Objective: To determine location, manner, and physician certifier of pediatric deaths.

Design: A descriptive study of death certificate information for all child deaths (aged birth through 17 years) for the years 1995 and 1996.

Setting: Urban county of more than 780,000 population.

Main Outcome Measures: Field of specialty of physician certifiers, location of death, and category of deaths certified by the medical examiner.

Results: Of 361 child deaths, 42.6% were certified by the medical examiner, 24.1% by neonatologists, 10.0% by obstetricians, 8.0% by pediatric critical care specialists, and 5.3% by general pediatricians. The remaining deaths were certified by pediatric subspecialists, surgeons, family practitioners, emergency medicine specialists, hospital pathologists, and law enforcement officials. The medical examiner certified deaths due to trauma (64.5%), sudden infant death syndrome (13.5%), unexplained or suspicious causes (9.7%), medical or surgical complications (3.9%), or because no other physician certifier was available (5.8%). Most children were pronounced dead at hospitals, but 10.0% died at home, 4.4% on roads, and 2.5% on public or private lands.

Conclusions: General pediatricians are unlikely to be directly involved in the care of most children who die and are therefore unlikely to sign the death certificate. Education about death and dying issues should be available for all pediatricians but should be directed at those specialists most likely to provide care during critical events. Support services for families need to be community based and accessible to survivors.


Editor’s Note: There’s something very sad about the results of this study, and I refer to more than the deaths of children. Modern medicine has forced the demise of house calls and, by inference of this study, comforting families at the time of children’s deaths.

Catherine D. DeAngelis, MD

Continuing improvements in child health have allowed dramatic decreases in infant and child mortality throughout this century. As a result, the current spectrum of child deaths in the United States is heavily weighted toward trauma and neonatal diseases. The general pediatrician practicing in an ambulatory setting is unlikely to care directly for many of these seriously ill or injured patients, and consequently he or she may have little direct experience with death and dying issues.

At the same time, continued surveillance is necessary to maintain and improve the public health. Manner and cause of death as noted on the death certificate are necessary data for national and local health assessment, yet often the death certificate data are of limited value because of completion errors, including unclear diagnoses. Therefore, there have been attempts to instruct all physicians in proper death certification.

We hypothesized that, because of the nature of medical practice today and the spectrum of conditions that most often cause death, general pediatricians sign few death certificates. These data may be useful in targeting instruction to physicians on death and dying issues (including completion of death certificates) and in planning community health and social services for children and their families.

See also pages 837 and 909

RESULTS

A total of 361 children died in Pima County during the 2-year study period. The professional field of the physician certifying death and the location of death are noted in the Table. The medical examiner certified 154 (42.6%) deaths, neonatologists 87 (24.1%), obstetricians 37 (10.2%), pediatric critical care specialists 29 (8.0%), pediatric subspecialists 14 (3.9%), surgeons (including cardiovascular surgeons and trauma specialists, hospital pathologists, and law enforcement officials. The medical examiner certified deaths due to trauma (64.5%), sudden infant death syndrome (13.5%), unexplained or suspicious causes (9.7%), medical or surgical complications (3.9%), or because no other physician certifier was available (5.8%). Most children were pronounced dead at hospitals, but 10.0% died at home, 4.4% on roads, and 2.5% on public or private lands.


Editor’s Note: There’s something very sad about the results of this study, and I refer to more than the deaths of children. Modern medicine has forced the demise of house calls and, by inference of this study, comforting families at the time of children’s deaths. Catherine D. DeAngelis, MD

Continuing improvements in child health have allowed dramatic decreases in infant and child mortality throughout this century. As a result, the current spectrum of child deaths in the United States is heavily weighted toward trauma and neonatal diseases. The general pediatrician practicing in an ambulatory setting is unlikely to care directly for many of these seriously ill or injured patients, and consequently he or she may have little direct experience with death and dying issues.

At the same time, continued surveillance is necessary to maintain and improve the public health. Manner and cause of death as noted on the death certificate are necessary data for national and local health assessment, yet often the death certificate data are of limited value because of completion errors, including unclear diagnoses. Therefore, there have been attempts to instruct all physicians in proper death certification.

