2005

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

A male child died from asthma after being seen in the Emergency Department and by his asthma doctor about 4 days prior to death. The mother said on the day of death the deceased went to a relative's house where he began to have an asthma attack. She said the relatives did not know how to respond to his asthma attack that progressed quickly. The mother believed the deceased was released from the ED too soon in the days prior to his death. The panel was concerned that although compliance was good in the child's home that triggers were present at the babysitter's home and the grandmother had not been educated about asthma. There was also concern as to whether different medication formularies in different health plans were an obstacle to this child receiving adequate medication.

A pre-teen female died from asthma in the winter after she told her mother she did not feel well, had a sore throat and was cold. The mother said the deceased's primary care physician did not want to put the deceased on oral steroids until the child turned 14 years old. She was referred to a pulmonologist but died before the scheduled appointment, which was 2 ½ months after the initial referral. The deceased slept with her cat and would wake up in the morning with itchy eyes. The mother and father said the doctor never expressed the seriousness of the deceased's asthma. The panel was concerned about bronchodilator over use, lack of steroid prescription, and the continued presence of a cat in her home. Although a referral to a specialist was made, the earliest the deceased could get an appointment with the specialist was months in the future and the deceased died before the scheduled appointment.

A male in his early twenties died from asthma after having cold symptoms for about one week. He woke up the night of his fatal attack at 2 A.M. and took six breathing treatments before 911 was called at 4:25 A.M. He smoked cigarettes monthly and marijuana weekly. He had breathing problems more than twice per week and was woken up from sleep weekly from his asthma symptoms. He was seen by his primary care physician three times in the year prior to death. One visit was for an asthma exacerbation. The pharmacy record stated the Albuterol inhaler was refilled seven times in the year prior to death; however, information on the refills of the nebulizer medication was unavailable. The panel was concerned about both inadequate use and prescription of steroids and overuse of bronchodilators

A female in her early twenties died from asthma in the fall. She died in her sleep at home. The mother said she never went to the Emergency Department or was hospitalized for her asthma. She did see her primary care doctor 24 times in the year prior to death for her asthma. She was never referred to an allergist or a pulmonologist. Her medications included Atrovent MDI and an allergy pill. She had breathing problems daily and had sleep apnea. Her physical activity was limited all the time because of her asthma symptoms. The panel was concerned about the inadequate use of steroids by the deceased and inadequate diagnosis and referral by the physician.

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A Joint Report

of the

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The investigators of this project invite you to comment on this report and how you might use the information it provides by taking a brief online survey. Please visit the following weblink to complete the survey: http://www.surveymonkey.com/s.asp?u=533383530201

Executive Summary

This is the fourth Annual Report of Asthma Deaths in Michigan among 2-34 year olds. Although the 113 deaths that occurred among children and young adults between 2002 and 2005 are not large in number, the circumstances surrounding these deaths are dramatic and are indicative of potential problems with asthma diagnosis and treatment in the community. The deaths are particularly tragic because most are preventable. **Ninety percent of the 80 deaths with sufficient autopsy information to classify type were of the slow onset type, not the sudden airway closure type, and therefore were preventable.** The majority of the deaths were among males (58%) and African-Americans (69%). They were most likely to occur among residents of Wayne County (42%). 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 past four years of investigation was the lack of compliance by patients with good asthma management techniques including regular use of inhaled steroids rather than dependence on β-agonists and elimination of asthma triggers such as cigarette smoke and pets. Major deficiencies noted in asthma management included poor appreciation of the severity of the patient's condition as indicated by a lack of timely referral to a specialist and inadequate prescription of inhaled steroids. The low percentage of decedents with management plans (only 19%) 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 Management for high-risk patients (patients with an Emergency Department (ED) visit and/or a hospitalization for asthma). This includes case management for children with asthma where lack of adequate parental supervision is a problem and adults with psychiatric problems.
- Pharmacy notification to doctors for patients who repeatedly fill β-agonist prescriptions and/or do not fill controller medication prescriptions for inhaled steroids. Also possibly placing a limitation on the number of β-agonist refills allowed without a new prescription or communication with physician.
- Emphasis on 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 asthma care in the ED setting that stops the cycle of repeated treatment of acute episodes. This should include prescription of inhaled steroids at discharge and a system for connecting patients with a primary care provider for follow-up.
- Education for 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 or ED visit for asthma or who use short-acting ß-agonists daily.
- Need for health insurance including coverage of medication costs for adults with asthma (not a problem in children).

The plan for the coming year is to continue the in-depth investigation of asthma deaths in children (2-18 years) and begin in-depth investigations of adults aged 45-54 years; an age group with marked racial disparity in asthma mortality. In addition, a less intensive review of asthma deaths in all other age groups will be conducted. We do not have the resources to conduct in-depth investigation on all 130 or so asthma deaths that occur each year. However, we are aware that by reviewing all asthma deaths in the state we will be able to examine whether the in-depth information we collect on the limited age groups is generalizable to all age groups. We also plan to continue to disseminate the information learned to educate health care providers and Michigan citizens and promote policy actions at the state and local level based on the panels' recommendations.

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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 four years of investigations that cover asthma deaths occurring between January 1, 2002 and December 31, 2005.

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]. Over-use of β-agonists [4] 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 have declined significantly between 2000 and 2005. A decrease was observed for all age groups except children 5 to 14 years. The mortality rate in Michigan for asthma in African-Americans of all ages (26.9 per million) was over two times that of Caucasians (10.3 per million) in 2005. The highest racial difference in asthma mortality rates was observed in the 35 to 64 year old age group, where the rate among African-Americans was over four times the rate of Caucasians.

During the years 1990 to 2005 in Michigan, there were a total of 2,716 deaths where asthma was the underlying cause of death, 438 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 15-39 per year. Asthma deaths in the 2-34 age groups were almost equally distributed between males (231 deaths, 53%) and females (207 deaths or 47% of asthma deaths). Two hundred forty-nine (57%) of the deaths were among African-Americans and 184 (42%) were among Caucasians.

Asthma deaths in Michigan were not evenly distributed throughout the year. (1990-2005) The highest number of deaths are observed in the fall and winter 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: Death Certificates

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. Since 2004 we were able to access enrollment, health care, and pharmacy utilization records for decedents enrolled in Medicaid programs from MDCH Data Warehouse to help identify medical records; this was especially helpful for the deaths where next-of-kin were not available for interview. After an interview with the next-of-kin was attempted or completed and after available 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 one-page summary was prepared of each the medical records and autopsy reports reviewed.

