2003

Annual Report on Asthma Deaths Among Individuals Age 2-34 in Michigan

An adult woman who had developed asthma as an adult collapsed at home and died. Her cause of death was attributed to over reliance on rescue inhalers and a nebulizer. She had regular medical care but had not eliminated all triggers including cigarettes and pets and did not regularly use inhaled steroids.

A male teenager who had asthma for about five years had cold symptoms and some respiratory symptoms at night, but woke up the next morning feeling good. Later that morning he became acutely short of breath and was found unresponsive next to his nebulizer when the police broke in the door. There was a concern by the advisory panel about an over reliance on a nebulizer and β-agonists, and lack of coordination of care.

An adult male who had asthma since childhood collapsed at home after using his nebulizer. He had been to the Emergency Department the day before his death. There was a history of poor compliance with using steroids. He lacked insurance for medication and the panel felt he needed a specialist, monitoring with pulmonary functions and more steroids prescribed.

A female pre-teen who had asthma for about five years who frequently had nighttime symptoms became short of breath at night. This progressed to the point she was unable to use her nebulizer and became unresponsive. Despite Emergency Department visits and two hospitalizations in the year before her death she was not using any steroids. There were multiple asthma triggers at her home.

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A Joint Report

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Summary

This is the 2nd Annual Report of Asthma Deaths in Michigan among 2-34 year olds. Although the 32 deaths that occurred in 2002 and 27 deaths that occurred in 2003 are not a large number, the circumstances surrounding these deaths are dramatic. The deaths are particularly tragic because they are preventable. The majority of the deaths were among males (58%), and African-Americans (63%). They were most likely to occur among residents of Wayne County (44%). The deaths typically occurred prior to the deceased reaching the hospital. Case summaries of the deaths are in Appendix I.

The primary causal factor identified in the first two years of investigation was the lack of compliance by patients with good asthma management including regular use of inhaled steroids rather than dependence on β agonists and elimination of asthma triggers such as cigarette smoke and pets. Some of the deficiencies noted in asthma management were from inadequate prescription of inhaled steroids particularly in emergency departments. The low percentage of people with asthma with management plans (only 9%) would suggest that more can be done by the health care system to provide information to patients to better manage their asthma. Particular recommendations were made for

- Case Managers for high-risk patients (patients with an Emergency Department visit and/or a hospitalization for asthma).
- Case Managers for people with asthma and psychiatric conditions; education on asthma for psychiatric health care providers.
- Case Managers for children with asthma where lack of parental supervision is a problem.
- Pharmacy notification to doctors for patients who repeatedly fill β agonist prescriptions or possibly placing a limitation on the number of refills allowed.
  Emphasize the chronic, and potentially severe nature of asthma and the importance of prescription and use of inhaled steroids to health care providers in all sectors (primary and urgent care) and among people with asthma.
- Provision of more comprehensive asthma care in the Emergency Department setting, including prescription of inhaled steroids at discharge and a system for connecting patients with a primary care provider for follow up.
- Educate people with asthma in self-management, emphasizing the importance of adhering to inhaled steroid medication as prescribed.
- Referral to specialists for patients with a hospitalization and/or Emergency Department visit for asthma.
- Need for health insurance for people with asthma (more of a problem in adults than children).

Plans over the coming year include the continuation of investigations into asthma deaths and dissemination of the information learned from these investigations. Continued monitoring of asthma deaths among 2-34 year olds will help determine whether the decrease in deaths from 2002 to 2003 in these generally preventable fatalities can be sustained.

Background

In response to a request for a proposal from the Centers for Disease Control and Prevention (CDC), the Michigan Department of Community Health (MDCH) in conjunction with Michigan State University (MSU) successfully competed to obtain funds to develop a rapid asthma death notification and investigation system for the State of Michigan. This system was limited, at the request of CDC, to investigations of asthma deaths among children and young adults ages 2-34. CDC selected this age group because of the increased likelihood that deaths ascribed to asthma in the ages 2-34 were truly caused by asthma. For individuals younger than the age of two or older than the age of 34 the number of other medical conditions that may present with symptoms similar to asthma increases. This report summarizes the first two years of investigations that cover asthma deaths occurring between January 1, 2002 and December 31, 2003.

Mortality from asthma in the United States has increased two-fold since the 1970's (1,2), although recent data suggest the asthma mortality rate has stabilized (3). Overuse of β-agonists (4,5) and under use of inhaled corticosteroids (6-8) have been associated with increased asthma mortality. Smoking, drinking, substance abuse (9) and family problems have been associated with increased asthma mortality, while the use of peak flow meters and a written asthma action plan have been associated with decreased asthma mortality (10). Fatal asthma has also been associated with specific work exposures (11).

Mortality is not evenly distributed across the population. Studies have shown high rates of asthma mortality among African-Americans, low-income populations and populations with low educational levels (12). Reasons suggested for the racial disparity include differential access to care, exposure to environmental pollutants (13), and crowded conditions leading to increased exposure to allergens and infections (14).

Asthma mortality rates in Michigan are slightly higher than the United State's rate for all age groups except among adults 65 years or older. Overall asthma mortality rates in Michigan did not change significantly between 1990 and 2002 with the exception of people ages 65 and older. Asthma mortality rates in this age group dropped significantly between 1990 and 2002, with the largest reduction in rates occurring between 1998 and 1999. The mortality rate in Michigan for asthma in African-Americans of all ages (48.5 per million) was over four times that of Caucasians (11.5 per million). This racial difference in asthma mortality rates was even greater in the 5-34 year old age group (African-American vs. Caucasian, 17.5 vs. 1.8/1,000,000, ages 5-14 and 24.2 vs. 4.0/1,000,000, ages 15-34).