We hypothesized that, because of the nature of medical practice today and the spectrum of conditions that most often cause death, general pediatricians sign few death certificates. These data may be useful in targeting instruction to physicians on death and dying issues (including completion of death certificates) and in planning community health and social services for children and their families.

See also pages 837 and 909

RESULTS

A total of 361 children died in Pima County during the 2-year study period. The professional field of the physician certifying death and the location of death are noted in the Table. The medical examiner certified 154 (42.6%) deaths, neonatologists 87 (24.1%), obstetricians 37 (10.2%), pediatric critical care specialists 29 (8.0%), pediatric subspecialists 14 (3.9%), surgeons (including cardiovascular surgeons and trauma specialists, hospital pathologists, and law enforcement officials. The medical examiner certified deaths due to trauma (64.5%), sudden infant death syndrome (13.5%), unexplained or suspicious causes (9.7%), medical or surgical complications (3.9%), or because no other physician certifier was available (5.8%). Most children were pronounced dead at hospitals, but 10.0% died at home, 4.4% on roads, and 2.5% on public or private lands.


Editor’s Note: There’s something very sad about the results of this study, and I refer to more than the deaths of children. Modern medicine has forced the demise of house calls and, by inference of this study, comforting families at the time of children’s deaths. Catherine D. DeAngelis, MD

Continuing improvements in child health have allowed dramatic decreases in infant and child mortality throughout this century. As a result, the current spectrum of child deaths in the United States is heavily weighted toward trauma and neonatal diseases. The general pediatrician practicing in an ambulatory setting is unlikely to care directly for many of these seriously ill or injured patients, and consequently he or she may have little direct experience with death and dying issues.

At the same time, continued surveillance is necessary to maintain and improve the public health. Manner and cause of death as noted on the death certificate are necessary data for national and local health assessment, yet often the death certificate data are of limited value because of completion errors, including unclear diagnoses. Therefore, there have been attempts to instruct all physicians in proper death certification.

We hypothesized that, because of the nature of medical practice today and the spectrum of conditions that most often cause death, general pediatricians sign few death certificates. These data may be useful in targeting instruction to physicians on death and dying issues (including completion of death certificates) and in planning community health and social services for children and their families.
MATERIALS AND METHODS

Pima County, Arizona, is a primarily urban area of approximately 780,000 population, composed of the city of Tucson, surrounding suburbs, and a large, sparsely populated rural area including the Tohono O’odham reservation. As part of the local child fatality review program, death certificates were obtained for all fatalities within the county among live-born children younger than 18 years for the years 1995 and 1996. The professional field of the physician who certified death was determined using the local telephone directory, the 1996 Fellowship Directory of the American Academy of Pediatrics, the catalog of the University of Arizona College of Medicine, and the Arizona Medical Directory of the State Board of Medical Examiners. Location of the death was noted from the death certificate (or other records if unavailable on the death certificate), including whether hospital fatalities were classified as inpatient, outpatient or emergency department, or dead on arrival.

For our study we grouped medical examiner–certified deaths as occurring due to trauma or injury (those listed as due to motor vehicle crashes, falls, suicide, homicide, blunt force or penetrating trauma, and drownings); sudden, suspicious, or unexplained (deaths with unrecognized underlying conditions, catastrophic acute conditions, choking, accidental strangulation, or undetermined cause); medical or surgical complications; or no other available physician certifier.

The majority (307 [85%]) of children and adolescents died in hospitals, including 263 (72.9%) who died in Tucson’s 2 tertiary care hospitals with pediatric ward and intensive care beds, level III neonatal intensive care units, and level I trauma care capabilities. An additional 44 patients were pronounced dead at other community hospitals. Among hospital deaths, 233 (75.9%) occurred among inpatients, 66 (21.5%) in the emergency or outpatient departments, and 8 (2.6%) of patients were dead on arrival at the hospital.

