribution to the states was 67 to Pennsylvania, 81 to Indiana, 9 to West Virginia, 5 to New York, 10 to Kentucky, and 5 to Michigan.

Ohio Trauma Program Medical Directors. Again following the survey format used with Ohio Coroners as indicated above, 59 Ohio emergency services and trauma medical directors were surveyed with 36 (61%) responding.

RESULTS

Overview of Ohio deaths and autopsies. The number of injury deaths and autopsies are presented to provide a context and a baseline. Ohio death certificate records identified 623,050 deaths from 1996 through 2001, of which 29,763 (4.8%) were attributed to injuries. Table 3 illustrates the major causes of death. A little over three out

of every 100 deaths are caused by unintentional injuries. About twice as many people die at their own hands (approximately 1 out of every 100 deaths are self-inflicted) as die at the hands of others (approximately 1 out of every 200 deaths are assaults). There was a statistically significant association between the year of death and major cause (Chi Square = 112, $p<.0001$) that appeared to be due to an increase in unintentional deaths starting in year 2000 (Table 3).

Table 3. Ohio Deaths by year and major type of injury.

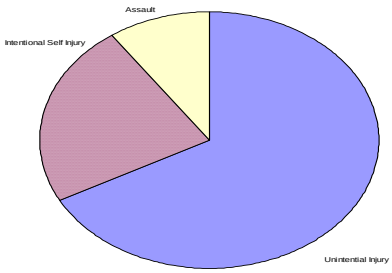
Year	Reason for Death				Number of Deaths
	Unintentional	Self Injured	Assault	Non-Injury	
1996	3.1%	1.1%	0.6%	95.2%	104,054
1997	3.0	1.1	0.5	95.5	102,407
1998	3.1	1.2	0.5	95.2	102,567
1999	3.1	1.1	0.4	95.4	105,040
2000	3.3	1.0	0.4	95.3	104,477
2001	3.6	1.1	0.5	94.8	104,505
Total	3.2	1.1	0.5	95.2	623,050

The death certificate indicates whether a death has been reviewed by a coroner. Of 593,287 non-injury deaths, 13.0 percent were reviewed by coroners. This was substantially less than the 90.1 percent of injury deaths that were reviewed by coroners. A review by the coroner included an autopsy in 29.4 percent of the non-injured cases. People who died of an injury and were reviewed by a coroner had an autopsy 69.7 percent of the time statewide across all ages. The above percentages do not include the few cases in which the death certificate was marked "unknown." Thirty percent of the injury deaths were drivers or passengers in motor vehicle crashes. Of those, about 64 percent had an autopsy. Figure 1 illustrates the general type of injuries suffered by Ohioans from 1996 through 2001. Figure 2 shows the relative proportion of cases reviewed by coroners and, of those reviewed, autopsies performed. In addition there were 135 injury autopsies performed whose cases were not marked on the death certificate as reviewed by Ohio coroners (e.g. hospital autopsy performed). Table 4 provides information on the autopsy rate by general cause of death from 1996 through 2001. There was a statistically significant relationship between the year and performing an autopsy in unintentional and self injured deaths, but not for death by assault. In general, assaults were subject to a high autopsy rate that has been consistent over the reporting period. The autopsy rate for unintentional and self injured cases has steadily increased.

Table 4. Percent of injury deaths autopsied for cases that were reviewed by Ohio coroners

Year	Major reason for injury			Number of Deaths Reviewed by Coroner
	Unintentional	Self Injured	Assault	
1996	56.4%	50.0%	97.8%	2,990
1997	56.1	52.5	96.5	2,765
1998	60.2	56.4	97.0	3,093
1999	66.6	57.9	97.6	3,262
2000	60.4	61.7	98.3	3,179
2001	60.2	66.5	98.1	3,546
Chi Square	127.1	84.6	3.4	
p	<0.001	<0.001	=0.64	

Figure 1. Types of injury in the State of Ohio from 1996 through 2001.		**Figure 2**. Overall number of injury autopsies completed during 1996 to 2001 period.



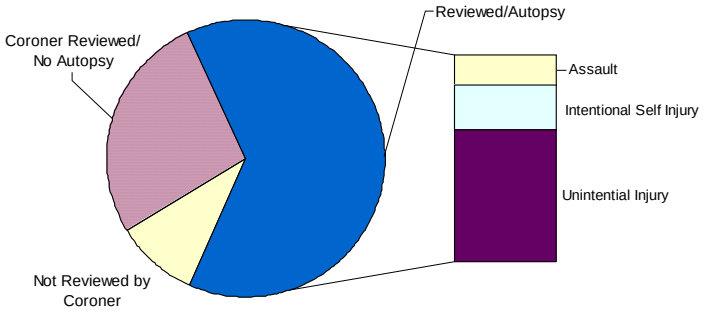


Figure 3 briefly describes injury deaths by county. In this map the background color of each county represents the population density. The densest counties are Cuyahoga, Hamilton, and Franklin and represent those areas of the state with the largest number of people per square mile as reported in the 2000 census. The pie charts within each county illustrate the proportion of injury deaths due to unintentional injuries, self-inflicted injuries (suicides), and assaults. The size of the pie reflects the **rate of injury by death per 100,000**. It should be noted that rate of death by injury does not parallel population density. The three largest counties do not have the largest pie charts (i.e. the highest death rate by injury). Rather the rural communities appear to be more dangerous in terms of the chances of dying by injury.

Figure 3. Rate of injury intent and injury deaths by county.

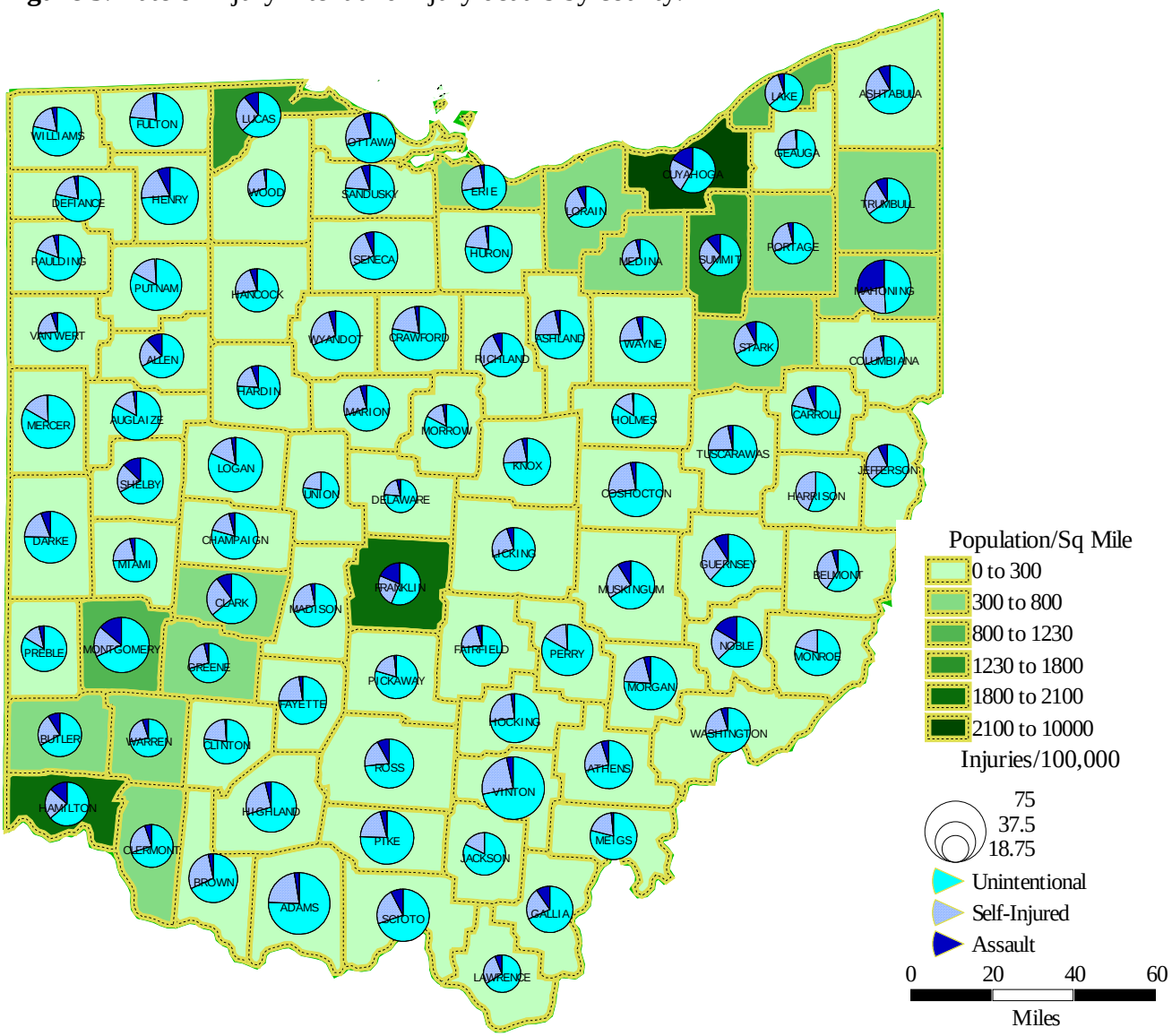


Table 5 provides a rank ordering of the counties with the greatest rates of injury in the three major categories. These are counties that exceed the mean death rate of Ohio counties by two standard deviations. Mean and standard deviations (SD) for identifying the outliers were computed by a ten percent trimming at both ends of the ranks (i.e. the nine highest and lowest overall injury rate counties were dropped when computing means and SD). Again this illustrates the predominance of rural counties with the highest rates of death by injury. In addition it points out that Mahoning County has a serious problem with death by assaults in terms of number of deaths per 100,000 population.

Table 5. Death rate by injury per 100,000 population.

Total Injury Deaths		Unintentional		Self-Inflicted		Assaults	
Vinton	74	Adams	55	Vinton	18	Mahoning	16
Adams	73	Vinton	53	Guernsey	16	Montgomery	8
Henry	63	Logan	48	Adams	16	Noble	8
Montgomery	60	Mercer	47	Harrison	15	Cuyahoga	7
Logan	58	Henry	47	Coshocton	14	Franklin	7
Coshocton	58	Crawford	44	Brown	14	Shelby	6
Crawford	57	Putnam	44	Belmont	13	Hamilton	5
Pike	57	Perry	44	Wyandot	13	Clark	5
Mahoning	56	Fulton	43	Highland	13	Guernsey	5
Mercer	56	Pike	43	Clark	13	Allen	5
Morgan	56	Morgan	43			Henry	5
Fulton	56	Coshocton	42			Lucas	4
						Gallia	4
County Mean	44.2	Mean	32.2	Mean	9.9	Mean	2.1
SD	9.4	SD	8.0	SD	2.3	SD	1.1

Figure 4 further shows the relationship between population density and rate of injury deaths per 100,000 population. There is a higher rate of injury deaths in rural counties as seen by the highest rate of injury deaths at the lowest population densities.