Advisory Panel Review

Two expert 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, ED physicians, family practitioners, internists, nurses, pediatricians, pharmacists, pulmonologists, respiratory therapists, and social workers. In the past year, two medical directors of medical care organizations joined the panels. 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 and the Child Mortality Review Panel each met once to review completed investigations of the 2005 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, their next-of-kin, health care providers, health care systems or insurers. Both the MDCH Human Subjects Committee and the MSU Human Subjects Review Board 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

Information from Death Certificates

During the four-year study period, there were a total of 553 deaths where asthma was the underlying cause for all ages, 151 in 2002, 133 in 2003, 134 in 2004, and 135 in 2005. One hundred thirteen (20%) of these deaths were among individuals age 2-34 years. The total number of deaths per year and age group are reported in Table 1.

Table 1. Number of Asthma Deaths and Percent of All Asthma Deaths Eligible for Review, Michigan, 2002 -2005

	2002	2003	2004	2005	2002-2005
Michigan asthma deaths (all ages)	151	133	134	135	553
Study Total	32 (21%)	27 (20%)	29 (22%)	25 (19%)	113 (20%)
Children 2-18	12	11	15	10	48
Adults 19-34	20	16	14	15	65

Three asthma deaths occurred to Michigan residents who were out-of-state at the time of their deaths, two in 2004 and one in 2005. These death certificates have not yet been obtained.

Information on the three out-of-state deaths is included in Tables 1 and 2, and Figure 1 but nowhere else in the report.

Table 2. Sociodemographic Characteristics Abstracted From Death Certificates of One Hundred and Thirteen Asthma Deaths, Ages 2-34 Years, Michigan, 2002 – 2005

	Children (2-18 years)	Adults (19-34 years)	Total (2-34 years)
Number of Asthma Deaths	48 (42.5%)	65 (57%)	113
Average Age (years)	12.8	27.5	21.3
Sex			
Male	60.4%	58.5%	59.3%
Female	39.6%	41.5%	40.7%
Race/Ethnicity			
Caucasian, Non-Hispanic	14.6%	47.6%	33.6%
African-American	79.2%	49.2%	62%
Other Reported	6.2%	3.2%	4.4%
Education Completed			
College Graduate (4 year Degree)	0%	1.6%	1%
Some College	2%	29.7%	17.8%
High School Graduate	4.2%	46.8%	28.5%
Grades 6-11	62.5%	20.3%	38.4%
Grades 5 and less	31.3%	1.6%	14.3%
Place of Death*			
Hospital	91.7%	72.3%	80.5%
Home	8.3%	24.6%	17.7%
Vehicle	0%	3.1%	1.8%
Autopsied	75%	80%	77.9%

*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 12.8 years (range: 2-18 years). The average age of adults who died was 27.5 years (range: 19-34 years).

Gender

Sixty-seven (59.3%) of the individuals who died were males and 46 (40.7%) were females. There were 1.5 times as many deaths among men as compared to women (1.5 times as many in children and 1.4 times as many in adults).

Race/Ethnicity

Seventy individuals who died (61.9% of all study deaths) were African Americans, while only 38 (33.6%) were Caucasian. The remaining five deaths were reported to be of Mexican-American, Vietnamese, or Bangladeshi ethnicity on the death certificate.

African Americans were significantly over-represented among people who died due to asthma. In 2003, 19% of Michigan's children were African American. In contrast, 79.2% of the children who died from asthma between 2002 and 2005 were African American. African Americans were also significantly over-represented among the adults who died from asthma, 59% of the asthma deaths in women and 42% of the asthma deaths in men were African-American in contrast to 14.3% of Michigan population being African American. There were 4 times as many asthma deaths for African-American women and 3 times as many for African-American men as expected from the population distribution.

Education

Of the 64 adults in the study where the level of education was known, one had completed a four-year college degree (1.6%), 19 (29.7%) had 1-3 years of college, 30 (46.8%) completed high school, 13 (20.3%) completed grades 6 to 11 of school, and one (1.6%) did not complete any school.

Place of Death

The death certificate information on place of death listed in Table 2 reflects where the 113 people were pronounced dead. Ninety-four were pronounced dead in the hospital. Eighty-six of the 94 asthma deaths were non-responsive and in code status when the individual reached the hospital. There is no information on the health states of three individual when they reached the hospital. Of the remaining five, three were admitted to the hospital and two died in the ED.

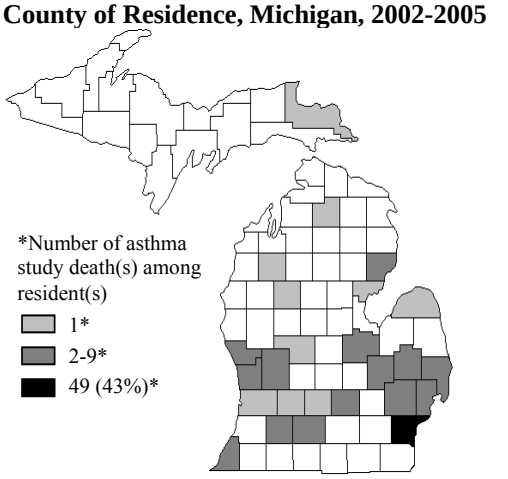
Autopsy

A high percentage of individuals, both children and adults, who died from asthma were autopsied (77.9%). Of the 88 deaths with autopsies, 72 (84.7%) showed mucus plugging in their bronchi, eight (9.4%) had empty/dry bronchi, for five (5.7%) individuals the autopsy report did not address the airways and for the three (3.4%) out-of-state deaths, the autopsies were not available. If one uses the presence of mucus plugging to characterize a death as slow onset versus the absence of mucus plugs as sudden onset of severe airway closure, then 72 of 80 (90%) would be characterized as slow onset versus 8 of 80 (10%) as a sudden onset.