During the years 1990 to 2002 in Michigan, there were a total of 1823 deaths where asthma was the underlying cause of death, 308 of these deaths occurred among the 2-34 year old age group. The annual number of deaths in the study age group has ranged from 5-40 per year. Asthma deaths in the 2-34 age group were equally distributed between males (153 deaths, 49.7%) and females (155 deaths or 50.3% of asthma deaths). One hundred seventy-five (56.8%) of the deaths were among African-Americans and 128 (41.6%) were among Caucasians.

Asthma deaths in Michigan were not evenly distributed throughout the year. The number of deaths increased in the summer and fall for children and young adults.

Asthma deaths are preventable. Successful disease management techniques are available to provide good control over asthma symptoms and a high quality of life. However, failure to maintain control over the disease results in a higher risk of mortality. Investigation of the reasons why people are not able to obtain and maintain good control will allow us to identify preventable risk factors for asthma mortality and recommend ways to address these factors. Interventions that reduce these risk factors can prevent future deaths as well as improve management for all people with asthma.

Methods

Notification of Asthma Deaths

Division of Health Statistics and Vital Records (DHSVR) staff at MDCH entered information from the death certificate into the master electronic file on a quarterly basis, at which time they provided MDCH asthma staff with a transcript of information on all deaths with asthma as the underlying cause of death. The DHSVR transcript contained a limited set of data from the death certificate, including name, address, date of death, date of birth, sex, county of death, and county of residence. Based on this information, MDCH asthma staff identified asthma deaths that met study criteria:

- Asthma as underlying cause of death (ICD-10 codes J45 or J46)
- Between the ages of 2-34 years
- Residing in Michigan at time of death

Staff requested an administrative copy of the death certificates for asthma deaths meeting these criteria.

Data Collection

Upon receipt of the copy of the death certificate, a letter was sent to the next-of-kin listed on the death certificate to explain the project and to request an interview. Interviews were conducted with the next-of-kin using a standardized questionnaire. All medical records from the year prior to death, pharmacy records and, if applicable, emergency response records, medical examiner records and the autopsy report were requested and reviewed. After an interview with the next-of-kin was attempted or completed and after records were reviewed, a one to two page summary of the circumstances surrounding the death for each of the individuals was prepared. In addition to the overall summary, a summary was prepared of each medical record and autopsy report reviewed.

Advisory Panel Review

Two advisory panels were convened: one for adults (reviewing deaths to individuals ages 19-34) and one for children (reviewing deaths for individuals ages 2-18). The advisory panels included allergists, asthma educators, emergency department physicians, family practitioners, internists, nurses, pediatricians, pharmacists, pulmonologists, respiratory therapists and social workers.

Members of the two panels are listed in Appendix II. Summaries of the data collected were shared with the appropriate Advisory Panels.

The Adult Mortality Review Panel met three times and the Child Mortality Review Panel met twice to review completed investigations of 2002 & 2003 asthma deaths. The advisory panels reviewed the summary materials for individual deaths and were asked to list causal factors and follow-up preventive activities that were suggested by each death. These conclusions are described in the Results section.

All medical records have been maintained in a confidential manner. Summaries shared with the advisory panels did not include personal identifiers on the individual who died, next-of-kin, their health care providers, health care systems or insurers. Both the MDCH and the MSU Human Subjects Review Boards reviewed this project. The MDCH Human Subjects Committee determined that this project was a surveillance activity and not human research. The MSU Human Subjects Review Board approved the project as human research. To provide further assurance of confidentiality this project was designated a Medical Research Project by the MDCH Chief Medical Executive under the provisions of MCL 333-2631-2635. This designation safeguards the confidential character of research studies conducted by MDCH and provides protection from release of the identifiable asthma mortality review materials for any purpose other than the research project.

Results

During the two-year study period, there were a total of 288 deaths where asthma was the underlying cause for all ages, 152 in 2002 and 136 in 2003. Fifty-nine (20.5%) of these deaths were among individuals age 2-34 years. Twenty-three (8.0%) of the deaths were among children age 2-18 years, 12 in 2002 and 11 in 2003 and 36 (12.5%) among young adults 19-34, 20 in 2002 and 16 in 2003.

Table 1: Sociodemographic Characteristics of Fifty-Nine Asthma Deaths From Death Certificates, Ages 2-34 Years, Michigan, 2002 and 2003

	Children (2-18 years)	Adults (19-34 years)	Total (2-34 years)
Number of Asthma Deaths	23 (39%)	36 (61%)	59
Average Age (years)	13.1	28.5	22.5
Sex			
Male	60.9%	55.6%	57.6%
Female	39.1%	44.4%	42.4%
Race/Ethnicity			
Caucasian, Non-Hispanic	17.4%	38.9%	30.5%
African-American	73.9%	55.5%	62.7%
Other	8.7%	5.6%	6.8%
Education Completed			
College Graduate (4 year Degree)	0%	0%	0%
Some College	4.3%	30.6%	20.3%
High School Graduate	4.3%	47.2%	30.5%
Grades 6-11	69.6%	22.2%	40.7%
Grades 5 and less	21.8%	0%	8.5%
Place of Death*			
Hospital	78%	72%	74%
Home	22%	25%	24%
Vehicle	0%	3%	2%
Autopsied	74%	78%	76%

*Place of death on the death certificate is the location where the person was declared dead, not where the fatal asthma attack occurred.