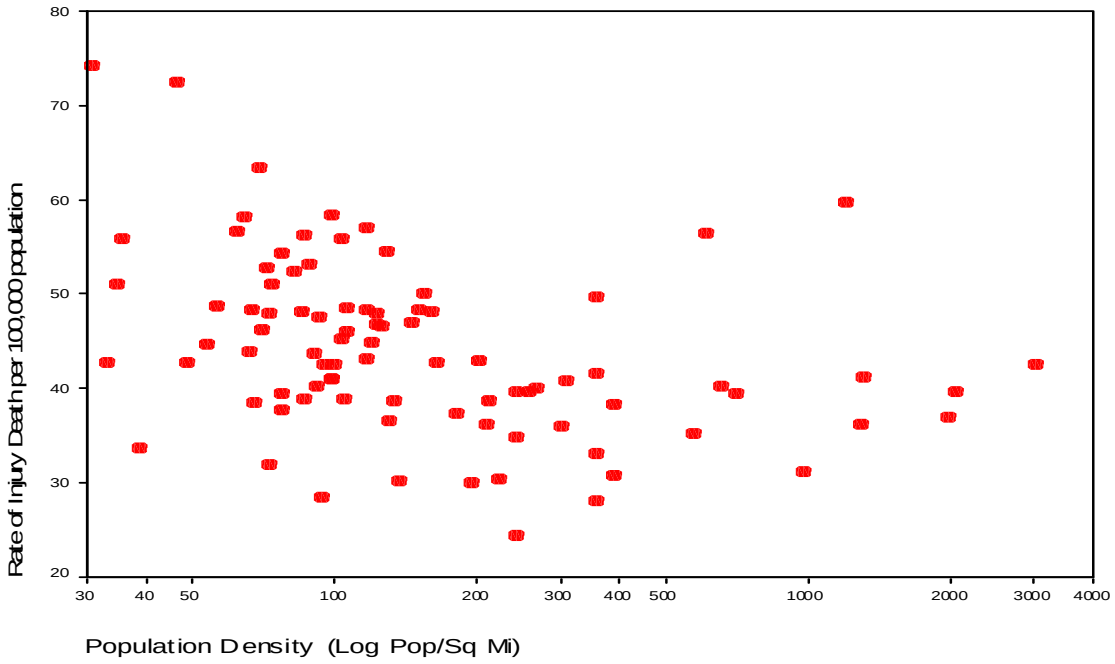


Figure 4. Relationship between population density and rate of injury death.

The map in Figure 5 illustrates the proportion of deaths that have autopsies. The counties are shaded based on their rate of injury deaths per 100,000 population. The size of the pie represents the actual number of injury deaths. Again the counties with high rates of injury deaths were not the same counties as those with a large number of injury deaths. The urban areas had more deaths by injury because they had more people, but the rural counties had a larger proportion of their population die by injury. The open clear slice of the pie represents the proportion of injury deaths that were **not** reviewed by a coroner. The solid slice is the proportion of injury deaths that were reviewed by coroners and had autopsies. Most of the injury deaths had autopsies.

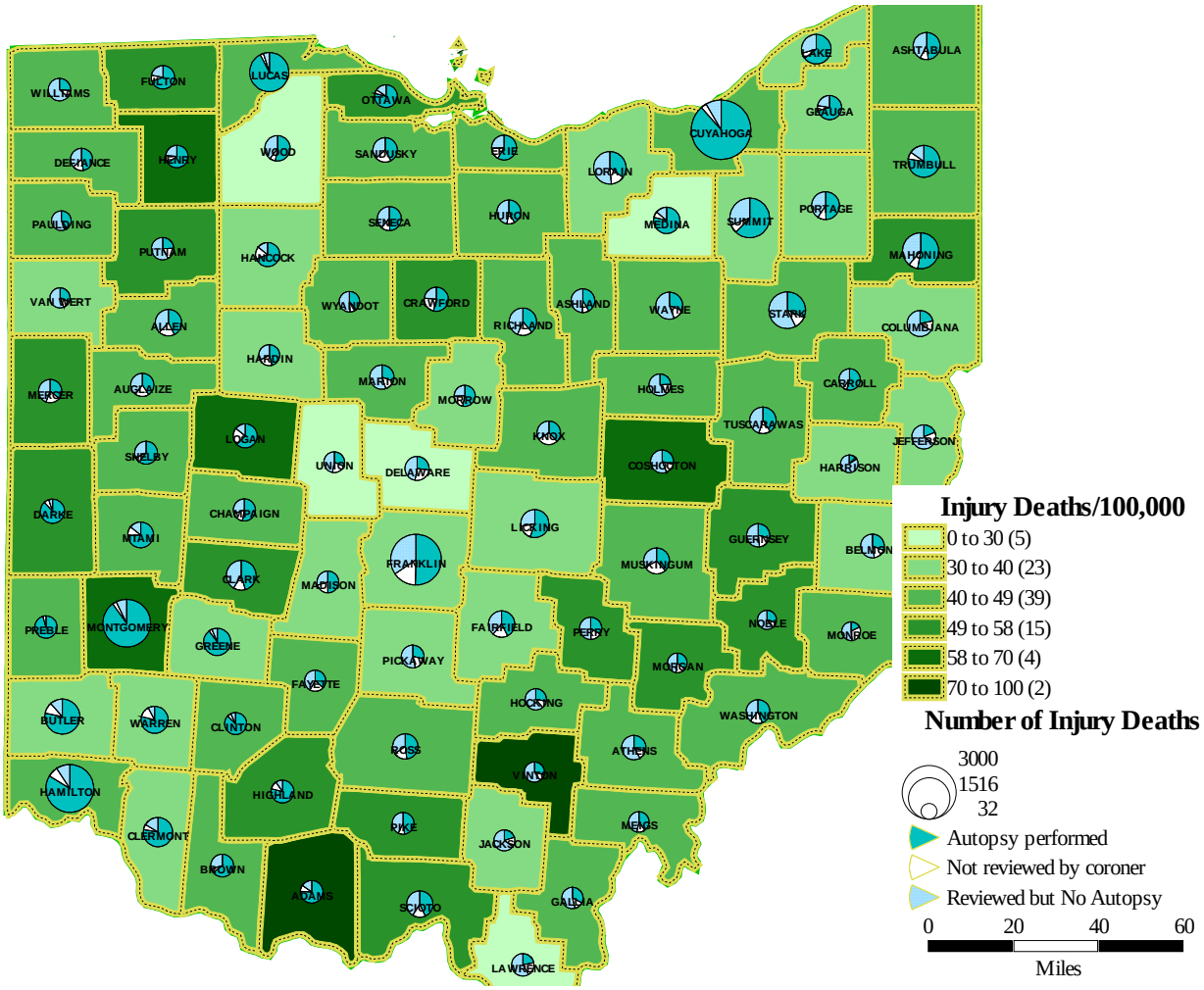


Figure 5. Rate of injury deaths and the number of autopsies performed.

Across the state of Ohio 69.3% of the unintentional deaths reviewed by coroners had autopsies; 58.2% self-inflicted deaths had autopsies; and 97.7% of the assaults were autopsied.

Survey Results. The first study objective **(Objective 1.1)** was to identify which injury types are deemed appropriate for autopsy. Table 6 provides the percentage of responses for each option type related to each type of injury. Essentially all mechanisms are sometimes perceived as appropriate for autopsy. The Ohio coroners' top reasons to always perform an autopsy were when the mechanism of injury was unknown (65%) or when there was death involving fire or flame (50%), suffocation (49%), strangulation (49%), cutting/piercing/stabbing (44%), or unspecified motor vehicle crash (41%) injuries. Differences in opinion were expressed on some of the items. Trauma medical directors (TMDs) felt there should be more autopsies in deaths from firearms, motor vehicle crashes in general, those involving pedestrians and motorcycles, drownings, pedalists, and pedestrians struck by non-motor vehicles. Ohio coroners felt there should be more autopsies than TMDs in deaths involving strangulation and fire/flame.

Table 6. *On which trauma victims do you consider it to be appropriate to perform an autopsy? Which of the following **MECHANISMS OF INJURY** identified by the CDC usually indicate an autopsy? When it is never appropriate to perform an autopsy, indicate if toxicology only should be performed:*