Location in State

Wayne County was the most common residence of the deceased (49) (Figure 1). There were 14 counties with two to nine residents who died of asthma in 2002-2005 (Berrien, Calhoun, Genesee, Ingham, Iosco, Kalamazoo, Kent, Lapeer, Macomb, Muskegon, Oakland, Ottawa, Saginaw, St. Clair). Another 11 counties each had one death (Allegan, Arenac, Barry, Chippewa, Eaton, Huron, Jackson, Montcalm, Osceola, Otsego, Wexford).

Figure 1. Number of Asthma Study Deaths by County of Residence, Michigan, 2002-2005



Occupation/Industry

The most common occupations listed on the death certificates of adults were laborer and homemaker/unemployed/ disabled. The most common industries listed on the death certificates of the adults were automotive, healthcare industry, manufacturing, and education. Other occupation and industry classifications are listed in Table 3.

Table 3. Occupation and Industry of Deceased as Listed on Death Certificate, Adults 19-34 Years, Michigan, 2002-2005

Number of Deaths	Occupation	Industry
13	Laborer	None listed
11	Homemaker/unemployed/disabled	
7		Automotive
5		Education; Healthcare Industry; Manufacturing
4	Manager; Student	Retail
3	Clerk/clerical; Machine operator	Cosmetology
2	Hair stylist; Nurse assistant; None listed	Food industry
1	Apprentice; Carpenter; Computer technician; Courier; Customer service; Dental assistant; Dietary aide; ER technician; Housekeeper; Independent contractor; Instructor; Mental health worker; Paper carrier; Presser; Salesperson; Seat builder; Stocker; Teacher; Truck driver; Waitress; Unavailable	Air line; Carpentry; Cleaners; Computer; Construction; Courier business; Dentistry; Electrical; Employment agency; Factory; Government; Hotel; Landscape; Newspaper; Paint; Pet store; Private firm; Self-employed; Unavailable; Various jobs; Wholesale distributing

Asthma Death Review Process: Investigations Completed

The average time between the death occurring in Michigan and project staff being notified to commence the investigation was 108 days in 2002, 125 days in 2003, 200 days in 2004 and 135 days in 2005. The increase in time to notification in 2004 was secondary to equipment issues in Vital Statistics. The three deaths that occurred out of state are not included in any further data presented in this report.

Among the 110 deaths from 2002-2005 in Michigan, the major difficulty in completing the next-of-kin interviews involved locating the next-of-kin. We were unable to locate 18 next-of-kin (seven adult and eleven children) and 13 next-of-kin refused (six adult and seven children). This was most problematic in 2002, where 13 next-of-kin were not interviewed, 4 in 2003, 7 in 2004, and 6 in 2005. Of the 111 deaths, 31 did not have a next-of-kin interview.

At least partial medical records were obtained for 98% of decedents (46 of 47 of children and 62 of 63 of adults). In the absence of a next-of-kin interview, the identification of medical records received was incomplete, because the majority of information on health care providers(s) for the year prior to death was obtained from the next-of-kin (see Table 4). The Michigan Medicaid utilization data allowed for the identification of additional medical records for the deceased who had Medicaid whether or not they had a next-of-kin interview.

Table 4. Percent of Asthma Mortality Investigations Completed, Ages 2-34, Michigan, 2002–2005

	Children	Adults
Number of Deaths Eligible for Review	47	63
Unable to locate next-of-kin	11 (23.4%)	7 (11.1%)
Next-of-kin refused interview	6 (12.8%)	6 (9.5%)
Interviews completed	30 (63.8%)	50 (79.4%)

Information from Data Collection

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 5 summarizes the risk factors.

Insurance
As determined from the medical record review and next-of-kin interview, 95% (43 of 45) of children and 79% (45 of 57) of adults where insurance status was known had medical insurance. Among the fifty-nine individuals with medical insurance where information about co-payment was known, 46 of 59 (77.9%) had co-pays of $10 or less, one had a 10% co-pay, one had $15-20 co-pay, four had a $20 co-pay, one had a $50-$75 co-pay, one had an 80% co-pay. Six percent (4 of 66) 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, 77% (36 of 47) of children and 56% (35 of 63) of adults were enrolled in Medicaid at sometime during their life. At the time of their death, 66% (31 of 47) of children and 41% (26 of 63) of adults were enrolled in Medicaid.

Co-morbidities
Forty-five percent (26 of 58) of adults and 39% (17 of 44) of children were reported to have a co-morbid medical condition during their lives, such as Down's Syndrome, Crohn's disease, diabetes, hypertension, cerebral palsy, spinal muscular atrophy, hypoxic encephalopathy, mental retardation or seizures which complicated their asthma management. Another eleven had a psychiatric condition, such as major depression, bipolar disease or schizophrenia; 2.1% (1 of 47) of children and 19.2% (10 of 52) of adults.

Substance Abuse/Family Dysfunction
Eighty-five individuals were autopsied and seventy-six had toxicology results. Eight adults and two children tested positive for illicit drug use at autopsy. Six of the eight adults tested positive for marijuana, three tested positive for cocaine and one tested positive for opiates. Both children tested positive for marijuana. One additional adult tested positive for alcohol. Substance abuse issues were mentioned by the next-of-kin or a health care provider in 23% of the adult deaths (16 of 56), and 3% of the child deaths (1 of 35). Seven adults and one child 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 25% of the child deaths (8 of 32).

Triggers
Forty-three percent of adults who died of asthma (25 of 58), including 44% of 18-24 year olds and 43% of 25-34 year olds, were current cigarette smokers. Among 25-34 year olds the percentage of current smokers was 1.7 times greater than the percentage of smokers in the general population (24.5% of 25-34 year olds) [16]. Smoking prevalence among 18-24 year olds differed only slightly from the general population prevalence (40.8% of general population)[16]. Of the adults in the study population who did not smoke, 44.4% of them were exposed to secondhand smoke at home. Fifteen percent (5 of 34) of deceased children smoked and 44% (14 of 32) lived with a cigarette smoker.

Forty-seven percent of children (15 of 32) and 60% of adults (28 of 47) had dogs and/or cats living in their homes at the time of their death.

Medication Utilization
About 72% of children (28 of 39) and 63% of adults (36 of 57) had been prescribed an inhaled or oral corticosteroid. Of those who were taking corticosteroids, about 36% of children (14 of 39) and 35% of adults (20 of 52) were taking inhaled steroids only; 25% of children (9 of 39) and 14% of adults (8 of 57) were taking both inhaled and oral steroids; and 12.8% of children (5 of 39) children and 14% of adults (8 of 57) adults were taking oral steroids only.