Age

The average age of children who died was 13.1 years (range: 2-18 years). The average age of adults who died was 28.5 years (range: 19-34 years).

Gender

Thirty-four (57.6%) of the individuals who died were males and 25 (42.4%) were females. There were 1.4 times as many deaths among men as compared to women.

Race/Ethnicity

Thirty-seven (62.7%) of the individuals who died were African-Americans, 18 (30.5%) were Caucasian, three (5.1%) were Mexican-American and one (1.7%) was Vietnamese. There were 2.1 times as many deaths in African-Americans as compared to Caucasians. For African-

American women there were 2.4 times as many deaths as for Caucasian women and for African-American men 1.8 times as many deaths as for Caucasian men.

Education

Of the 36 adults in the study, none had completed a four-year college degree, 11 (30.6%) had 1-3 years of college, 17 (47.2%) completed high school, and the remaining eight (22.2%) completed grades 6 to 11 of school.

Place of Death

The death certificate information on place of death listed in Table 1 reflects where the 59 deaths were pronounced. Forty-four of the asthma deaths were pronounced dead in the hospital. However, all individuals were non-responsive and in code status when emergency responders first reached the deceased. Of the six deaths that occurred among people with asthma admitted to the hospital, all were unresponsive and in a coma when admitted.

Autopsy

A high percentage of individuals, both children and adults, who died from asthma were autopsied (76%). Of the 45 deaths with autopsies, 36 (80%) showed mucus plugging, six (13%) were empty/dry, and for three (7%) the autopsy report did not address the airways.

Location in State

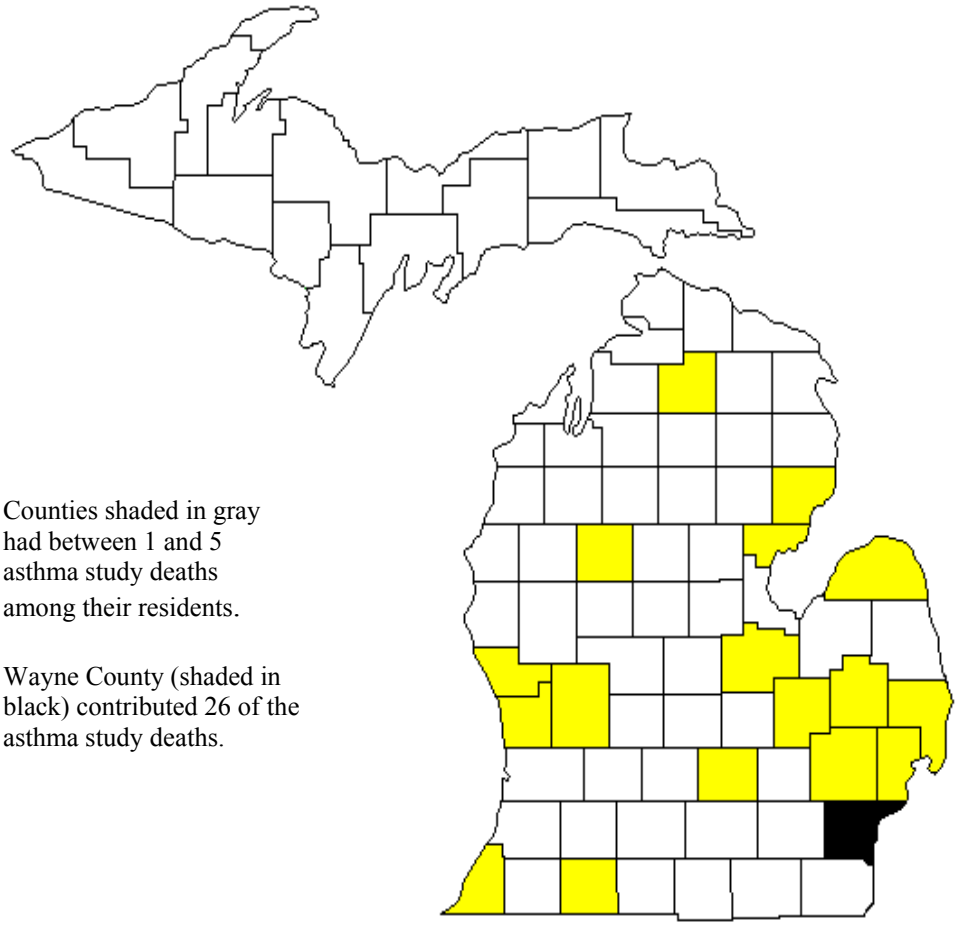
Wayne County was the most common residence of the deceased (26) (Figure 1). The other counties had between one and five residents who died of asthma during 2002 (Arenac, Berrien, Genesee, Huron, Ingham, Iosco, Kent, Lapeer, Macomb, Muskegon, Oakland, Osceola, Otsego, Ottawa, Saginaw, and St. Clair, St. Joseph). No study deaths occurred among residents of the Upper Peninsula.

Occupation/Industry

The occupation listed on the death certificates of adults were: homemaker/unemployed/disabled - 7; laborer-4; clerk/clerical-3; manager-3; machine operator-2; salesperson-2; student-2; carpenter-1; courier-1; customer service-1; houskeeper-1; instructor-1; nurse assistant-1; paper carrier-1; presser-1; seat builder-1; self-employed-1; truck driver-1; unavailable-1; welder-1.