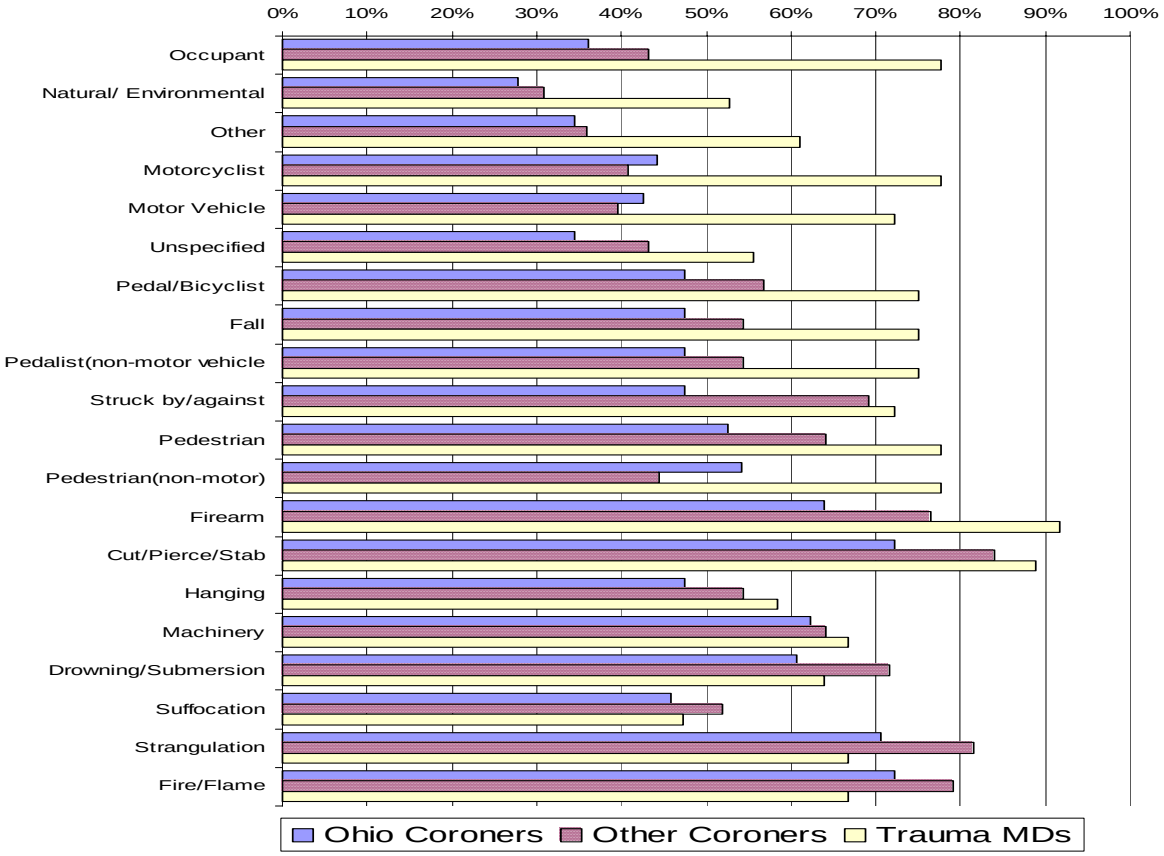
Percentage		*Appropriate to perform an autopsy*					*Appropriate for*
		Always	*Usually*	*Sometimes*	*Seldom*	*Never*	*toxicology only*
Cut / Pierce /Stab Chi Square p=0.239	Ohio Coroner	44.4%	37.0	16.7	1.9	0.0	0.0
	Other Coroner	54.4	31.6	13.9	0.0	0.0	0.0
	Trauma MD	62.9	28.6	5.7	0.0	0.0	0.0
Firearm Chi Square p=0.013	Ohio Coroner	35.8	37.7	24.5	1.9	0.0	0.0
	Other Coroner	48.1	30.4	21.5	0.0	0.0	0.0
	Trauma MD	71.4	22.9	2.9	0.0	0.0	0.0
Motor Vehicle Traffic Chi Square p=0.001	Ohio Coroner	28.8	21.2	40.4	3.8	0.0	5.8
	Other Coroner	16.7	27.8	54.2	1.4	0.0	0.0
	Trauma MD	48.4	35.5	6.5	3.2	0.0	3.2
Motorcyclist Chi Square p=0.007	Ohio Coroner	28.3	22.6	35.8	7.5	0.0	5.7
	Other Coroner	18.2	24.7	50.6	5.2	0.0	1.3
	Trauma MD	45.7	34.3	14.3	0.0	0.0	2.9
Occupant Chi Square p=0.008	Ohio Coroner	20.8	20.8	35.8	18.9	1.9	1.9
	Other Coroner	18.8	25.0	42.5	11.3	1.3	1.3
	Trauma MD	45.7	34.3	11.4	2.9	2.9	0.0
Other Chi Square p=0.057	Ohio Coroner	25.0	27.5	32.5	12.5	2.5	0.0
	Other Coroner	18.8	23.2	46.4	7.2	1.4	2.9
	Trauma MD	40.0	33.3	13.3	3.3	6.7	0.0
Pedal / Bicyclist Chi Square p=0.040	Ohio Coroner	30.2	24.5	26.4	11.3	3.8	3.8
	Other Coroner	26.3	31.3	37.5	5.0	0.0	0.0
	Trauma MD	45.7	31.4	14.3	2.9	2.9	0.0
Pedestrian	Ohio Coroner	37.7	22.6	30.2	3.8	1.9	3.8

Chi Square p=0.211	Other Coroner	35.4	30.4	31.6	2.5	0.0	0.0
	Trauma MD	45.7	34.3	11.4	0.0	2.9	2.9

Unspecified Chi Square p=0.305	Ohio Coroner	41.7	16.7	33.3	5.6	0.0	2.8
	Other Coroner	27.7	26.2	41.5	1.5	1.5	1.5
	Trauma MD	46.4	25.0	17.9	7.1	0.0	0.0
Suffocation Chi Square p=0.241	Ohio Coroner	48.7	23.1	25.6	2.6	0.0	0.0
	Other Coroner	49.2	22.0	25.4	1.7	0.0	1.7
	Trauma MD	54.5	22.7	4.5	9.1	0.0	4.5
Hanging Chi Square p=0.362	Ohio Coroner	32.1	22.6	26.4	17.0	0.0	1.9
	Other Coroner	32.9	22.8	30.4	11.4	0.0	2.5
	Trauma MD	31.4	28.6	17.1	8.6	2.9	8.6
Strangulation Chi Square p=0.015	Ohio Coroner	49.1	32.1	17.0	1.9	0.0	0.0
	Other Coroner	67.5	15.0	16.3	1.3	0.0	0.0
	Trauma MD	40.0	28.6	14.3	8.6	2.9	2.9
Struck By / Against Chi Square p=0.141	Ohio Coroner	40.0	18.0	34.0	6.0	0.0	2.0
	Other Coroner	53.3	21.3	22.7	1.3	1.3	0.0
	Trauma MD	44.1	32.4	17.6	0.0	2.9	0.0
Drowning / Submersion Chi Square p=0.001	Ohio Coroner	30.8	38.5	26.9	1.9	0.0	1.9
	Other Coroner	43.8	28.8	25.0	1.3	0.0	1.3
	Trauma MD	37.1	28.6	8.6	17.1	5.7	0.0
Fall Chi Square p=0.004	Ohio Coroner	24.5	30.2	30.2	15.1	0.0	0.0
	Other Coroner	21.3	33.8	41.3	3.8	0.0	0.0
	Trauma MD	34.3	42.9	14.3	0.0	2.9	2.9
Pedalist (non-motor vehicle related) Chi Square p=0.074	Ohio Coroner	23.5	33.3	33.3	5.9	0.0	3.9
	Other Coroner	26.6	29.1	38.0	6.3	0.0	0.0
	Trauma MD	40.0	37.1	14.3	2.9	2.9	0.0
Fire / Flame Chi Square p=0.014	Ohio Coroner	50.9	29.1	12.7	7.3	0.0	0.0
	Other Coroner	62.5	17.5	17.5	2.5	0.0	0.0
	Trauma MD	31.4	37.1	17.1	5.7	0.0	5.7
Pedestrian (non-motor vehicle) Chi Square p=0.007	Ohio Coroner	28.8	34.6	28.8	3.8	0.0	3.8
	Other Coroner	24.4	21.8	48.7	5.1	0.0	0.0
	Trauma MD	40.0	40.0	14.3	0.0	2.9	0.0
Machinery Chi Square p=0.094	Ohio Coroner	37.0	31.5	24.1	7.4	0.0	0.0
	Other Coroner	39.2	26.6	31.6	2.5	0.0	0.0
	Trauma MD	38.2	32.4	14.7	8.8	5.9	0.0
Natural / Environmental Chi Square p=0.081	Ohio Coroner	21.2	11.5	50.0	15.4	1.9	0.0
	Other Coroner	10.1	21.5	55.7	11.4	0.0	1.3
	Trauma MD	23.5	32.4	29.4	8.8	2.9	0.0
Overexertion Chi Square p=0.048	Ohio Coroner	24.5	30.2	28.3	15.1	0.0	1.9
	Other Coroner	15.0	21.3	47.5	15.0	1.3	0.0
	Trauma MD	29.4	35.3	14.7	11.8	2.9	2.9

Hot Object Chi Square p=0.018	Ohio Coroner	20.4	34.7	34.7	10.2	0.0	0.0
	Other Coroner	24.0	20.0	46.7	8.0	0.0	1.3
	Trauma MD	20.6	38.2	14.7	14.7	5.9	2.9
Bites / Stings Chi Square p=0.217	Ohio Coroner	25.0	34.6	26.9	7.7	1.9	3.8
	Other Coroner	35.1	24.7	27.3	10.4	0.0	2.6
	Trauma MD	20.0	28.6	17.1	20.0	2.9	8.6
Transport, Other (non-motor vehicle) Chi Square p=0.149	Ohio Coroner	28.8	30.8	28.8	7.7	1.9	1.9
	Other Coroner	25.7	25.7	39.2	8.1	0.0	1.4
	Trauma MD	35.3	44.1	5.9	8.8	2.9	2.9
Other Chi Square p=0.068	Ohio Coroner	24.1	20.7	48.3	6.9	0.0	0.0
	Other Coroner	13.8	17.2	62.1	3.4	1.7	1.7
	Trauma MD	34.6	26.9	19.2	7.7	7.7	0.0
Unknown Mechanism Chi Square p=0.166	Ohio Coroner	65.3	20.4	12.2	2.0	0.0	0.0
	Other Coroner	59.5	77.1	59.5	77.1	0.0	0.0
	Trauma MD	21.5	17.1	21.5	17.1	0.0	0.0

Figure 6. Perception of the appropriateness of an autopsy by mechanism of injury among Ohio and non-Ohio coroners and Ohio trauma medical directors.



Mechanisms of Injury were not broken down by intention. The Oho Bureau of Vital Statistics categorizes death certificate data according to the National Center for Health Statistics Cause Codes.

Table 7. Proportion of Injury Deaths that had autopsies by National Center for Health Statistics Cause Code

Unintentional Injury	
Accidental poisoning and exposure to noxious substances	85.6%
Accidental drowning and submersion	78.8
Accidental exposure to smoke, fire and flames	77.3
Accidental discharge of firearms	76.8
Water, air and space, and other and unspecified transport	74.0
Other land transport accidents	72.6
Other and unspecified non-transport accidents and their	68.4
Falls	63.5
Motor vehicle accidents	65.2
Intentional self-harm	
Intentional self-harm (suicide) by other and unspecified	62.4
Intentional self-harm (suicide) by discharge of firearms	54.8
Assault	
Assault (homicide) by other and unspecified means	98.1
Assault (homicide) by discharge of firearms	97.5

Objective 1.2 of the study was to determine the barriers to performing autopsies. The major barriers identified in Ohio were the lack of funds, personnel, and equipment. Personnel, equipment, and funds appear to be significantly less of a problem in other states surveyed than in Ohio. There were substantially more Ohio coroners who expressed that trauma related autopsies were not necessary, in contrast to non-Ohio coroners and Ohio TMDs who felt they were necessary.