Routine and Specialty Care
Other aspects of medical care during their lifetime were:

- ***Allergist Care:*** 58% (43 of 74) had ever seen an allergist during their lifetime - 67% (20 of 30) of children and 52% (23 of 44) of adults.
- ***Pulmonologist Care:*** 47% (36 of 76) had ever seen a pulmonologist - 52% (16 of 31) of children and 44% (20 of 45) of adults
- ***Combined Specialist Care:*** 35% (28 of 79) had seen both an allergist and pulmonologist and 31% (25 of 79) had seen neither an allergist nor a pulmonologist during their lifetime. The remaining 34% had seen either a pulmonologist or an allergist. National guidelines contain recommendations for when patients should be seen by a specialist (16) – the majority of these patients met one of the criteria in the year prior to their death.
- ***Pulmonary Function Testing:*** 53% of children and 52% of adults had ever had pulmonary function testing that included at least spirometry during their lifetime. It is recommended that spirometry be used to aid in the management of asthma, after

treatment is initiated and symptoms have stabilized to document "normal" airway function, and at least every 1 to 2 years to assess the maintenance of airway function[15].

- ***Peak Flow Meter:*** 74% (25 of 34) of children and 56% (25 of 45) of adults had a peak flow meter (only fourteen of the children and two of the adults with a peak flow meter used it regularly per next-of-kin reporting)
- ***Asthma Management Plan:*** 9% (4 of 43) of adults and 31% (10 of 32) of the children had an asthma management plan.

Intubations and Emergency Care

Thirty-four percent of adults (16 of 47) and 26% of children (9 of 35) had a history of prior intubation in their lifetime. Sixty-four percent of children (23 of 36) and 59% of adults (30 of 51) had been previously admitted to the hospital for asthma, including 56% and 49%, respectively in the year prior to death. Eighty-eight percent of children (28 of 32) and 87% of adults (41 of 47) had an ED visit for asthma in their lifetime, including 70% and 68% in the year prior to death, respectively.

Obesity

At the time of their death, 47% of adults (28 of 59) were considered obese (body mass index (BMI) of 30 or greater) at the time of their death, including 33% of 18-24 year olds (6 of 18), and 54% of 25-34 years old (22 of 41). Another 24% of adults (14 of 59) were considered overweight (BMI of 25 to 29). Four individuals had no height and weight available, although one of the latter individuals was described as obese in their medical records. The prevalence of obesity among the deceased adults was 2.4 times higher than that for the general adult population of Michigan. According to the 2005 Michigan Behavioral Risk Factor Survey, 13.6% of 18-24 year olds and 25.8% of 25-34 year olds are obese[16].

The percentage of the children considered obese (BMI-for-age of 95th percentile or greater) at time of death was higher than expected from national data. Thirty-six percent (17 of 47) of the children had a BMI that was at the 95th percentile or greater for their age, 23% (11) were at the 85th to 94th percentile and 41% (19) were less than the 85th percentile. The BMI of one child was unknown. Weight status data for the general population of children in Michigan is not available. Sixteen percent of U.S. children 6-11 years and 16% of U.S. children 12-19 years have a BMI at the 95th percentile or greater for their age[17].

Table 5. Characteristics of Asthma Management History Based on Deaths with Information Available for Children (Ages 2-18) and Adults (Ages 19-34) in Michigan from 2002 – 2005

	Children	Adults	Total
Insurance Status			
Deceased Had Some Form of Health Insurance	95%	79%	86%
Insurance Had Co-Pays	35%	56%	47%
Co-pay Mentioned as Reason for Not Filling Medication, Seeing Specialist, or Getting Tests	7%	6%	6%
Deceased Had Co-Morbid Condition	37%	45%	42%
Deceased Had Psychological Illness	3%	19%	13%
Significant Substance Abuse Noted by Family or Health Care Provider	3%	29%	19%
Exposure to Triggers			
Current Smoker	15%	43%	33%
Smoker in the Home	44%	57%	52%
Pets in the Home	47%	60%	54%
Routine Asthma Management			
Prescribed Inhaled Steroids	36%	35%	35%
Prescribed Oral Steroids	13%	14%	14%
Taking Both Inhaled and Oral Steroids	23%	14%	18%
No Steroids	28%	37%	33%
Seen by Specialist	73%	65%	68%
Seen by Allergist	67%	52%	58%
Seen by Pulmonologist	52%	44%	47%
Ever Had Pulmonary Function Testing	53%	52%	53%
Had a Peak Flow Meter	74%	56%	63%
Regularly Used Peak Flow Meter	56%	8%	32%
Had a Nebulizer	80%	71%	75%
Asthma Management Plan	31%	9%	19%
Urgent Asthma Management			
Prior History of Intubation	26%	34%	30%
Previously Hospitalized for Asthma in Lifetime	64%	59%	61%
In Year Prior to Death	56%	45%	49%
Previous ED Visits for Asthma in Lifetime	88%	87%	87%
In Year Prior to Death	70%	68%	69%
Average Number (range) of ED Visits for Asthma Reported in Year Prior to Death	2.5 (1-8)	7.6(1-52)	5.5 (1-9)
Family Dysfunction	25%	12%	17%

Weight			
Children		*Adults*	
≥ 95 percentile	36%	Obese (BMI 30+)	47%
≥ 85-94th percentile	23%	Overweight (BMI 25-29)	24%
< 85th percentile	41%	Not Overweight (BMI<25)	29%

Weight status among the deceased children and adults did not vary significantly by race. Among African-American children, 37% (14 of 38) had a BMI that was at the 95th percentile or greater versus 38% (3 of 8) of Caucasian children. Among African-American adults, 53% (16 of 30) had a BMI of 30 or greater versus 55% (12 of 22) of Caucasian adults.

Asthma Death Review Findings: Causal Factors

Causal factors may include: patient-related factors (such as compliance with medication and trigger avoidance and the need for patient education); physician-related factors (such as the need for education or changes in practice behavior); and system-related factors (such as lack of health care, need for changes in health care provision, or asthma management provisions in foster care systems). Table 6 provides causal factors identified for the 63 reviewed adult asthma deaths. Table 7 provides causal factors for the 47 child deaths reviewed.