The industry listed on the death certificates of the adults were: automotive-4; retail-3; airline-1; carpentry-1; cleaners-1; construction-1; courier-1; employment agency-1; factory-1; food industry-1; government-1; hotel-1; landscape-1; medical-1; miscellaneous-1; newspaper-1; pet store-1; pharmacy-1; private firm-1; school-1; unavailable-1; and wholesale distributing-1. No industry was listed for the seven homemakers/unemployed and two students.

Figure 1: County of Residence: Asthma Study Deaths, 2002 and 2003



Counties shaded in gray had between 1 and 5 asthma study deaths among their residents.

Wayne County (shaded in black) contributed 26 of the asthma study deaths.

Investigations Completed

The average time between the death occurring and project staff being notified to commence the investigation was approximately 4 months.

The major difficulty in completing the next-of-kin interviews involved locating the next-of-kin. In 2003 we were unable to locate nine next-of-kin; six of the children's next-of-kin and three of the adult's next-of-kin. Eight next-of-kin declined to be interviewed; three of the children's next-of-kin and five of the adult's next-of-kin. Of the 59 deaths, 17 did not have next-of-kin interview. This was a greater problem in 2002, where 14 next-of-kin were not interviewed.

Medical records were obtained on 91% (21 of 23) of children and 97% (35 of 36) of adults. In the absence of a next-of-kin interview, the medical records received were incomplete, because the health care providers(s) for the year prior to death would be unknown (see Table 2).

Table 2: Percent of Asthma Mortality Investigations Completed Ages 2-34 Years, Michigan, 2002 and 2003

	Children	Adults
Average Time Between Death and Notification	4.1 months	4.0 months
Next-of-kin Contacted	73.9%	91.6%
Interviews Completed	60.8%	77.7%
Medical Records Received (not including autopsy report)	91%	97%

RISK FACTORS FOR ASTHMA MORTALITY

The denominators for the different risk factors listed below vary due to the availability of records or whether all of the next-of-kin interviews were completed. After each percentage is the number with a positive response and the denominator for that factor. Table 3 summarizes the risk factors.

Insurance

As determined from the medical record review and next-of-kin interview, 90% (18 of 20) of children and 71% (22 of 31) of adults where insurance status was known had medical insurance. Among the twenty-eight individuals with medical insurance where information about co-payment was known, 22 of 28 (78.5%) had co-pays of $10 or less, one had a 20% co-pay and one had a $50-$75 co-pay. Six percent (2 of 32) next-of-kin or health care providers mentioned that co-pays (one had a 10% co-pay, one had a "spend down" co-pay), or cost of referrals for specialists and testing interfered with the patient's management.

As determined from querying Medicaid enrollment files, 70% (16 of 23) of children and 56% (20 of 36) of adults were enrolled in Medicaid at sometime during their life. At the time of their death, 61% (14 of 23) of children and 42% (15 of 36) of adults were enrolled in Medicaid.

Co-morbidities

Fifty-five percent (18 of 33) of adults and 40% (8 of 20) of children were reported to have a co-morbid medical condition during their lives, such as Down's Syndrome, Crohn's disease, diabetes, or hypertension, which complicated their asthma management. Another six had a psychiatric condition, such as major depression, bipolar disease or schizophrenia, 6.3% (1 of 16) of children and 17.2% (5 of 29) of adults.

Triggers

Thirty-six percent (12 of 33) of adults who died of asthma were current cigarette smokers, which is a higher percentage than the general population of adults (31.4% of 18-24 year olds and 26.3% of 25-34 year olds) according to the 2002 Michigan Behavioral Risk Factor Survey. Thirteen percent (2 of 15) of children smoked and 42% (5 of 12) were exposed to smoke at the home.

Fifty percent (7 of 14) of children and 46% (12 of 26) of adults had dogs or cats living in their homes at the time of their death.

Substance Abuse/Family Dysfunction

Forty-five individuals were autopsied and forty-six had toxicology results. Three adults tested positive for illicit drug use. Substance abuse issues were mentioned by the next-of-kin or a health care provider in 23% (7 of 31) of adult deaths, but none of the children's deaths. Two adults who were positive for illicit drugs also had their next-of-kin mention substance abuse during the interview. There appeared to be a lack of parental supervision or family dysfunction that interfered with asthma management in 36% (5 of 14) of the pediatric deaths.

Medical Care

Seventy-six percent (13 of 17) of children and 61% (19 of 31) of adults were taking an inhaled or oral corticosteroid at the time of their death. Six of the 13 children and nine of the 19 adults who were taking corticosteroids were taking inhaled steroids only; six of 13 children and five of 19 adults were taking inhaled and oral steroids and one of 13 children and five of 19 adults were taking oral steroids only.

Twenty-five percent (6 of 24) of adults had a history of prior intubation in their lifetime. Twenty-one percent (3 of 14) of the children had been intubated prior to the time of their death. Eighty-six percent (12 of 14) of children and 60% (15 of 25) of adults had been previously admitted to the hospital for asthma. Ninety-two percent (11 of 12) of children and 89% (24 of 27) of adults had an emergency department visit for asthma in their life.