The coroners reported the actual number of autopsies performed for each injury type. The sample represented the reporting of 3531 autopsies. Coroners reported that 78 autopsies (2%) should have been performed but were not because of various barriers.

Table 8. *For each of the following **MECHANISMS** of injury how many autopsies did you perform in **2001?***

Percent of autopsies conducted for each type of injury	***Number actually performed***	***Number of autopsies that should have been performed but were not due to a BARRIER****	***Number of autopsies performed because another county made a request***
Cut / Pierce /Stab	1.6%	0.0%	0.6%
Firearm	19.4	19.2	20.8
Motor Vehicle Traffic	12.1	43.6	7.4
Motorcyclist	1.5	2.6	0.8
Occupant	14.2	0.0	23.9
Other	5.0	0.0	11.5
Pedal / Bicyclist	0.4	1.3	0.0
Pedestrian	2.5	1.3	1.4
Unspecified	0.2	0.0	1.4
Suffocation	2.1	2.6	2.7
Hanging	4.5	0.0	3.3
Strangulation	0.7	1.3	0.6
Struck By / Against	1.7	2.6	3.1
Drowning / Submersion	2.7	11.5	3.7
Fall	9.9	1.3	3.9
Pedalist (non-motor vehicle)	0.0	3.8	0.0
Fire / Flame	2.9	2.6	1.0
Pedestrian (non-motor vehicle)	0.0	0.0	0.4
Machinery	0.5	1.3	0.2
Natural / Environmental	8.5	0.0	0.4
Overexertion	0.0	0.0	0.0
Hot Object	0.1	0.0	0.0
Bites / Stings	0.1	0.0	0.0
Transport, Other (non-motor vehicle)	0.3	1.3	0.2
Other	7.6	3.8	12.4
Unknown Mechanism	1.4	0.0	0.0
Total Number of Autopsies	**3531**	**78**	**485**

Figure 7. Comparison of Ohio and non-Ohio coroners' and Ohio trauma medial directors' perceptions on commonly cited barriers to injury-related autopsies.

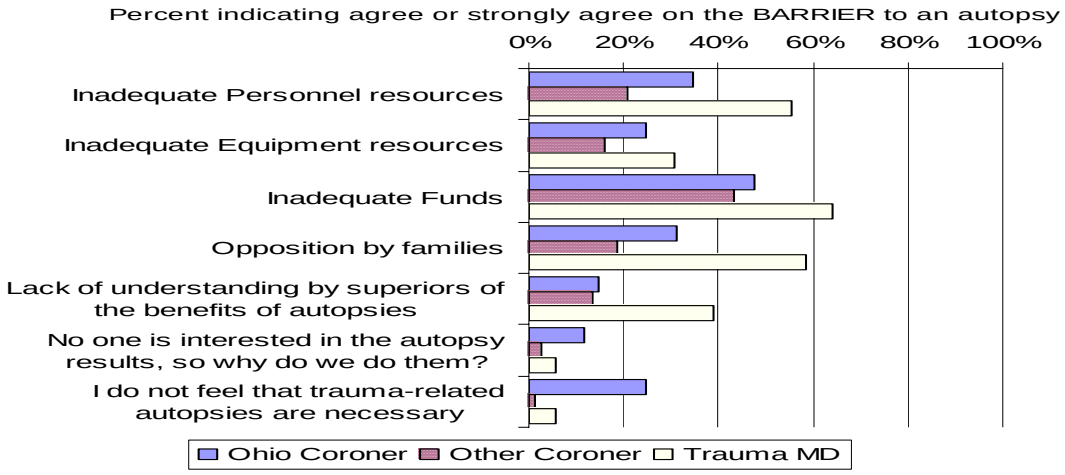


Table 9. *At my agency, **BARRIERS** to requesting or conducting trauma-related autopsies are:*

		Strongly Disagree	*Disagr*	*Undecide*	*Agree*	*Strongl Agree*
Inadequate Personnel resources Chi Square p=0.0001	Ohio Coroner	35.2	22.2	3.7	14.8	24.1
	Other Coroner	31.3	41.3	6.3	16.3	5.0
	Trauma MD	11.4	20.0	8.6	42.9	14.3
Inadequate Equipment resources Chi Square p=0.0001	Ohio Coroner	37.7	30.2	3.8	9.4	18.9
	Other Coroner	28.8	46.3	8.8	11.3	5.0
	Trauma MD	14.3	22.9	28.6	22.9	8.6
Inadequate Funds Chi Square p=0.0001	Ohio Coroner	27.3	16.4	1.8	12.7	41.8
	Other Coroner	25.0	26.3	5.0	30.0	13.8
	Trauma MD	8.6	5.7	14.3	28.6	37.1
Opposition by families Chi Square p=0.001	Ohio Coroner	13.2	34.0	18.9	28.3	5.7
	Other Coroner	22.8	43.0	15.2	17.7	1.3
	Trauma MD	5.7	20.0	11.4	42.9	17.1
Lack of understanding by superiors of the benefits of autopsies Chi Square p=0.011	Ohio Coroner	30.8	42.3	9.6	15.4	1.9
	Other Coroner	34.2	39.2	12.7	11.4	2.5
	Trauma MD	5.7	31.4	20.0	31.4	8.6
No one is interested in the autopsy results, so why do them? Chi Square p=0.012	Ohio Coroner	41.5	34.0	13.2	9.4	1.9
	Other Coroner	53.8	41.3	2.5	1.3	1.3
	Trauma MD	25.7	51.4	14.3	5.7	0.0
I do not feel that trauma-	Ohio Coroner	38.5	21.2	13.5	15.4	11.5

related autopsies are necessary Chi Square p=0.0001	Other Coroner	63.8	31.3	3.8	1.3	0.0
	Trauma MD	73.5	14.7	2.9	2.9	2.9

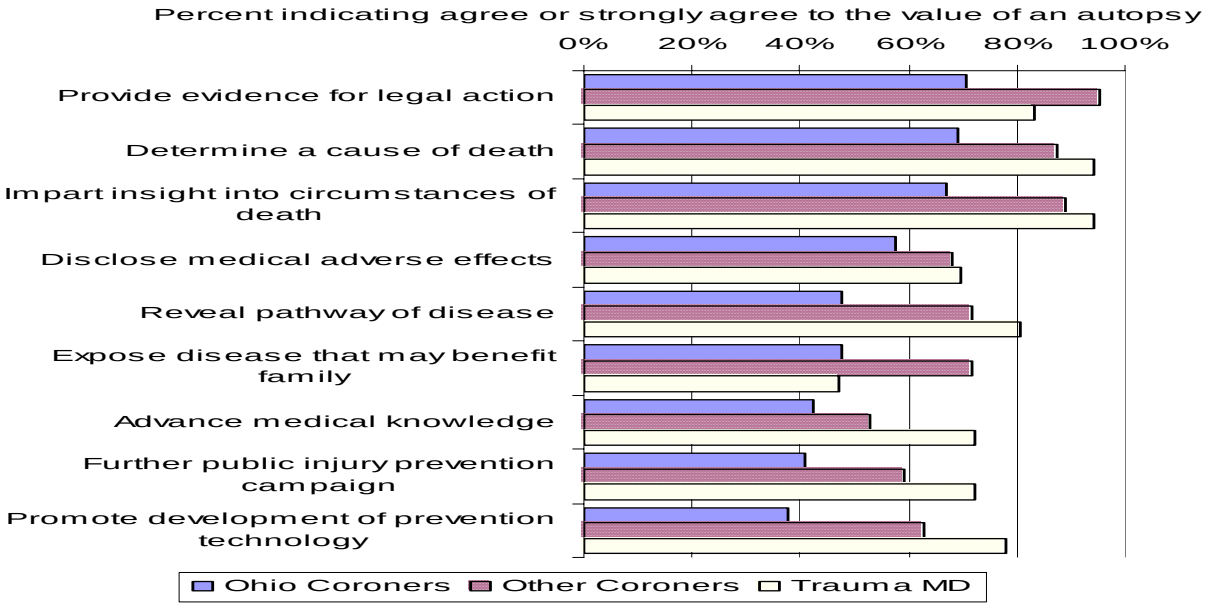
The value of the autopsy was expressed. Once past the obvious value of the determination of cause and manner of death, the Ohio coroners appeared to see the value of autopsies relating to the legal system more than to injury prevention or advancing medical knowledge. A majority felt the autopsy had value in imparting genetic information to relatives. In general, coroners from other states and the trauma medical directors in Ohio ranked the value of autopsies higher than the value ranking by Ohio coroners.

Table 10. *Autopsies in trauma victims have **VALUE** because they:*

		Strongly Disagree	*Disagr*	*Undecide*	*Agree*	*Strongly* Agree
Determine a cause & manner of death Chi Square p=0.006	Ohio Coroner	1.8	14.5	7.3	41.8	34.5
	Other Coroner	3.7	3.7	4.9	46.9	40.7
	Trauma MD	0.0	0.0	0.0	31.4	65.7
Impart insight into the circumstances of death Chi Square p=0.003	Ohio Coroner	3.6	10.9	9.1	52.7	23.6
	Other Coroner	1.2	1.2	8.6	56.8	32.1
	Trauma MD	0	0	0	44.1	55.9
Provide evidence for legal action Chi Square p=0.028	Ohio Coroner	1.9	9.3	9.3	44.4	35.2
	Other Coroner	1.2	0	3.7	37.0	58.0
	Trauma MD	0	2.9	8.6	37.1	48.6
Reveal the pathway of a disease Chi Square p=0.022	Ohio Coroner	20.4	25.9	38.9	14.8	1.8
	Other Coroner	1.2	7.4	19.8	48.1	23.5
	Trauma MD	0	0	14.3	57.1	25.7
Disclose medical adverse effects Chi Square p=0.384	Ohio Coroner	1.8	14.3	21.4	50.0	12.5
	Other Coroner	1.3	10.0	20.0	50.0	18.8
	Trauma MD	0.0	5.9	20.6	41.2	32.4
Expose genetic or familial disease that may benefit living relatives Chi Square p=0024	Ohio Coroner	1.8	23.6	21.8	40.0	12.7
	Other Coroner	2.5	11.4	2.5	11.4	2.5
	Trauma MD	8.6	17.1	8.6	17.1	8.6
Advance medical knowledge Chi Square p=030	Ohio Coroner	7.4	22.2	22.2	37.0	11.1
	Other Coroner	2.5	13.6	30.9	34.6	18.5
	Trauma MD	0.0	2.9	20.0	45.7	28.6
Promote the development of injury prevention technology Chi Square p=0.0001	Ohio Coroner	5.8	23.1	26.9	32.7	11.5
	Other Coroner	1.2	3.7	32.1	44.4	18.5
	Trauma MD	0.0	2.9	14.3	48.6	31.4

Further public injury prevention campaigns Chi Square p=0.0001	Ohio Coroner	10.9	23.6	20.0	36.4	9.1
	Other Coroner	1.2	7.4	32.1	39.5	19.8
	Trauma MD	0.0	2.9	20.0	51.4	22.9

Figure 8. Comparison of the value of trauma-related autopsies among Ohio and non-Ohio coroners and Ohio trauma medical directors.