Adults:
The most frequent causal factors for adult deaths cited by the panel were:

1. *Compliance issues, such as following advice to eliminate asthma triggers and using prescribed steroids.*

2. *The need for a specialist referral and pulmonary function testing for high-risk patients.*

3. *The inadequate prescription of steroids and over prescription of bronchodilators by health care providers, including the improper use of a home nebulizer*[18].

4. *Lack of regular medical care with a primary care physician, and a lack of health insurance.*

5. *Psychiatric disease, including depression.*

Children:
The most frequent causal factors for asthma deaths in children were:

1. *Inadequate use of steroids and over-use of β-agonists, including the improper use of a home nebulizer*[18].

2. *Compliance issues such as lack of elimination of triggers.*

3. *The need for specialist referral for high-risk patients.*

4. *The inadequate prescription of steroids by health care providers.*

5. *Lack of adequate adult supervision and regular maintenance health care visits.*

Table 6. Causal Factors for Asthma Mortality Based on 63 Deaths Reviewed for Adults Ages 19-34, Michigan, 2002–2005

Factor	Number of Deaths*
Patient-Related Factors	
Compliance	33
Inadequate Use of Steroids/Over-use of β-agonists	32
Depression/Psychiatric Disorder	11
Lack of Recognition of Severity	8
Obesity	5
Drug Abuse	5
Lack of Prior Diagnosis	2
Allergic Reaction	1
Aspirin Sensitivity	1
Amount of Pain Medication	1
Physician-Related Factors	
Needed Referral or Inadequate Diagnosis for High-Risk Patients	28
Inadequate Prescription of Steroids	23
Over Prescription of Bronchodilators	4
Poor ED Care	3
System-Related Factors	
Lack of Regular Medical Care	17
Lack of Health Insurance	8
Work Place Exposure	4
Quality of Asthma Care Provided in Prisons/Psychiatric Hospitals	3
Health Insurance Would Not Pay for Referral	1

*Multiple causes are possible for each death.

Table 7. Causal Factors for Asthma Mortality Based on 47 Deaths Reviewed for Children Ages 2-18, Michigan, 2002-2005

Causal Factor	Number of Deaths*
Patient–Related Factors	
Inadequate use of Steroids/Over-use of β-agonists	22
Compliance: Trigger Avoidance; Pets; referral to specialist	21
Co-Morbid Conditions	4
Aspirin Sensitivity	1
Inadequate Appreciation of Severity	1
Physician-Related Factors	
Needed Referral or Inadequate Diagnosis for High-risk Patients	14
Inadequate Prescription of Steroids/over prescription bronchodilator	10
System-Related Factors	
Lack of Adequate Adult Supervision	8
No Regular Maintenance Health Care Visits	7
Psycho Social and Psychiatric Issues	3
Repeated Refill of Bronchodilators	3
Lack of Insurance to Cover Medication	1
Multiple Formularies	1

*Multiple causes are possible for each death.

Other Issues Raised During the Death Reviews

The absence of deaths from certain risk factors was also an important finding. There were only 3 asthma deaths that the panel felt were related to care received for the fatal attack in the Emergency Department. There were nineteen asthma deaths where illegal drug usage may have been a factor in compliance but none in which it was 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 panels 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.

The advisory panels questioned whether the death was caused by asthma in seventeen cases. Some of this has to do with whether medical examiners are provided sufficient clinical information that would allow them to accurately record the cause of death. Additionally, panel members questioned whether, under certain circumstances, the federal algorithm used to code the cause of death will code a death as asthma when asthma is only listed on the death certificate as an ”other significant conditions contributing to the death” but not in the causal chain of events/conditions.

A large percentage of the adults and children who died were obese, 47% and 36% respectively. These percentages are greater than those found in the general population, 14 - 23% for 19- to 34-year-old in adults[15] and 16% in children[17]. 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[19] 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[20]. The mechanism for obesity adversely effecting respiratory function has been described but further studies are needed to better elucidate the association[21].

Asthma Death Review Panel Recommendations

Adults

Suggested interventions involved education on the prescription and use of steroids for both health care providers and patients (see Table 8). Emphasis was placed on educating emergency doctors on the need to prescribe inhaled steroids for chronic management in addition to oral steroids for the acute exacerbation and for educating patients about the importance of taking inhaled steroid once the acute episode is resolved. This education on changing management practice was intended for patients who had regular primary care physicians to assist them until they visited their primary health care provider as well as those who, despite referrals to primary care providers, continued to obtain their asthma care from the ED. A suggestion was made to market an "asthma pak" that included both oral and inhaled steroids to replace the current tapering steroid dose pack.

System level changes that were suggested by the panels included the need for case managers for high-risk patients and the need for provisions to ensure regular medical care for both those individuals with or without health insurance. Active case management for individuals with repeated ED visits and hospitalizations was a high priority. A mechanism to ensure that case managers have repeated interactions, even with difficult to manage patients such as those with psychiatric disease, is needed.

Some mechanism, such as notification of health care providers by pharmacies or a restriction on the refilling of β-agonist prescriptions, to reduce β-agonist over-use that would prompt reassessment of asthma status and medication regime by the health care provider was favored.

Education to improve compliance by patients on regularly using inhaled steroid and eliminating triggers was a high priority. The low percentage of asthmatics with written asthma management plans supported the review boards' conclusion that patient education needed to be improved.

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.

Children

Like adults, education on the prescription and use of steroids for both health care providers and patients was the highest priority (see Table 9). 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 over-use 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, either coverage or co-pays, were not noted to be a significant problem with children.