Other aspects of medical care during their lifetime were:

- Allergist Care: 53% (18 of 34) had ever seen an allergist - 62% (8 of 13) of children and 48% (10 of 21) of adults.
- Pulmonologist Care: 42% (14 of 33) had ever seen a pulmonologist - 45% (5 of 11) of children and 41% (9 of 22) of adults
- Combined Specialist Care: 34% (11 of 32) had ever seen both an allergist and pulmonologist - 45% (5 of 11) of children and 29% (6 of 21) of adults.
- Pulmonary Function Testing: 55% (6 of 11) of children and 53% (10 of 19) of adults had pulmonary function testing
- Peak Flow Meter: 67% (10 of 15) of children and 52% (12 of 23) of adults had a peak flow meter (only seven of the children and two of the adults with a peak flow meter used it regularly)
- Asthma Management Plan: none of adults and three of the children had an asthma management plan.

Obesity

Fifty-five percent (17 of 31) of adults had a body mass index (BMI) of 30 or greater (obese), 26% (8 of 31) had a BMI of 25 to 29 (overweight), 19% (6 of 31) had a BMI less than 25 and for five individuals height and weight were not available (although one of the latter individuals was described as obese in their medical records). According to the Michigan Behavioral Risk Factor Survey, 25.4% of all Michigan adults are obese, 36.6% are overweight, and 38% are not overweight or obese.

Thirty-three percent (7 of 21) of the children had a body mass index (BMI) that was at the 95 percentile or greater for their age, 33% (7) were at the 85th to 94th percentile and 33% (7) were less than the 85th percentile. The BMI of two children was unknown. Weight status data for the general population of children in Michigan is not available. From the National Health and Nutrition Examination Survey, 16% of U.S. children 6-11 years and 16% of U.S. children 12-19 years have a BMI at the 95 percentile or greater for their age.

Table 3: Characteristics of Asthma Management History Based on Deaths With Information Available Children (Ages 2-18) and Adults (Ages 19-34), Michigan, 2002 and 2003

	Children	Adults	Total
Insurance Status			
Deceased Had Some Form of Health Insurance	90%	71%	78%
Insurance Had Co-Pays	33%	50%	43%
Co-pay Mentioned as Reason for Not Filling Medication, Seeing Specialist, or Getting Tests	8%	5%	6%
Deceased Had Co-Morbid Condition	40%	55%	49%
Deceased Had Psychological Illness	6%	17%	16%
Significant Substance Abuse Noted by Family or Health Care Provider	0%	23%	16%
Exposure to Triggers			
Current Smoker	13%	36%	29%
Smoker in the Home	42%	64%	57%
Pets in the Home	50%	46%	48%
Routine Asthma Management			
Taking Inhaled Steroids	35%	29%	31%
Taking Oral Steroids	6%	16%	13%
Taking Both Inhaled and Oral Steroids	35%	16%	23%
No Steroids	24%	39%	33%
Referred to Specialist	69%	59%	63%
Seen by Allergist	62%	48%	53%
Seen by Pulmonologist	45%	41%	42%
Ever Had Pulmonary Function Testing	55%	53%	53%
Had a Peak Flow Meter	67%	52%	58%
Regularly Used Peak Flow Meter	58%	18%	39%
Had a Nebulizer	76%	69%	72%
Asthma Management Plan	23%	0%	9%
Urgent Asthma Management			
Prior History of Intubation	21%	25%	24%
Previously Hospitalized for Asthma	86%	60%	69%
In Year Prior to Death	54%	38%	44%
Previous ED Visits in life	92%	89%	90%
Average Number of ED Visits Reported in Year Prior to Death	2.2	10.7	7.8
Family Dysfunction	36%	11%	19%

Weight			
Children		*Adults*	
≥ 95 percentile	33%	Obese (BMI 30+)	55%
≥ 85-94th percentile	33%	Overweight (BMI 25-29)	26%
< 85th percentile	33%	Not Overweight	19%

CAUSAL FACTORS

Causal factors were divided into sections based on the setting in which action is needed: physician-related factors, such as the need for education or changes in practice behavior; patient-related factors, such as compliance issues, the need for education or trigger avoidance; and system-related factors, such as lack of health care, need for changes in health care provision or foster care systems. Table 4 provides causal factors identified for the 33 reviewed adult asthma deaths. Table 5 provides causal factors for the thirteen child deaths reviewed.

Adults:

1. *Compliance issues such as the elimination of asthma triggers, follow-up with regular medical care, and use of steroids were the most important causal factors listed by the adult panel.*

2. *The inadequate prescription of steroids by health care providers was the second most important causal factor identified by the adult panel.*

3. *The need for specialist referral and pulmonary function testing for high-risk patients were listed as the third most important causal factors by the adult panel.*

4. *Lack of regular medical care with a primary care physician which many times was coupled with a lack of health insurance was listed as the fourth most important causal factor by the adult panel.*

5. *Psychiatric disease including depression was listed as the fifth most important causal factor by the adult panel*.

Children:

1. *Patient compliance issues were identified as the primary causal factor by the panel. This included inadequate use of steroids and overuse of β-agonists.*

2. *The need for specialist referral for high-risk patient was the second most important causal factor identified by the child panel.*

3. *The inadequate prescription of steroids by health care providers was the third most important causal factor identified by the child panel.*

4. *Lack of adequate adult supervision, and psycho social issues were listed as the fourth most important causal factor by the child panel.*

Table 4: Causal Factors for Asthma Mortality Based on 33 Deaths Reviewed Adults Ages 19-34, Michigan, 2002 and 2003

Factor	Number of Deaths*
Patient-Related Factors	
Compliance	17
Inadequate Use of Steroids/ Over use of β agonists	13
Depression/Psychiatric Disorder	6
Obesity	3
Lack of Prior Diagnosis	2
Allergic Reaction	1
Aspirin Sensitivity	1
Amount of Pain Medication	1
Physician-Related Factors	
Inadequate Prescription of Steroids	14
Needed Referral or Inadequate Diagnosis for High Risk Patients	11
System-Related Factors	
Lack of Regular Medical Care	7
Lack of Health Insurance	4
Quality of Asthma Care Provided in Prisons/Psychiatric Hospitals	3
Heat Exposure on the Job	2
Health Insurance Would Not Pay for Referral	1

*Multiple causes are possible for each death.