The reasons coroners conduct autopsies parallel the value of the autopsy.

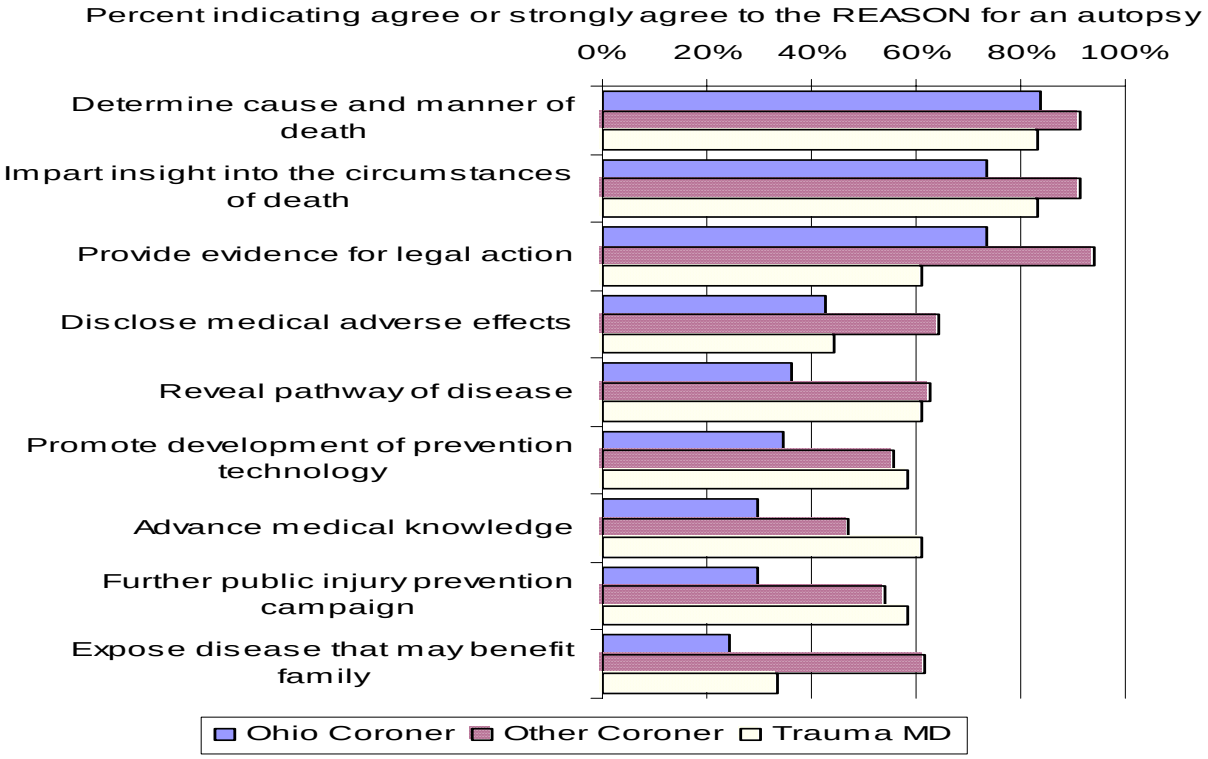


Figure 9. Comparison of the reasons for an autopsy among Ohio and non-Ohio coroners and Ohio trauma medical directors.

Table 11. *The most common **REASON** that I perform or request an autopsy is to:*

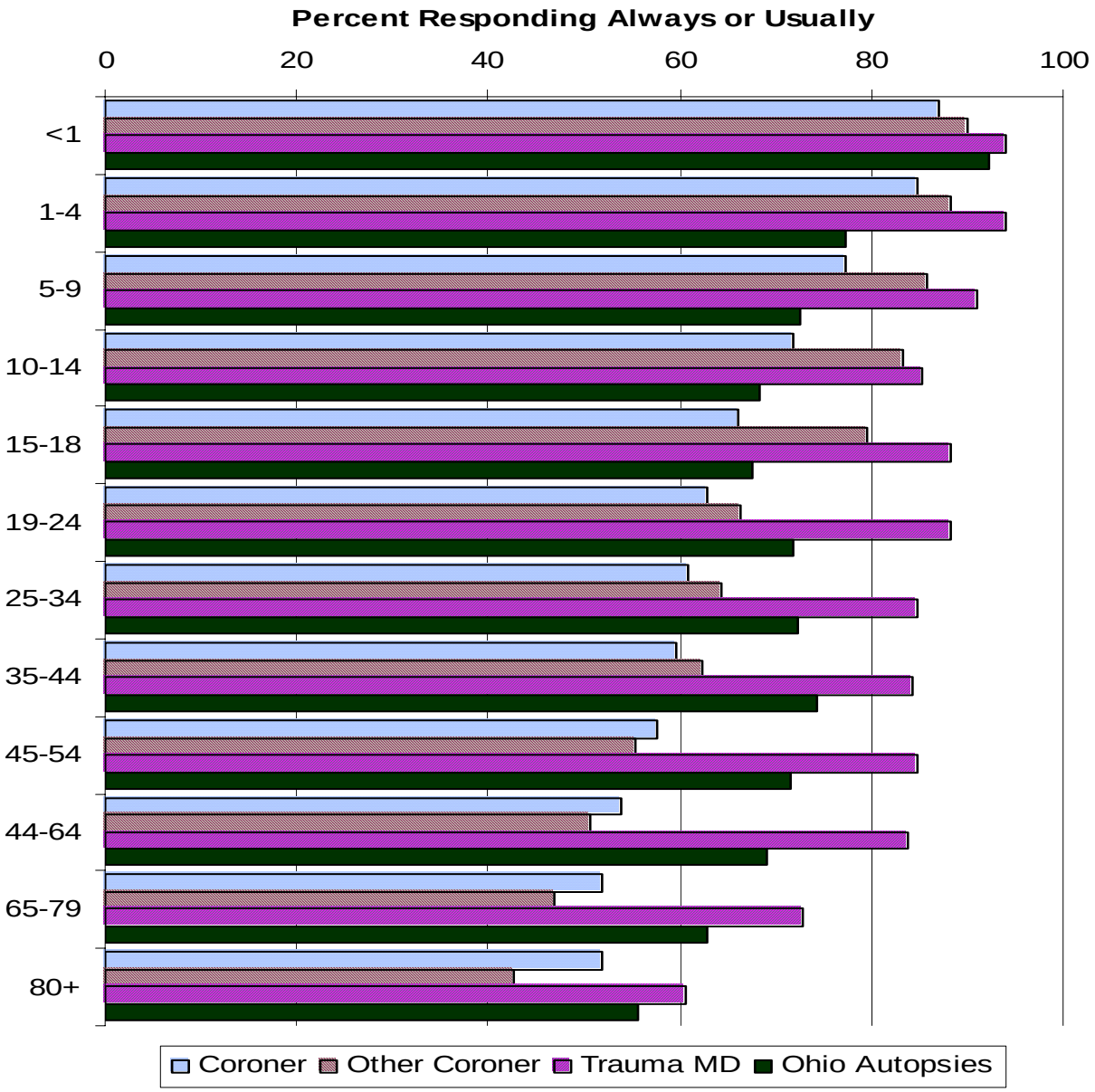
Comparison of the value of trauma-related autopsies among Ohio and non-Ohio coroners and Ohio trauma medical directors.		*Strongly Disagree*	*Disagr*	*Undecide*	*Agree*	*Strongly* Agree
Determine a cause & manner of death Chi Square p=0.335	Ohio Coroner	1.8	5.5	0.0	38.2	52.7
	Other Coroner	4.9	2.5	1.2	33.3	58.0
	Trauma MD	0.0	5.7	5.7	25.7	60.0
Impart insight into the circumstances of death Chi Square p=0.324	Ohio Coroner	3.7	11.1	3.7	48.1	33.3
	Other Coroner	1.2	2.5	4.9	55.6	35.8
	Trauma MD	0.0	2.9	8.6	42.9	42.9
Provide evidence for legal action Chi Square p=0.005	Ohio Coroner	3.7	7.4	3.7	44.4	40.7
	Other Coroner	2.5	0.0	3.7	44.4	49.4
	Trauma MD	2.9	17.1	14.3	40.0	22.9
Reveal the pathway of a disease Chi Square p=0.222	Ohio Coroner	3.8	21.2	32.7	32.7	9.6
	Other Coroner	2.5	12.3	22.2	40.7	22.2
	Trauma MD	0.0	11.4	22.9	42.9	20.0
Disclose medical adverse effects Chi Square p=0.173	Ohio Coroner	5.8	17.3	26.9	36.5	13.5
	Other Coroner	2.5	10.1	21.5	49.4	16.5
	Trauma MD	5.7	11.4	34.3	22.9	22.9
Expose genetic or familial disease that may benefit living relatives Chi Square p=0.005	Ohio Coroner	3.8	34.0	34.0	20.8	7.5
	Other Coroner	3.7	14.8	19.8	37.0	24.7
	Trauma MD	8.6	34.3	20.0	22.9	11.4
Advance medical knowledge Chi Square p=0.016	Ohio Coroner	11.1	29.6	25.9	24.1	9.3
	Other Coroner	5.0	22.5	25.0	33.8	13.8
	Trauma MD	0.0	2.9	31.4	40.0	22.9
Promote the development of injury prevention technology Chi Square p=0.073	Ohio Coroner	15.4	23.1	21.2	28.8	11.5
	Other Coroner	3.7	16.0	24.7	42.0	13.6
	Trauma MD	0.0	17.1	20.0	45.7	14.3
Further public injury prevention campaigns Chi Square p=0.061	Ohio Coroner	11.3	28.3	26.4	22.6	11.3
	Other Coroner	3.7	17.3	24.7	38.3	16.0
	Trauma MD	0.0	17.1	20.0	42.9	17.1

One of the determinants of conducting an autopsy is the age of the trauma victim. The younger the victim, the more likely the autopsy. In general other state coroners and Ohio trauma medical directors expressed the opinion that autopsies should be performed more often than Ohio coroners.