Table 8. Recommended Interventions for Asthma Mortality Based on 63 Deaths Reviewed for Adults Ages 19-34, Michigan, 2002-2005

Recommendation	Number of Deaths
Educate Health Care Providers	
Need for Inhaled Steroids	24
Need to Refer High-Risk Patients to Specialists	12
Need for Pulmonary Function Tests	5
Asthma Education for Providers in Psychiatric Hospitals and Prisons	5
Diagnosis of Asthma	3
Guidelines to Admit versus Discharge from ED	3
Need for Provision of Epinephrine Self-injection for Selected Patients	2
Need for Limitations of Refills for Bronchodilators	2
Improve Management of Work-Related Asthma	1
Educate Patients	
General Asthma Education and Need for Regular Care	23
Need to Use Steroids	21
Provide Education in ED	4
Provide Aspirin Sensitivity Education	1
System Level Changes	
Need for Case Management	21
Improve Insurance Coverage	14
Pharmacy Notification of Excessive β-agonist Use/under use of inhaled steroids	14
Raise Public Awareness of Asthma	2
Regulation of Insurance Companies on Referrals to Specialist	1
Improve Labeling of Products Containing Aspirin	1
Repackage Asthma Medication Provided in ED/urgent care setting	1
Medical Examiners	
Develop Clear Criteria for Identifying Asthma Deaths	15

Table 9. Recommended Interventions for Asthma Mortality Based on 47 Deaths Reviewed for Children Ages 2-18, Michigan, 2002-2005

Recommendation	Number of Deaths
Educate Health Care Providers	
Need for Inhaled Steroids, Include ED Doctors	12
Referrals for High-Risk Patients	11
Limitation of Refills for Bronchodilators Without a Physician Visit or Active Approval	3
Need for Pulmonary Function Test	1
Educate Patients	
Education of Patients/Family, Possibly Focus Groups for Teenagers	27
Dangers of Aspirin Sensitivity	1
System Level Changes	
Case Manager for High-Risk Cases	19
Pharmacy Notification of Excessive Bronchodilator Use or if long term controls prescription not filled	12
School Based Asthma Program	10
Child Protective Services – Attention Needed for Foster Care Environment	4
Development and Dissemination of Generic Action Plan	1
Better Labeling of Aspirin Products	1
Transportation Costs in Rural Area for High-Risk Cases	1
Inadequate Emergency Medical Response	1
Improve Accessibility to Children's Special Health Care Program	1
Resolve Multiple formulary plans	1
Medical Examiners	
Develop Clear Criteria for Identifying Asthma Deaths	2

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 556 asthma deaths from 2002 through 2005 represent only a small percentage (0.16%) of the 345,747 deaths that occurred in Michigan during this same 4-year period. However, asthma is a treatable condition and each asthma death is a tragedy that could have been prevented, particularly the 113 deaths occurring to children and young adults.

The primary causal factor identified in the first four 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. Major deficiencies noted in asthma management included a lack of appreciation of the

severity of the patient's condition with referral to a specialist and inadequate prescription of inhaled steroids. The low percentage of people with asthma with management plans (only 19%) 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 Management for high-risk patients (patients with an ED visit and/or a hospitalization for asthma). This includes case management for children with asthma where lack of adequate parental supervision is a problem and adults with psychiatric problems.
- Pharmacy notification to doctors for patients who repeatedly fill β-agonist prescriptions and/or do not fill controller medication prescriptions for inhaled steroids. Also possibly placing a limitation on the number of β-agonist refills allowed without a new prescription.
- Emphasis on 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 ED setting, including prescription of inhaled steroids at discharge and a system for connecting patients with a primary care provider for follow-up.
- Education for 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 ED visit for asthma.
- Need for health insurance including coverage of medication costs for adults with asthma (not a problem in children).

More specific issues identified in previous years included better labeling of 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[22]. 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. Of the 85 Michigan deaths with an autopsy, five did not include a microscopic examination. **Ninety percent of the remaining 80 deaths with an autopsy 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 continue to be shared with many asthma stakeholders who have the expertise and position to institute these recommendations.

Annual reports were distributed to asthma stakeholders and policy makers across Michigan, including members of the Michigan Asthma Advisory Committee and its work groups; contacts at all 14 local asthma coalitions; all local public health officers in Michigan; all managed care plan medical directors and quality improvement directors in Michigan. Copies have been sent to the Michigan State Library; Michigan State Medical Society; Michigan College of Emergency Physicians; and the Michigan Nurses Association. The report was distributed widely within the state health agency including to the MDCH Director; Surgeon General; directors of Chronic Disease Programs, Maternal Child Health Programs, and the Health Disparity Reduction Program. The report has also been distributed to health care providers who requested a copy; Centers for Disease Control and Prevention asthma staff; and to asthma contacts in all 50 states.

The findings have been presented to staff in the Michigan Department of Community Health's Public Health Administration; to the Michigan Asthma Advisory Committee and its Quality Improvement in Asthma Care Work Group, including members for MDCH Medical Services Administration, to the Michigan Child Death Review State Advisory Board, and through selected presentations to local asthma coalitions, physician and allied health workers through grand rounds, conferences, and national meetings. Data have also been presented to the to the Medical Directors and Quality Improvement Directors of the Michigan Association of Health Plans. Data were also presented to the organization representing Medical Examiners to discuss criteria for recording a death as being secondary to asthma.

These findings have had national exposure. The methods and results were presented per request to CDC asthma program staff and other state asthma programs nationally via teleconference. Findings on nebulizer use were presented at the Annual Meeting of the College of Chest Physicians[18] and picked up by national media.

A number of actions have been taken based on these findings:

- The findings and methods have contributed to development of asthma protocol for Child Death Review.

- A physician education activity, including online CME course (www.oem.msu.edu), has been developed from the blinded case studies used for panel review.

- The Michigan Asthma Advisory Committee (MAAC) used the findings and recommendations in past annual reports to help shape the revision of the state's strategic plan for addressing asthma.

- The MAAC's Quality Improvement in Asthma Care work group developed of a set of standardized discharge instructions for asthma patients treated in the Emergency Department (available at www.GetAsthmaHelp.com) and distributed to all emergency departments in the state.

- The Michigan Society for Respiratory Care and other partners are developing a similar plan for discharge from urgent visits to other outpatient settings.

- The American Lung Association of Michigan and MDCH Asthma partnered with the Child Death Review Staff at the Michigan Public Health Institute to improve the link between local asthma coalitions and local Child Death Review Teams. It is hoped that these organizations will work together to share expertise and assist with implementation of recommendations that may arise for community deaths. The MPHI staff presented information on the Child Death Review teams and process at the Michigan Asthma Coalition Summit and contact information has been shared with both sets of organizations.

- This experience has been used by many of the panel members to initiate policy and procedure reviews within their own organizations.

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

- Providing prescriptions for inhaled steroids and asthma education in conjunction with ED visits as well as a system to ensure follow-up by a primary health care provider.