Table 5: Causal Factors for Asthma Mortality Based on Thirteen Deaths Reviewed Children Ages 2-18, Michigan, 2002 and 2003

Causal Factor	Number of Deaths*
Patient–Related Factors	
Compliance: Trigger Avoidance; Pets; Bronchodilator Overuse	7
Inadequate use of Steroids/Overuse of β agonists	7
Inadequate Prescription of Steroids	3
Physician-Related Factors	
Needed Referral or Inadequate Diagnosis for High Risk Patients	5
Aspirin Sensitivity	1
System-Related Factors	
Lack of Adequate Adult Supervision	2
Psycho Social and Psychiatric Issues	2
No Regular Maintenance Health Care Visits	2
Repeated Refill of Bronchodilators	1

*Multiple causes are possible for each death.

Other Issues Raised During the Death Reviews

The ingestion of aspirin in an aspirin sensitive individual was suspected to be the causal factor in one adult and one child death. In both cases, the deceased unknowingly used a product with aspirin in it.

The absence of deaths from certain risk factors was also an important finding. There were no asthma deaths related to care received in the hospital. There was only one asthma death where illegal drug usage was felt to be a factor in compliance but none related to the immediate cause of death. Although peak flows meters were available but rarely used by the deceased, the lack of regular use of peak flow meters was felt by the Advisory Panel to be symptomatic of more important health care management deficiencies rather than a direct causal factor. Both the adult and child Advisory Panels felt that it was more important to put emphasis on steroid use rather than peak flow usage.

A secondary issue was the need to work with medical examiners to address whether there are changes that could be introduced to ensure that medical examiners are provided sufficient clinical information that would allow them to more accurately record the cause of death. The Advisory Panel questioned whether the death was caused by asthma in nine cases.

A large percentage of the adults and children who died were obese, 55% and 33% respectively. These percentages are greater than those found in the general population, 37% in adults (BRFSS) and 16% in children (NHANES). There has been some disagreement in the medical literature over whether obesity is a consequence of decreased physical activity among people with asthma and not a risk factor for asthma (15) and/or whether the increase in asthma symptoms reported by obese individuals is truly asthma or is a consequence of misdiagnosis of asthma among obese individuals (16).

RECOMMENDATIONS FROM ADVISORY PANELS (see Tables 6 and 7)

Adults

Suggested interventions involved education on the prescription and use of steroids for both health care providers and patients. Inclusion of education in the emergency departments for people with asthma on the prescription of steroids by health care providers and their use by patients was also strongly indicated. Referral to specialists was also indicated for three of the deceased.

System level changes that were suggested by the panels included the need for case managers for high-risk patients and the need for provisions for regular care for those without health insurance. Some mechanism, such as notification of health care providers by pharmacies, to monitor or restrict the refilling of β agonist prescriptions to reduce β-agonist overuse was favored.

Two of the most troubling asthma deaths in adults were in two individuals who had never previously been diagnosed with asthma. A general public awareness campaign on asthma management that also emphasized diagnosis of recurrent/chronic respiratory symptoms might be

useful in preventing similar deaths in the future. Finally, although a factor in only one adult death, adequate labeling of products that contain aspirin and patient education might have prevented this death.

Children

Like adults, education on the prescription and use of steroids for both health care providers and patients was the highest priority. Some mechanism such as notification of health care providers by pharmacies, to monitor or restrict the refilling of β agonist prescriptions to reduce β agonist overuse was favored. Timely referral to a specialist was also indicated. Interventions specific to children included setting up a focus group of teenagers with asthma to better understand how to conduct asthma education in this age group; attention to foster care environment (i.e. presence of asthma triggers), and a school-based asthma plan.

Insurance issues were not noted to be a problem with children. Similar to adults, there was one death in a teenager where better labeling for products that contained aspirin might have prevented the death.

Table 6: Recommended Interventions for Asthma Mortality Based on 33 Deaths Reviewed Adults Ages 19-34, Michigan, 2002 and 2003

Recommendation	Number of Deaths
Educate Health Care Providers	
Need for Inhaled Steroids	13
Asthma Education For Providers in Psychiatric Hospitals and Prisons	4
Need to Refer High Risk Patients to Specialists	3
Need for Pulmonary Function Tests	2
Need for Provision of Epinephrine self- injection for selected patients	2
Educate Patients	
Need to Use Steroids	10
General Asthma Education and Need for Regular Care	4
Provide Education in Emergency Department	3
Aspirin	1
System Level Changes	
Improve Insurance Coverage	11
Need for Case Management	10
Pharmacy Notification of Excessive β agonist use	6
Raise Public Awareness of Asthma	2
Regulation of Insurance Companies on Referrals to Specialist	1
Improve Labeling of Products Containing Aspirin	1
Medical Examiners	
Develop Clear Criteria for Identifying Asthma Deaths	9

Table 7: Recommended Interventions for Asthma Mortality Based on Twelve Deaths Reviewed Children Ages 2-18, Michigan, 2002 and 2003

Recommendation	Number of Deaths
Educate Health Care Providers	
Need for Inhaled Steroids, Include Emergency Department Doctors	5
Limitation of Refills for Bronchodilators Without a Physician Visit or Active Approval	2
Referrals for High-Risk Patients	2
Educate Patients	
Education of Patients/Family, Possibly Focus Groups for Teenagers	12
Dangers of Aspirin Sensitivity	1
System Level Changes	
Case Manager for High Risk Cases	5
Pharmacy Notification of Excessive Bronchodilator Use	4
School Based Asthma Program	2
Child Protective Services – attention needed for foster care environment	2
Development and Dissemination of Generic Action Plan	1
Better Labeling of Aspirin Products	1

Discussion

Asthma is a chronic but manageable condition. This project is based on the premise that all asthma deaths are preventable with appropriate asthma management.