Table 12. *Indicate which of the following trauma victim* ***AGE IN YEARS AT FATALITY*** *in which it is:*

Age	Respondent	Appropriate to perform an autopsy			
		Always	Usually	Sometimes	Seldom
< 1	Ohio Coroner	66.7%	20.4%	11.1%	1.9%
Chi Square p=0.381	Other Coroner	73.8	16.3	10	
92.3 percent autopsied	Trauma MD	70.6	23.5	2.9	2.9
1-4	Ohio Coroner	47.2	37.7	13.2	1.9
Chi Square p=0.245	Other Coroner	62.8	25.6	11.5	
77.3 percent autopsied	Trauma MD	67.6	26.5	2.9	2.9
5-9	Ohio Coroner	32.1	45.3	20.8	1.9
Chi Square p=0.026	Other Coroner	52.6	33.3	14.1	
72.5 percent autopsied	Trauma MD	67.6	23.5	5.9	2.9
10-14	Ohio Coroner	30.2	41.5	26.4	1.9
Chi Square p=0.111	Other Coroner	48.7	34.6	16.7	
68.2 percent autopsied	Trauma MD	58.8	26.5	11.8	2.9
15-18	Ohio Coroner	28.3	37.7	30.2	1.9
Chi Square p=0.05	Other Coroner	44.9	34.6	20.5	
67.6 percent autopsied	Trauma MD	55.9	32.4	8.8	2.9
19-24	Ohio Coroner	27.5	35.3	33.3	2
Chi Square p=0.068	Other Coroner	29.9	36.4	32.5	1.3
71.7 percent autopsied	Trauma MD	55.9	32.4	8.8	2.9
25-34	Ohio Coroner	27.5	33.3	35.3	2
Chi Square p=0.084	Other Coroner	28.9	35.5	34.2	1.3
72.4 percent autopsied	Trauma MD	57.6	27.3	12.1	3
35-44	Ohio Coroner	26.9	32.7	38.5	1.9
Chi Square p=0.060	Other Coroner	29.9	32.5	36.4	1.3
74.3 percent autopsied	Trauma MD	56.3	28.1	12.5	3.1
45-54	Ohio Coroner	26.9	30.8	40.4	1.9
Chi Square p=0.012	Other Coroner	21.1	34.2	43.4	1.3
71.5 percent autopsied	Trauma MD	54.5	30.3	12.1	3
55-64	Ohio Coroner	26.9	26.9	42.3	3.8
Chi Square p=0.003	Other Coroner	20.8	29.9	48.1	1.3
69.2 percent autopsied	Trauma MD	54.8	29	9.7	6.5
65-79	Ohio Coroner	23.1	28.8	42.3	5.8
Chi Square p=0.072	Other Coroner	18.2	28.6	45.5	7.8
62.9 percent autopsied	Trauma MD	45.5	27.3	21.2	6.1
80+	Ohio Coroner	23.1	28.8	34.6	13.5
Chi Square p=0.175	Other Coroner	16	26.7	42.7	13.3
55.7 percent autopsied	Trauma MD	42.4	18.2	30.3	9.1

Figure 10. Appropriateness of autopsy by age group. Percent who say the autopsy should always or usually be performed. The numbers are compared to the actual percent of autopsies performed on injury death cases in Ohio from 1996 through 2001.



Similarly another major determinant was the intentional nature of the injury. Intentional injuries and unknown intent were major predictors of performing autopsies. In general, all groups agreed in this category.

Table 13. *Indicate which of the following* ***TRAUMA INTENT*** *of injury it is appropriate to perform an autopsy:*

		Appropriate to perform an autopsy					**Appropriate for Toxicology only**
		Always	*Usually*	*Sometimes*	*Seldom*	*Never*	
Intentional Chi Square p=0.483	Ohio Coroner	68.5	16.7	11.1	1.9	0.0	1.9
	Other Coroner	67.5	15.0	15.0	2.5	0.0	0.0
	Trauma MD	74.3	17.1	2.9	2.9	0.0	0.0
Unintentional Chi Square p=0.132	Ohio Coroner	29.6	37.0	31.5	1.9	0.0	0.0
	Other Coroner	36.7	25.3	36.7	1.3	0.0	0.0
	Trauma MD	42.9	40.0	11.4	2.9	0.0	0.0
Unknown Intent Chi Square p=0.616	Ohio Coroner	57.7	28.8	11.5	1.9	0.0	0.0
	Other Coroner	63.8	25.0	10.0	0.0	0.0	1.3
	Trauma MD	62.9	28.6	5.7	0.0	0.0	0.0

Objective 2.1 of the study was to assess which medical stakeholders in the community routinely utilize autopsy reports and for what purpose. Law enforcement, attorneys, and insurance companies are viewed as the primary stakeholders of autopsy information. About one third of Ohio coroners had the belief that trauma medical professionals seldom or never routinely utilize autopsy reports. In fact, over ninety percent (91.4%) of the TMDs agreed or strongly agreed that they routinely used the reports Coroners from the surrounding states essentially agreed with the Ohio coroners in their belief that trauma physicians seldom use the reports. A similar pattern was noted for EMS personnel. In the "Other" category, the media was identified as a consumer of autopsy data. The questionnaire did not specifically ask about the media.

Other stakeholders were included by coroners. While the objective was to consider the medical community, it is clear that additional groups utilize the autopsy results. Primarily the coroners provide information to families.

List any other people or groups who routinely utilize your autopsy reports:

- Families (11)
- Journalist
- Product/Safety Council
- Medical Students
- State Safety Agencies
- Media

The inquiry posed by the State is consideration of the methods to ensure that autopsy data are reported to the state trauma registry in a timely manner. About 40 percent of the Ohio coroners still type their reports on conventional typewriters rather than in an electronic form that is easily transferred.

Table 14. ***STAKEHOLDERS*** *that routinely utilize autopsy reports through your agency include:*

		Always	*Usually*	*Sometimes*	*Seldom*	*Never*
Trauma medical professionals (trauma physicians / nurses) Chi Square p=0.0001	Ohio Coroner	7.3	7.3	38.2	14.5	32.7
	Other Coroner	7.5	12.5	33.8	27.5	18.8
	Trauma MD	54.3	37.1	2.9	2.9	0.0
Family practice physicians Chi Square p=0.068	Ohio Coroner	3.6	5.5	56.4	23.6	10.9
	Other Coroner	3.7	3.7	37.0	43.2	12.3
	Trauma MD	6.1	12.1	48.5	30.3	0.0
Emergency Medical Services / Paramedics Chi Square p=0.0001	Ohio Coroner	3.6	3.6	45.5	23.6	23.6
	Other Coroner	2.5	3.8	31.3	31.3	31.3
	Trauma MD	20.0	28.6	25.7	22.9	0.0
Public Injury prevention programs (i.e. MADD, Domestic Violence, etc.) Chi Square p=0.0001	Ohio Coroner	1.9	9.4	24.5	34.0	30.2
	Other Coroner	1.3	10.0	26.3	38.8	23.8
	Trauma MD	15.2	39.4	36.4	6.1	0.0
Coroners Chi Square p=0.0001	Ohio Coroner	31.5	13.0	27.8	20.4	7.4
	Other Coroner	2.5	6.3	28.8	40.0	22.5
	Trauma MD	16.1	51.6	19.4	9.7	0.0
Insurance companies Chi Square p=0.109	Ohio Coroner	11.3	35.8	43.4	7.5	1.9
	Other Coroner	11.3	58.8	25.0	3.8	1.3
	Trauma MD	17.2	34.5	31.0	10.3	3.4
Attorneys Chi Square p=0.022	Ohio Coroner	11.5	30.8	44.2	11.5	1.9
	Other Coroner	12.3	50.6	33.3	2.5	1.2
	Trauma MD	30.3	36.4	24.2	3.0	3.0
Law enforcement/ prosecutors Chi Square p=0.057	Ohio Coroner	20.8	37.7	30.2	7.5	3.8
	Other Coroner	35.4	45.6	15.2	3.7	0.0
	Trauma MD	29.4	50.0	17.6	0.0	0.0

Within the survey, a potential format for autopsy reports was posed to ascertain a willingness for standardization of the information. Standardized information would make it easier to consolidate and trend over-disparate groups and diagnoses. About 43% of the Ohio coroners did not like the idea of a standardized reporting format. About half (52.0%) of the non-Ohio coroners either agreed or strongly agreed with the idea. The TMDs expressed that it was very good idea with about 79% of them agreeing or strongly agreeing. The apparent difference may be due to one group burdened with completing the task and the other group wanting the information.

Table 15. *Autopsy data reports that you document or review are* ***FORMATTED***

		Always	*Usually*	*Sometimes*	*Seldom*	*Never*
Typed on a conventional typewriter Chi Square p=0.056	Ohio Coroner	29.3	12.2	2.4	2.4	53.7
	Other Coroner	17.3	13.3	12.0	8.0	49.3
	Trauma MD	15.6	21.9	15.6	15.6	28.1
Electronically in a computer form or spreadsheet Chi Square p=0.029	Ohio Coroner	51.3	5.1	7.7	10.3	25.6
	Other Coroner	46.1	13.2	5.3	9.2	26.3
	Trauma MD	19.4	35.5	6.5	12.9	25.8
Electronically in a computer database that can download and collate data Chi Sq p=0.089	Ohio Coroner	36.1	2.8	5.6	5.6	50.0
	Other Coroner	46.1	13.2	5.3	9.2	26.3
	Trauma MD	18.8	34.4	6.3	12.5	25.0
By E codes Chi Square p=0.013	Ohio Coroner	3.3	0.0	3.3	3.3	90.0
	Other Coroner	0.0	4.8	0.0	9.7	85.5
	Trauma MD	3.6	7.1	14.3	17.9	57.1
By AIS / ISS Chi Square p=0.014	Ohio Coroner	0.0	0.0	3.3	0.0	96.7
	Other Coroner	0.0	1.7	0.0	11.7	86.7
	Trauma MD	7.1	3.6	7.1	17.9	60.7

House Bill 138, which became law in 2000, requires Coroners' data to be submitted to the Ohio Trauma Registry (OTR). The Ohio Trauma Registry is a computer database.
As a professional in your organization do you think there is support for standardization or a template for the narrative notes you make on an autopsy report? For example, if you determined that part of the autopsy should include the cranium, then you would dictate answers to a small set of standard questions that, among other things, would enable the determination of an Abbreviated Injury Scale (AIS) score. You would also add any additional observations you deemed relevant. I would support this idea.