If neonates (nearly all of whom where born in hospital) were excluded, 108 (48.9%) of pediatric deaths occurred among outpatients. This is particularly striking for children 10 years and older; among this group, 62 (66.7%) died in the outpatient or emergency department, at home, on a roadway, on public or private lands, or were dead on arrival at a hospital. A few children or adolescents were noted to have died outside of hospitals but were also classified as dead on arrival on the death certificate. These were counted as out-of-hospital deaths in this study.

Most deaths occurring outside the hospital were certified by the medical examiner. Among children who died at home (n = 31), the medical examiner certified death for 21, general pediatricians for 8, a family practitioner for 1, and a neonatologist for 1. Trauma was the cause of 14 (45.2%) of home deaths, chronic disease for 11 (35.5%), sudden infant death syndrome for 4 (12.9%), and suspicious, unexplained, or sudden conditions for 2 (6.4%). All home deaths certified by physicians other than the medical examiner were related to a chronic condition. The medical examiner certified 1 home death due to chronic disease in addition to the remaining home deaths.

Deaths certified by the medical examiner (n = 154) were due mostly to trauma (100 [64.9%]) and sudden infant death syndrome (23 [14.9%]). Sudden, unexplained, or suspicious deaths accounted for 15 (10.4%) of cases, while complications of surgical (4 [3%]) or medical care (2 [1%]) were also noted. Sudden, unexplained, or suspicious deaths included children with cerebral aneurysm, congenital heart disease, undiagnosed diabetes mellitus, meningococcal meningitis, Newcastle syndrome, neonatal pneumonia, and accidental suffocation or choking. The cause of death could not be determined for 2 children. Nine deaths (6%) due to known medical conditions were certified by the medical examiner because no other physician certifier was available.

Eighty general pediatricians practiced in Pima County in 1996, including 10 clinical faculty members in general pediatrics at the University of Arizona College of Medicine, Tucson. General pediatricians certified 19 (5.3%) of the 361 deaths. Calculating 19 deaths in 2 years for 80 general pediatricians yielded an average of 0.12 deaths each year per pediatrician, or 1 death every 8.3 years. During the study period, 1 pediatrician certified 3 deaths, 1 certified 2 deaths, and the remaining 14 pediatricians certified 1 death each.

<table>
<thead>
<tr>
<th>Age</th>
<th>Total No. of Deaths</th>
<th>OB</th>
<th>N</th>
<th>ME</th>
<th>PI</th>
<th>PG</th>
<th>SU</th>
<th>PS</th>
<th>Other</th>
<th>HI</th>
<th>OP/ED</th>
<th>DOA</th>
<th>Home</th>
<th>Road</th>
<th>Other Lands</th>
<th>Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-28 d</td>
<td>140</td>
<td>37</td>
<td>75</td>
<td>11</td>
<td>6</td>
<td>6</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>131</td>
<td>7</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>28-364 d</td>
<td>67</td>
<td>0</td>
<td>12</td>
<td>19</td>
<td>13</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>35</td>
<td>20</td>
<td>4</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1-4 y</td>
<td>36</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>14</td>
<td>7</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>5-9 y</td>
<td>25</td>
<td>0</td>
<td>0</td>
<td>16</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>15</td>
<td>6</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10-14 y</td>
<td>34</td>
<td>0</td>
<td>0</td>
<td>24</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>13</td>
<td>12</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>15-17 y</td>
<td>59</td>
<td>0</td>
<td>0</td>
<td>49</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>17</td>
<td>14</td>
<td>1</td>
<td>11</td>
<td>7</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>361</td>
<td>37</td>
<td>87</td>
<td>154</td>
<td>29</td>
<td>19</td>
<td>15</td>
<td>14</td>
<td>6</td>
<td>233</td>
<td>66</td>
<td>8</td>
<td>31</td>
<td>12</td>
<td>9</td>
<td>2</td>
</tr>
</tbody>
</table>

*OB indicates obstetrician; N, neonatologist; ME, medical examiner; PI, pediatric intensivist; PG, pediatric generalist; SU, surgeon; PS, pediatric subspecialist; HI, hospital inpatient; OP/ED, outpatient, emergency department; and DOA, dead on arrival to hospital.
Our study shows that today’s metropolitan area primary care pediatrician is infrequently called on to certify the death of a child. Most deaths resulted from trauma or sudden infant death syndrome (by law, certified by the medical examiner) or newborn-related conditions (certified by a neonatologist or obstetrician). Few deaths came at the end of an illness managed by a general pediatrician, especially for those patients who died as inpatients at a hospital. Indeed, our findings complement the analysis of Melzer et al10 that pediatric care is largely the province of a small subset of pediatricians.