- Developing a basic reading level fact sheet on benefits, safety, and use of inhaled corticosteroids.

- Working with Medical and Quality Improvement Directors of Michigan health plans to enhance asthma management, particularly in Medicaid patients.

- Sharing the findings with Michigan's Tobacco program and coalitions to assist with efforts to reduce second hand smoke exposure in homes, schools, day care settings, and workplaces.

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 varied from 152 in 2002, 133 in 2003, to 136 in 2004, to 135 in 2005 and from 32 to 27 to 28 to 24 in the 2-34 age groups being intensely tracked. This tracking will be continued to evaluate effectiveness of interventions to reduce both asthma mortality.

The plan for the coming year is to continue the in-depth investigation of asthma deaths in children (2-18), conduct in-depth investigations in adults (45-54) (an age group with a marked racial disparity in asthma mortality) and a less intensive review of asthma deaths in all other age categories. We do not have the resources to conduct in-depth investigation on all 130 or so asthma deaths that occur each year, but can review death certificates, day-of-death records, and medical examiner reports and findings. However, by reviewing all asthma deaths in the state we will be able to examine whether the in-depth information we collect on the limited age groups is generalizable to all age groups. We also plan to continue to disseminate the information learned to educate health care providers, policy makers, and Michigan citizens to promote policy actions and system changes at state and local levels based on the panels' recommendations.

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APPENDIX I

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

2005 Case Narratives

Adults

1. A female in her thirties died from asthma after being exposed to the cold air of winter along with the dry heat from the furnace. She used her Albuterol inhaler 5-10 times per day and did not like to take her steroid pills because her mouth became dry. She did use illicit drugs and marijuana one to two times per month. She did not smoke but was around cigarette smokers at home and at work. She had daily breathing problems. The panel's concerns were overuse of bronchodilators, inadequate use of steroids, exposure to triggers and lack of referral to a specialist.

2. A male in his late twenties died from asthma in the winter. The grandmother said he lived with a roommate who called her because the deceased was having trouble breathing. 911 was called and he was pronounced dead in the ED. His medical history included asthma, hypertension, obesity, paranoid schizophrenia, bipolar manic, and alcohol and tobacco abuse. He was hospitalized for psychological issues at least two times in the year prior to death. Factors concerning the panel included cigarettes, inadequate use of steroids, lack of regular maintenance health care, lack of referral to a specialist and psychiatric issues.

3. A female in her twenties died from asthma after spending 34 hours in the ED prior to having a respiratory arrest. She was in the ICU for 9 days. She was non-compliant with her medications stating she did not get some of her prescriptions filled due to insurance issues. She was taking oral steroids but no steroid inhalers as prescribed. She was diagnosed with asthma as a child. She had been intubated three times in her life for asthma. The grandmother said the deceased was on disability due to her asthma. She worked in a hair salon and wore a mask. The panel was concerned about patient compliance issues, inadequate prescription of steroids and lack of referral to a specialist. More immediately there were concerns about the adequacy of care in the ED included receiving a beta-blocker, sedation and lack of awareness of the severity of her condition.

4. A male in his early twenties died form asthma. He was diagnosed with asthma as an infant and was bi-polar. He smoked cigarettes and marijuana. He had severe breathing problems for one hour before 911 was called. He died in the ED. His panic attacks triggered his asthma. He used his nebulizer 3-4 times per day on a "good day". Factors that concerned the panel included poor compliance with continued exposure to triggers: pet; cigarettes; and illegal drug use, and overuse of bronchodilators. Psychiatric issues were an important contributor.

5. A male in his twenties was diagnosed with asthma as a toddler but grew out of his asthma as he entered his teen years. He was hurt in high school and went to the ED where they gave him an injection of codeine. Subsequent to this his asthma flared up and he was put on asthma medications. He overused his Albuterol. He was a cigarette and marijuana smoker. The panel was concerned about the deceased's lack of avoidance of triggers, overuse of bronchodilators and the need for a referral to a specialist.

6. A female in her twenties had asthma all her life and was on disability for asthma. The day of death the deceased had taken a shower and gone out with friends to a bar. At one point that night the deceased and her friends went outside the bar to smoke marijuana and then returned to the bar. She then asked a staff member to help her outside because of difficulty breathing. She was responsive when EMS arrived but was unresponsive upon arrival to the ED. The decease was reported to have anger issues and smoked cigarettes and marijuana daily. Factors that concerned the panel included lack of avoidance of triggers, bronchodilator overuse and inadequate use of steroids, repeated ED visits without inhaled steroids and lack of referral to a specialist.

7. A male in his twenties was diagnosed with asthma as a toddler and had his last asthma attack before he was a teenager. He was incarcerated for the last five years of his life. He was last seen exercising in his jail cell and was later found unresponsive. He used illicit drugs and marijuana daily when he wasn't in jail. Based on the autopsy his death was felt by the panel to be secondary to food aspiration and not asthma.

8. A male in his thirties worked in an ED as a technician. He was sent to the ED from his doctor's office for worsening throat pain. A pharyngeal abscess was found which was subsequently drained. He was given narcotics post-op for his pain. A nurse found him unresponsive. The panel was concerned about poor self-recognition by the deceased of respiratory symptoms and inadequate recognition of asthma symptoms in the post-op setting.

9. A male in his early thirties died from asthma. He had several health issues including severe mental retardation, cerebral palsy, epilepsy, and quadriplegia to name a few. He died from complications of his asthma. The pulmonary notes from about one month prior to death stated that there was not more that could be done for the deceased. The panel attributed his death to the severity of his medical conditions.

10. A female in her thirties had gone to dinner with her partner. They returned home together but then her partner went out to the store. When he returned the deceased asked him what took him so long and to call 911. EMS arrived to see the deceased collapse and fall down 14 stairs. She had been intubated 4-5 times in her life for breathing problems. The panel noted bronchodilator overuse, inadequate use of steroids, and poor compliance with continued exposure to asthma triggers. The panel was also concerned that the tapering of oral steroids by her physician may have been too rapid.