Table 16. Opinion on a standard template for autopsies.

Chi Sq p=0.000	*Strongly*	*Disagree*	*Undecided*	*Agree*	*Strongly* Agree
Ohio Coroner	30.6	12.2	28.6	24.5	4.1
Non-Ohio Coroner	6.8	6.8	34.2	43.8	8.2
TMDs	0.0	2.9	14.7	41.2	38.2

Finally, the study tool asked for any general comments. Even though the State has not indicated a desire to mandate autopsies, Ohio coroners widely perceive that is the State

plan. The Ohio coroners' concern is that there is no money for additional autopsies and even if there were, the value is limited.

General comments by Ohio coroners (as written):

There are many uses for trauma-related autopsy reports that can be realized if autopsies are performed and reports submitted in a timely, complete, and consistent manner. Your input on how the State can implement such a system in a realistic manner is greatly appreciated. Please take a moment to further express your opinion on the data that should or should not be reported to the State and methods that should or should not be used to report to the Ohio Trauma Registry.

- I don't think the survey questions are relevant or relevant to the rural coroners anyway. It does not consider the general operation of the coroner's offices in Ohio. The State should not be entitled to county post data (autopsies) without contributing to the cost. (No unfunded state mandate). The State can get its data from its own agencies (Vital Statistics - death certificates).
- Problem: My county has no deputy, no staff, no computer, and no typist. All autopsies are done in a distant county and we have transportation and autopsy costs which is hard for my county to bear. Secondly, my son was killed in an auto accident six months ago. I do not feel an autopsy was indicated - only toxicology. (He died in my county.)
- The purpose of the Ohio Coroner is to determine the cause and manner of death. The only reason to conduct an autopsy is to help, if necessary, determine the cause and manner of death. If you want other academic or statistical information, then have a hospital pathologist perform the autopsy. But they don't want to and refuse to do their own autopsies on their own hospital deaths not from trauma. Most of the coroners in Ohio don't have the funds, staff, equipment, time, and money to keep up with the new (and old) demands placed on them already. Every case is individually investigated and all types of information is obtained to determine if an autopsy is necessary (current meds, past medical history, weather conditions, seat belt usage, eye witness statements, sheriff and OSP evaluation etc. etc. etc. Therefore it is not a check but a cookbook approach to determine if an autopsy is necessary because each case is unique. Let the trained, experienced, elected coroners determine autopsy necessity in each case.
- There is no funding for more work.
- State-mandated trauma victim autopsies and/or reporting MUST be accompanied by state financial support to county coroner offices or this initiative will not be possible.
- Lots of bad questions. Most of the time with a good scene investigation, and or x-rays and lab, the cause of death can be determined. Our autopsies on traumas are more driven by the legal system, the medical need to know, the manner and cause. Also dollar resources are LIMITED.
- Autopsies done at tertiary centers after patients have been transported to these centers are worthless to the counties of origin. They are extremely expensive. There is no consideration of the circumstances of the injury from the coroner of the referring county. Clinical data from hospitalization, i.e. CT, MRI reports, OP reports, and discharge summaries are adequate the vast majority of the time to determine cause of death.
- My opinion is that state mandated autopsies on all trauma will waste millions of dollars of taxpayers' money. Investigating personnel at the scene should make the

decision as to the necessity for autopsy. Autopsy on through and through gunshot wounds, suicidal hangings, pedestrians struck by cars, bicyclists struck by auto and badly mutilated are not going to contribute to understanding the cause of death nor in most cases why the death occurred. A reasoned decision not a mandate is a more logical way to do autopsies.

- I'll send them the data (report) and they can collate whatever patient information they want from it. I'm not in favor of doing their work or their job.
- The idea of a trauma related autopsy data base is a major misconception that distracts the attention and the funds from other trauma related issues, such as helmet law for motorcycles, or use of seat belts or alarmingly low level of driver's education.
- Coroner sends autopsy report to state. State hires staff to extract information from autopsy report and load it into their data base.
- I feel any information needed could be obtained from death certificate obtainable from Department of Health (vital statistics). I have found that any more detail becomes "busy" work that others don't review or utilize except for statistics and data bases. I'm not a statistician. I am an elected official. My job is not to create data bases or statistics. For most part autopsies are not accidents. Common sense, practicality and scene evidence will decrease accidents. Others are self evident - but not practiced or enforced. i.e. seat belt, ETOH, risky behaviors, speed, inattentiveness, stupidity. Autopsies on all trauma will not change these. I do autopsies if after investigation there's suspicion of legal implications or no obvious cause.
- WHAT: Drug and alcohol related traumatic deaths. Abuse (physical) related deaths (any age). Medical therapy misadventures. Deaths related to inadequate safety warnings and/or measures.
- METHOD: Standardized form filled out by coroner checking relevant boxes (or something as simple) and submitted on each trauma death. i.e. alcohol involved YES / NO / UNDETECTED
- Our office contracts with four hospital pathologists and forensic pathologists in the area.
- None come to my office because we don't have a morgue. Most are taken to the local hospital.
- Small county. Autopsies contracted out.
- I have several problems with the trauma system generally and particularly with mandated autopsies and mandated paperwork. [1.] There is no need for any of this. It is being pushed for political gain by a few and is being justified as research which will save lives. Legitimate questions are (A) will the amount of work and expense involved justify the potential few lives saved? I don't think so. (B) What steps can be taken to keep this program from taking on a life of it's own and having self perpetuation becoming its #1 goal? Examples of such programs are 1-Madd Mothers which has evolved into an abolitionist group and 2-DARE with it's ever changing slogans and initials and growing budget which doesn't really work. [2.] We need to end unfunded mandates. It's easy for politicians to pass laws requiring work to be done by others, already coroners have to do special paperwork for (A) SIDS, (B) children< 2yrs, (C) DOT/highway deaths, (D) The proposed universal death

certificate which is about six pages long requesting trendy research topics such as was the dead person an Eskimo? Ever smoked? Number of pregnancies? Level of education? How is a coroner looking at a dead body supposed to know these things? Our jobs as coroners should be law enforcement. Our basic mission is to determine if someone was murdered. We're already underpaid and overworked enough that we have to recruit and beg doctors in some counties to be coroners. This is not so for commissioners, judges, sheriffs, etc.

- I handle each case of trauma individually. The idea of "cook booking" criteria is neither cost effective nor practical.

Non-Ohio coroner comments:

Describe your state's reporting requirements.

- Investigative affidavit must be filed
- MI has ME database that individual institutions can op to put pt in or not
- Motor vehicle accidents; impaired dangerous driving OSHA
- MVAs & Fire deaths-we complete a state provided form
- MVA to DMV
- Not autopsy results. Must report fatal motor vehicle accidents.
- Not through coroner's office
- Only MVC
- Penn DOT MVA
- Regional trauma centers collect/forward state
- Report motor fatalities to DOT
- Specifically for children under 18: death is reported to social service dept of family service (who) has a child fatality team to investigate death.
- Strongly oppose any bill requiring this

How would you improve state reporting requirements?

- Collecting data is fine - but what will you do with it?
- Don't have time/staff to report trauma stats to state.
- Have standard forms for all.
- However, the problem is funding. Where's it coming from?
- Make reporting mandatory but provide funding to help locals establish
- More standardized form or processing.
- No personnel to code & report data.
- Standard Forms
- State Death Certificate is sufficient in my opinion.
- State wide uniform database program
- We are now in process of implementing a standard form
- We should have input into design/content of forms. Other categories might be developed/industrial deaths, firearms, etc.
- With a standard form.

Trauma medical director general comments:

Suggestions for reporting format.

- Since the trauma registry cannot really DO anything with the coroner's data, it is irrelevant how the narrative portion is stored.
- It would be helpful for hospital peer review and coding to have the report include AIS coding. We update our AIS code once we review the autopsy data to arrive at the most accurate injury severity scale (ISS).
- Make sure the standard template is small and not restrictive.

What were the primary reasons autopsies were not done that should have been done?

- Age & Circumstance of Death
- All trauma patient deaths MUST have autopsy!
- As stated in this document.
- Budget
- Coroner's unwillingness to do it
- DNA
- Failure of hospital staff to notify coroner.
- Family
- Family Opposition
- Family religious preference
- Limited Budget
- N/A
- Occult injury identification; Cause of death
- PCP's sign death certificate
- We get 100% autopsies

List examples of specific use of autopsy data:

- Autopsy data helpful. Peer review, evaluate care, determine accurate AIS and ISS contributes to probable survival (PS).
- Autopsy information on cervical spine injury has caused us to re-examine our x-ray policy AND our C-spine clearance policy protocol. Two cervical fractures with cord injury were MISSED on our routine x-rays. Patients died of other causes---but future ...
- Confirms diagnosis, identifies missed diagnosis/cause of death when not clear, clarifies medical legal issues
- Discovered c-spine injury MVC victim - not appreciated before she died.
- Helped to differentiate between an accident and a homicide.
- I am sure some patients are dying of MISSED injuries or NOT dying of ASSUMED injuries. This is bad medicine not bad doctors. I meet resistance from my coroner when I suggest an autopsy. It is primarily an issue of cost.
- Often autopsy data show injuries not aware of at time data. Autopsy clarified cause death, extremely valuable, educational tool in M&M conferences.
- Specific cause of death and in performance improvement analysis
- The coroner and coroner reporting process are integrated into our quality assurance program. Our trauma surgeons often call the coroner personally to report a case and trauma team members often participate in post mortem exams.
- Too early to be of use yet. Do review with case reviews in peer review committee.