The 288 asthma deaths in 2001 and 2002 represent only a small percentage (.2%) of the 173,784 deaths that occurred in Michigan during this same 2-year period. However, asthma is a treatable condition and each asthma death is a tragedy that could have been prevented.

The primary causal factor identified in the first two years of investigation was the lack of compliance by patients with good asthma management including regular use of inhaled steroids rather than dependence on β agonists and elimination of asthma triggers such as cigarette smoke and pets. Some of the deficiencies noted in asthma management were from inadequate prescription of inhaled steroids particularly in emergency departments. The low percentage of people with asthma with management plans (only 9%) would suggest that more can be done by the health care system to provide information to patients better manage their asthma. Particular recommendations were made for

- Case Managers for high risk patients (patients with a Emergency Department visit and/or a hospitalization for asthma).
- Case Managers for people with asthma and psychiatric conditions; education on asthma for psychiatric health care providers.
- Case Managers for children with asthma where lack of parental supervision is a problem.
- Pharmacy notification to doctors for patients who repeatedly fill β agonist prescriptions or possibly placing a limitation on the number of refills allowed.
- Emphasize the chronic, and potentially severe nature of asthma and the importance of prescription and use of inhaled steroids to healthcare providers in all sectors (primary and urgent care) and among people with asthma.
- Provision of more comprehensive asthma care in the Emergency Department setting, including prescription of inhaled steroids at discharge and a system for connecting patients with a primary care provider for follow up.
- Educate people with asthma in self-management, emphasizing the importance of adhering to inhaled steroid medication as prescribed.
- Referral to specialists for patients with a hospitalization and/or Emergency Department visit for asthma.
- Need for health insurance for people with asthma (more of a problem in adults than children).

More specific issues identified included better labeling for aspirin products to prevent death for individuals allergic to aspirin and prescription of epinephrine self-injection for people with asthma who have asthma attacks secondary to acute allergic reactions.

It has been suggested by some researchers that asthma deaths can be divided into two types; 1) slow onset, late arrival for care and poor use of steroids because of psychological, social and cultural factors; and 2) sudden onset of severe airway closure (19). The pathology on autopsy in

the first type of death shows abundant sticky mucus plugging in the airways and in the second there are empty/dry airways suggesting sudden airway closure by a neural mechanism. The second type of asthma death, sudden onset, is harder to prevent but review of Michigan deaths indicate that most of the asthma deaths were the slow onset type and accordingly were preventable.

Next Steps

Investigation of these deaths from asthma has identified a number of avenues to reduce asthma mortality. Action needs to occur at many levels, including health care providers, patients and system-level changes. The findings from these investigations will be shared with many asthma stakeholders who have the expertise and position to institute these recommendations. Results from the first year have been disseminated in the following way:

- A presentation to the Michigan Department of Community Health and the Michigan Asthma Advisory Committee.

- Selected presentations to local asthma coalitions, physician and allied health workers through grand rounds, national meetings and other state asthma programs.

- Presentation of data to the organization representing Medical Examiners to discuss criteria for recording a death as being secondary to asthma.

Further work is needed to disseminate the findings and initiate changes. Plans include:

- Development of physician education activity from the blinded case studies developed for panel review.

- A meeting with the organization representing Emergency Room Physicians to discuss providing prescriptions for inhaled steroids and asthma education in conjunction with Emergency Department visits as well as a system to ensure follow up by a primary health care provider.

- A meeting with the medical directors of the managed care organizations in the State.

Continued tracking of asthma deaths in Michigan is planned to identify risk factors that can be addressed to prevent such deaths. The overall number of asthma death decreased from 152 in 2001 to 136 in 2002, and from 32 to 27 in the 2-34 age groups being intensely tracked. This tracking needs to be continued to see if a downward trend in asthma mortality is under way and evaluate any interventions instituted.

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APPENDIX I

More comprehensive case summaries are available upon request for use in educational programs for health care providers.

2003 Case Narratives

Adults

1. An adult male who had asthma since childhood and psychiatric disease died while an in-patient in a mental health facility. The major issue which contributed to his death was inadequate medical evaluation and provision to treat his asthma at the time of his admission to the mental health facility. More long-term issues included compliance with the use of prescribed inhaled steroids and management of asthma in patients with psychiatric disease.

2. An adult male who had asthma since childhood developed increased respiratory symptoms while at his job at a plastic injection molding facility. He was sent home early, developed increased respiratory symptoms and died in the Emergency Department about 5 hours later, after initially delaying seeking medical care. He had no medical insurance and no regular medical care.

3. An adult woman who had developed asthma as an adult collapsed at home and died. Her cause of death was attributed to over reliance on rescue inhalers and a nebulizer. She had regular medical care but had not eliminated all triggers including cigarette smoke and pets and did not regularly use inhaled steroids.