Arizona state statute requires the medical examiner to investigate all deaths that occur: (1) while the victim is not under the care of a physician for a potentially fatal illness or when there is no attending physician available to sign the certificate; (2) as the result of violence; (3) suddenly when the victim is in apparent good health; (4) in a prison; (5) to a prisoner; (6) in a suspicious, unusual, or unnatural manner; (7) as a consequence of the victim’s occupation; (8) causing a public health hazard; and (9) during anesthesia or surgery (Arizona Statute 11-593). Because of this mandate, general pediatricians will not certify deaths in any of these categories. However, this does not preclude involvement of the primary care physician in follow-up care, including grief support for families.6 It is quite possible, though, that the general pediatrician may be unaware of the death of one of his or her patients, and many other children do not have primary care providers, as 14% of children have no health insurance.7 Good communication with community physicians by the medical examiner’s office and emergency departments and referral to community resources by law enforcement, emergency departments, intensive care units, and the medical examiner’s office could alleviate many such problems. Further study of this subject should clarify how often these referrals occur and what (if any) barriers exist.

Because certification of death is not a sure proxy for attending physician status, we may have underestimated the involvement of the general pediatrician in pediatric deaths. Some primary care providers actively co-manage treatment with neonatologists, pediatric subspecialists, surgeons, and pediatric intensivists. However, many factors work against such involvement being routine, including the prehospital occurrence of many deaths and a discontinuity of primary care (in our community often because of managed care eligibility changes due to age, employment status, or income). Reimbursement, training requirements, and practice schedules also do not encourage or allow intensive care involvement by many general pediatricians. Plans to “carve out” chronic disease patients from the rosters of general pediatricians may further accentuate this trend.9

In a study of the characteristics of death certifiers and institutions,6 personal physicians certified 80.2% of all deaths in a large metropolitan county. Nearly all of these deaths were attributed to natural causes and 72.3% of the deaths occurred among inpatients at institutions. Medical examiners and coroners certified 19.8% of deaths, attributing 70.7% to natural causes. In contrast to that general population study, our pediatric population (especially beyond the neonatal period) died far more frequently as a result of accidents, suicides, homicides, or unexpected causes (38.5%), and a larger percentage died in emergency departments or noninstitutional settings (34.9%).

Two of the major death and dying issues the medical profession should address are death certification and support for survivors. Death certificates serve many vital public health and social functions,3,10 including identification of new health problems, geographic trends, and high-risk populations. Research and prevention funding is allocated based on death certificates. Much of the most important data is obtained from the stated cause of death, yet this is often noted to be faulty.11,12 To improve accuracy of cause of death notation, some authors have suggested formal instruction in death certification during medical school and residency,3 while others have suggested targeting of such instruction.13,14 Our data support the notion of a general introduction for all physicians, with more detailed instruction directed toward particular specialists and fields of practice.

A child’s death is a great tragedy and often comes suddenly and unexpectedly to an unprepared family. In many instances the family will not even have the luxury of familiarity with the physician who certifies the death. Although every pediatrician must be prepared to manage death and dying,15 neonatologists, intensivists, and certain pediatric subspecialists should maintain special expertise in this area. For many families, however, deaths occur outside of hospitals or in emergency departments. For these families, pediatricians and communities must ensure that support and grief counseling are available from other sources.

Accepted for publication March 16, 1998.

This study was funded in part by the Flinn Foundation, Phoenix, Ariz.

We thank the Pima County Child Fatality Review Team and the State of Arizona Child Fatality Review Program for valuable assistance.

Reprints: Kathryn Bowen, MD, Department of Pediatrics, 1501 N Campbell Ave, Tucson, AZ 85724-5073.

REFERENCES