Meeting with Ohio State Coroners Association. The results of the statewide survey of Ohio coroners were shared with the Ohio State Coroners Association at a Board of Trustees meeting. Feedback on the survey, process, and study proposal were requested. There was a general consensus verbalized on several issues:

1. Coroners were concerned that additional autopsy mandates will be required when their budgets are limited. 41.8 percent of the coroners identified lack of funding as a barrier to conducting trauma related autopsies. The primary concern is that only a limited number of autopsies can be done within their budgets. They do not want to lose the ability to prioritize the decision to perform autopsies on the most appropriate cases across all causes of deaths.
2. The decision to perform an autopsy cannot be reduced to a "cookbook" equation for mandating an autopsy.
3. The State needs to be clear on the reasons why information is required for the OTR and how that information is going to be used. Many are distressed that more work is going to be required when the payoff for the public good is not at all clear.
4. The death certificate is the means the coroners use for the dissemination of autopsy information. A separate form is not feasible to many Ohio coroners at this time.

POTENTIAL STUDY WEAKNESSES

In the analysis of the study, a few potential weaknesses were identified and warrant mention.

- **Non-differentiated groups within professions.** Trauma medical directors are physician chiefs of trauma programs in Ohio from hospitals with exemplary services for victims of serious injuries. To become recognized as a trauma center in Ohio, a hospital must undergo rigorous review and approval by a nationally recognized body known as the American College of Surgeons (ACS). The ACS requires that trauma hospitals have a highly functioning multidisciplinary trauma performance improvement (PI) committee. Trauma medical directors often utilize quality autopsy data at morbidity and mortality review PI committees. Special Study #5 reveals significant disparity in the number of coroners who perceive physicians as using autopsy data and the number of trauma medical directors who perceive physicians as using autopsy data. Special Study #5 questionnaire recipients included all Ohio county coroners/medical examiner as well as trauma medical directors from verified as trauma centers. Twelve of Ohio's 88 counties currently have verified trauma centers. All physicians answering this question were from trauma centers whereas coroners who responded may or may not have been from a county with a trauma center. Coroners who reside in counties without trauma centers may not receive regular requests to provide autopsy data to their medical community, thus contributing to Ohio coroners' general perception that physicians are not routinely stakeholders of autopsy data.
- **Non-differentiated location of death, i.e. scene vs. in-hospital.** Physicians and coroners were asked the same questions in the study questionnaire. Both responded from their perspectives. Researchers failed to differentiate potentially significant location patterns among the victim autopsies in question. Trauma physicians responded from the perspective of those patients who arrive to the hospital, receive some degree of care, and then expire. Coroners responded based on patients who died at hospitals but also *those who died at the scene and were never transported to*

a hospital for care. Victims who were fatally injured from an obvious critical event and expired at the scene, i.e. decapitation injuries, may have been deemed by coroners as not necessitating an autopsy. This may have played out in the discrepancy of data results involving autopsies among motor vehicle crash victims. Trauma medical directors felt that autopsy was substantially more appropriate in motor vehicle crashes than the coroners. The argument can be made that even among obvious death cases, autopsy is warranted to determine natural disease that may have led to the traumatic event, however this was not specified in the study.

- **Potential misunderstanding over trauma patient versus all autopsy patient subgroups.** The survey tool for this study was clearly titled "Trauma-Related Autopsy Survey." All of the survey questions included the word "trauma" in them with the exception of the question relating to the reasons that autopsies are performed. This question, *"The most common **REASON** that I perform or request an autopsy is to…"* did not make a specific reference to trauma. Study authors assumed the relationship, however the concern has been raised that for this one question, data may reflect all deaths, natural and traumatic. Thus conclusions from this inquiry may be skewed in that they are non-specific to traumatic injury deaths.

CONCLUSIONS

Objective 1.1: To identify which injury types are deemed appropriate for autopsy by surveying:

- Ohio's 86 county coroners and one medical examiner
- A sampling of county coroners/medical examiners in contiguous states
- Hospital emergency and/or trauma medical directors in Ohio

According to State of Ohio death certificate data from 1996 to 2001, about 60 percent of unintentional injury deaths have an autopsy. A similar 60 percent of intentional self-injury deaths are autopsied. About 98 percent of intentional deaths (homicides) are autopsied. Ohio coroners, other state coroners, and trauma medical directors did not identify any mechanism of injury that always requires an autopsy. In general the trauma medical directors and non-Ohio coroners expressed the opinion that autopsies should be performed more often than the Ohio coroners. From the survey of Ohio coroners, only about two percent of the injury deaths should have received an autopsy, but did not because of a barrier.

Objective 1.2: And of those injury types deemed appropriate for autopsy who did not get an autopsy, to identify what are the most common barriers to achieving the autopsy

The Ohio coroners' survey revealed that, based on those patients who they deemed appropriate for an autopsy, only about two percent of the injury deaths did not receive an autopsy because of a barrier. The greatest barriers were cost, family opposition, and personnel (can't find pathologists and other office personnel to assist the coroner's work).

Ohio Vital Statistics data indicate a number of injury deaths (2,936 from 1996-2001) that were not reviewed by a coroner. According to the Ohio State Coroner's Association (OSCA), there is no legitimate reason why coroners should not be reviewing all of these cases. The consensus of OSCA Board Members is that coroners are currently not being notified in these cases. Lack of notification obviously negates any possibility of a coroner's autopsy and subsequent data to the state. Coroners must be made aware of any records submitted to Vital Statistics from their county which indicate that the case has not been reviewed. Only with feedback can improvement strategies be initiated.

Objective 2.1: To assess which medical stakeholders in the community routinely utilize autopsy reports and for what purpose

Both the Ohio coroners and the non-Ohio coroners consider trauma medical directors and EMS personnel infrequent users of autopsy data. The trauma medical directors expressed the opinion that both they and the EMS personnel were very frequent users of autopsy information.

Objective 2.2: To conduct a random sampling of those stakeholders in order to assess areas of the reports in which they perceive that their needs are not being met.

Trauma medical directors were sampled. The greatest discrepancy between coroners and trauma medical directors was that the trauma medical directors felt the autopsy was substantially more appropriate in motor vehicle crashes than the coroners. About two thirds of motor vehicle crash victims have an autopsy.

Objective 3.1: To evaluate what trauma autopsy data is utilized by trauma care providers (trauma medical directors and trauma nurse coordinators/managers) from American-College-of-Surgeons-verified trauma centers in the state of Ohio.

The trauma medical directors (TMDs) consistently expressed greater value and reason for autopsies across all reasons than the Ohio coroners. An important use identified by TMDs from open ended comments was "missed diagnoses that only an autopsy can reveal."

Objective 3.2: To do the same with a sampling of recognized injury prevention programs around the State of Ohio (Safe Communities of the Governor's Highway Safety Office, MADD, etc. who might use autopsy data).

From the survey of coroners we were unable to identify injury programs that utilized autopsy data.

Objective 4.1: To survey at a regional meeting the 87 county coroners and one medical examiner in Ohio as well as a sampling of trauma physicians from around Ohio for suggestions on how autopsy data might be submitted to the OTR.

There was not such a regional meeting that the study team could attend, but a presentation and question/answer session were done at a Board of Trustees meeting of the Ohio State Coroners Association (OSCA). The greatest concerns expressed by OSCA Board members were regarding unfunded state mandates and the potential undesirable creation of a statewide autopsy report form. The coroners prefer a single form (i.e. the death certificate) as opposed to the creation of a special form for injury reporting.

Objective 4.2: To assess the current required method of submitting coroner's data to the OTR (death certificate data via the Ohio Department of Health Vital Statistics Division) for compatibility with submitting autopsy data

Ohio death certificate information was obtained from 1996 to 2001. It was shown that there has been a significant increase in unintentional injuries in the past few years. Unfortunately the death certificate database does not include the circumstances of the injury (E codes). Additionally much of the other injury data that is included in the death certificate is missing (e.g. 59% of ICD9-10 data). Lack of relevant fields and missing data make it difficult to evaluate the cause of the increase in injury deaths. However many Ohio coroners expressed non-support for the creation of a new form and process to report autopsy injury data to the OTR. To increase trauma death information to the OTR, resources and other efforts may be most effective if used to promote complete documentation on the death certificate. The specific addition of the E codes to the death certificate would be helpful. This is a particularly good time to consider adding relevant fields to the death certificate as the form is now under review for revision. Whatever fields are chosen to be included in the death certificate, it is critical that the fields be completely and accurately filled in.

E codes on the Vital Statistics records based on sound coroner documentation would ultimately enhance the Ohio Trauma Registry's (OTR) ability to track and trend population injury data. Once available, such data could be used by other groups that do not use it now because of the inability to relate it to nationally recognized E code categorization. In order for E code data to be reliable and usable, personnel need to be trained in the E code classification system. One obvious method would be to train the coroners, however such standardization among coroners was clearly not supported in the study. An alternative method would be to assure training of Vital Statistics or OTR staff in E coding. In addition to submission of the death certificate data, autopsy documentation could be submitted so that the trained Vital Statistics or OTR staff could extract the information required to assign the E code. Coroners would have to commit to documentation that includes all injuries, rather than only the major injury that caused the death.

Ohio coroners do not currently interface directly with the state department of Vital Statistics. A standardized process for submitting coroners' autopsy/E code data to the state Vital Statistics department would need to be established. Currently coroners' data (cause and manner of death) is forwarded by funeral homes or crematoriums to county vital statistics agencies. County vital statistics agencies then forward the data to the

State Vital Statistics. In instances of supplemental death certificates, the information is sent by the Coroner directly to the county vital statistics agency who then forwards it to the State. To attain optimum support from Ohio's coroners, a process that maximizes autopsy data while minimizing additional work of the coroners should be sought.

In addition to the death certificate, the coroners presently complete a report that describes the autopsy findings. There is a perception among a majority of coroners that trauma physicians do not utilize autopsy reports. This is a perception confuted by the trauma medical directors. While the majority of Ohio coroners are not in favor of a standardized format, the non-Ohio coroners and the trauma medical directors find this a reasonable request. Rather than adding additional work, a report that provided standard autopsy information of the body areas studied would be useful to those reading the reports. With more precise documentation, autopsy reports would contain information sufficient to determine an AIS score. Again, coroners do not need to do the AIS coding. AIS coding can be accomplished by OTR, regional registry, or hospital coders. Improved coroner documentation and subsequent AIS coding allow objective assessment and reliable trending of population data.

Clearly a barrier in the process of standardizing reports is the finding that about 40 percent of the coroners usually or always prepare their reports on manual typewriters. Resources need to be provided to coroners to enable them to complete reports with tools that are designed to disseminate the information in an efficient and complete manner. Future study on the funding of county coroners' offices in light of work loads and capabilities may shed light on resource allocation that is necessary to promote autopsy data being submitted to the OTR.

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