4. An adult female with multiple medical problems including congenital heart disease and neurologic conditions, including epilepsy and mental retardation was found dead in bed in the morning. Asthma was coded as the cause of death. No autopsy was performed. Based on the severity of her medical conditions in relation to her asthma, the review committee did not believe that asthma was the cause of her death.

5. An adult male who had been diagnosed with asthma as an adult developed a pain in his head, then became short of breath and then stopped breathing. Asthma was coded as the cause of death. No autopsy was performed. Based on the results of medical tests done at the hospital the review panel did not believe that asthma was the cause of his death.

6. An adult male who was born with respiratory problems was found dead in bed. He had had diabetes since childhood. Asthma was coded as the cause of death. No autopsy was performed. Based on review of previous medical records, the review committee did not believe that asthma was the cause of his death.

7. An adult male who had had asthma since childhood completed work and went to Emergency Department and collapsed. Factors causing his death included lack of health insurance, lack of involvement of a specialist and poor coordination of medication usage. He had driven past the closest Emergency Department because he owed them money from previous care he had received for asthma.

8. An adult female who had had asthma since childhood died while in prison. Because of litigation, medical records from the prison were not provided. The deceased had been using a bronchodilator without inhaled steroids prior to incarceration.

9. An adult female who had had asthma since childhood went into respiratory arrest after using an inhaler. There was no history of steroids being prescribed. The patient had mental illness and used illegal drugs and cigarettes.

10. An adult male who had had asthma since childhood collapsed at home after using his nebulizer. He had been to the Emergency Department the day before his death. There was a history of poor compliance with using steroids. He lacked insurance for medication and the panel felt he needed a specialist, monitoring with pulmonary functions, and more steroids prescribed.

11. An adult female who had had asthma since childhood collapsed in her bathroom in the early morning. She had repeatedly used a bronchodilator through the night preceding her death. Chronic issues included lack of health insurance, inadequate use of steroids and poor compliance in eliminating asthma triggers.

12. An adult female who had had asthma since childhood developed increased shortness of breath and passed out while driving to the Emergency Department. She was released from prison shortly before her death. She had not been prescribed steroids while in jail. There was ongoing exposure to asthma triggers.

13. An adult male whose doctor stated he had COPD not asthma collapsed while trying to use his nebulizer a day after refusing admission to the hospital and then leaving a second Emergency Department. The cause of his death was felt by the review panel to relate to his overuse of bronchodilators and psychological issues.

14. An adult female who had had asthma since childhood was found dead in bed. Other medical problems included psychiatric illness and seizures. Asthma was coded as the cause of death. No autopsy was performed. Based on review of medical records, the review panel did not believe that asthma was her cause of death.

15. An adult male who had had asthma since childhood was found dead on the floor of his apartment. He had no regular medical care, had not been prescribed inhaled steroids and had been inadequately evaluated despite good health insurance coverage.

16. An adult male with asthma of unknown duration was found dead in his car after announcing he was going to the Emergency Department. He had no regular medical care, no health insurance, and did not use inhaled steroids that had been prescribed for him.

Children

1. A male teenager was found dead at a relative's house near his nebulizer. He was obese. No other information was available.

2. A female teenager who had had asthma since infancy was found unresponsive in her bathroom in the middle of the night. There was a history of a lack of parental supervision, allergies, and syncope with a recent asthma attack.

3. A male teenager who had had asthma for about five years had cold symptoms and some respiratory symptoms at night, but woke up the next morning feeling good. Later that morning he became acutely short of breath and was found unresponsive next to his nebulizer when the police broke in the door. There was a concern by the advisory panel about an over reliance on a nebulizer and β-agonists, and lack of coordination of care.

4. A female teenager who had had asthma since infancy died while eating and choking on a piece of meat. The review panel believes the death was secondary to aspiration of food and not asthma.

5. A male pre-teen who had had asthma since infancy "passed out" on the way to the Emergency Department after using his nebulizer. There was an over reliance on β agonists, no steroids had been prescribed and no specialist had been involved despite multiple Emergency Department visits and daily symptoms.

6. A female teenager who had had asthma since infancy collapsed at night after coming out of the bathroom. She had not been having respiratory problems during the evening. There was a history of inadequate compliance with the use of steroids.

7. A female pre-teen who had had asthma for about 5 years who frequently had nighttime symptoms became short of breath at night. This progressed to the point she was unable to use her nebulizer and became unresponsive. Despite Emergency Department visits and 2 hospitalizations in the year before her death she was not using any steroids. There were multiple asthma triggers at her home.

8. A male teenager who had had asthma since infancy was found dead in his room. There was a history of poor compliance with medication and psychological issues that interfered with treating his asthma.

9. A male teenager who had had asthma since infancy collapsed at home while using his nebulizer. There was concern by the review panel about compliance with the use of steroids.

10. A female teenager who had had asthma since infancy was found unresponsive in the morning when a relative came in to wake her. There was history of not using prescribed steroids, overuse of her nebulizer, and lack of specialist involvement despite frequent Emergency Department visits.

11. A male teenager who had had asthma for about 5 years died after becoming increasing short of breath despite use of his inhaler and nebulizer. Despite frequent Emergency Department visits and intermittent symptoms he was not on steroids.

APPENDIX II

Members of Adult and Child Asthma Mortality Review Panels

Adult Asthma Mortality Review Panel Members

Panel

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