11. A male in his early twenties died from asthma after having cold symptoms for about one week. He woke up the night of his fatal attack at 2 am and took six breathing treatments before 911 were called at 4:25 am. He smoked cigarettes monthly and marijuana weekly. He had breathing problems more than twice per week and was woken up from sleep weekly from his asthma symptoms. The panel was concerned about both inadequate use and prescription of steroids and overuse of bronchodilators.

12. A female in her early twenties died from asthma in the fall. She died in her sleep at home. The mother said she never went to the ED or was hospitalized for her asthma. She did see her primary care doctor 24 times in the year prior to death for her asthma. She was never referred to an allergist or a pulmonologist. Her medications included Atrovent metered dose inhaler, an anti cholinergic bronchodilator, and an allergy pill. She had breathing problems daily and had sleep apnea. Her physical activity was limited all the time because of her asthma symptoms. The panel was concerned about the inadequate use of steroids by the deceased and inadequate diagnosis by the physician.

13. A male in his early thirties died from asthma. The wife believed that the stress of a legal issue triggered his fatal attack. He was having trouble breathing before he went to work on the day he died. He continued to have trouble breathing at work and went to the medical department who offered to call the ambulance. He declined and decided to go home and then to an urgent care clinic where he was given nebulizer treatments. He died later that day. He was on no medications and had not seen his doctor in two years. The panel was concerned about the inadequate use of steroids and failure by the deceased to recognize the severity of his disease, as well as inadequate prescription of steroids and a lack of appreciation of the severity of his disease by the urgent care facility.

14. A female in her twenties was never diagnosed with asthma. The only respiratory illness reported was when the deceased was in elementary school and was diagnosed with reactive airway disease. Subsequent to that she had no other abnormal lung findings. She was found by her mother unresponsive in the bathroom when the deceased failed to show up to work. The panel was concerned about her poor recognition of symptoms by the deceased.

Children

1. An elementary school aged female had multiple cardio and pulmonary problems related to birth defects was identified as having died due to her asthma. The panel attributed his death to her co-morbid conditions although there was a concern about a delay in intubation.

2. A male child died from asthma after being in the ED and seeing his asthma doctor a few days prior to death. The mother said on the day of death the deceased went to a relative's house where he began to have an asthma attack. She said the relatives did not know how to respond to his asthma attack that progressed quickly. The mother believed the deceased was released from the ED too soon in the days prior to his death. The panel was concerned that, although compliance was good in the child's home, triggers were present at the babysitter and the other family caregivers had not been educated about asthma. There was also concern about how different medication formularies in different health plans were an obstacle to this child receiving adequate medication.

3. A male in his teens died from asthma in the early morning after other children alerted the mother to his breathing problems. EMS transported him to the ED where they pronounced him dead. The panel was concerned about the inadequate use of steroids and lack of compliance to keep his appointment with a specialist.

4. A male in his teens was running from a person who was chasing him. He became short of breath and collapsed and pronounced dead at the scene. He had allergies to animals, dusts, and "most things outdoors". He smoked cigarettes daily and was around secondhand smoke and pets. His asthma was not well controlled. He did not keep an appointment for a referral to a pulmonologist. The panel was concerned about the inadequate use and prescription of steroids, overuse and over prescription of bronchodilators and continued cigarette smoking.

5. A male teenager died shortly after cutting the grass. There were inadequate records available to suggest reasons for his death from asthma.

6. A female in her teen years died 10 days after she was seen in the ED and diagnosed with pneumonia and bronchial asthma. She did not fill the medications that were prescribed at that visit. She was diagnosed with asthma 2 years prior to her death. The panel was concerned about her lack of compliance with medication.

7. A preteen female had an asthma attack at home and was not responding to her home medications. The father drove her to the ED where she was pronounced dead. She saw her primary care physician regularly but did not see an allergist or pulmonologist on an outpatient basis. The panel was concerned that she had not been referred to a specialist.

8. A pre-teen female died from asthma in the winter after she told her mother she did not feel well, had a sore throat and was cold. The mother said the deceased's primary care physician did not want to put the deceased on oral steroids until the child turned 14 years old. She was referred to a pulmonologist but died before the scheduled appointment, which was 2 ½ months after the initial referral. The deceased slept with her cat and would wake up in the morning with itchy eyes. The mother and father said the doctor never expressed the seriousness of the deceased's asthma. The panel was concerned about bronchodilator over use, lack of steroid prescription, and the continued presence of a cat in her home. Although a referral to a specialist was made, the earliest the deceased could get an appointment with the specialist was months in the future and the deceased died before the scheduled appointment.

9. An elementary-aged female died after she was treated and released from the ED a day and a half prior for an acute asthma exacerbation. The panel was concerned about the inadequate use and prescription of inhaled steroids.

10. A male teenager was with his older brother at home when he had an asthma attack and died. He was never diagnosed with asthma. The panel was concerned about the inadequate recognition of symptoms by the deceased and his parents.

APPENDIX II

Members of Adult and Child Asthma Mortality Review Panels

2005 Adult Asthma Mortality Review Panel Members

John Armstrong, MD
Private Practice
Pulmonologist

Susan B. Blonshine, RRT, RPFT, FAARC
Private Consultant
Respiratory Therapist/Asthma Educator

Ridhu Burton, MD
Private Practice
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Larry Hennessey, MD
Private Practice
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Bob Hyzy, MD
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Pulmonologist

Dana Kissner, MD
Wayne State University
Pulmonologist

Geoffrey Linz, MD
Ingham Regional Medical Center
Internist

Thomas P. Miller, MD
Private Practice
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Les Puretz, DO
Ingham Regional Medical Center
Emergency Medicine Specialist

Edward Zoratti, MD
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2005 Child Asthma Mortality Review Panel Members

Karen Boyd, MSW
Michigan State University
Social Worker

Debbie Eggleston, MD
Michigan Dept Community Health
Medical Advisor

James Forshee, MD
Molina Health care of Michigan
Chief Medical Officer

Duane Harrison, MD
Private Practice
Allergist

Steven Kreshover, MD
Private Practice
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Karen Meyerson, RN, BSN, AE-C
Pediatric and Adult Asthma
Network of West Michigan
Asthma Educator/Caseworker

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Wayne State University
Pharmacist

Elizabeth Secord, MD
Children's Hospital of Michigan
Pediatric Allergist/Immunologist

Debbie Toder, MD
Children's Hospital of Michigan
Pediatric Pulmonologist