

Pesticide Illness and Injury Surveillance in Michigan 2006

October 2007

*Division of Environmental Health
Michigan Department of Community Health*

*Michigan Department
of Community Health*



**Jennifer M. Granholm, Governor
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Pesticide Illness and Injury Surveillance in Michigan: 2006

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Acknowledgements

The Occupational Pesticide Illness and Injury Surveillance Program wishes to acknowledge those who have contributed to the development and implementation of the surveillance program and this report:

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This publication was supported by a sub-award to MDCH from MSU of grant number U60 OH008466 from the U.S. Centers for Disease Control and Prevention – National Institute for Occupational Safety and Health (CDC-NIOSH). Its contents are solely the responsibility of the authors and do not necessarily represent the official views of CDC-NIOSH.

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Summary

The Michigan Department of Community Health (MDCH) has been conducting surveillance for acute work-related pesticide illnesses and injuries since 2001, and began collecting data on non-occupational cases in 2006. The Public Health Code grants Michigan the authority to do public health surveillance for work-related conditions (PA 368 of 1978, Part 56, as amended). This is the fourth annual report on work-related pesticide illnesses and injuries in Michigan. It also includes data on the first year of non-occupational surveillance in Appendix 1.

From 2001 through 2006, 567 reports of occupational exposures and pesticide illness or injury were received and 396 (69.8%) were confirmed as cases according to the surveillance case definition. In 2006, there were 152 reported occupational cases; 113 (74.3%) were confirmed.

Michigan's Poison Control Centers (PCC) remain the main data source, reporting 121 (84.6%) occupationally exposed individuals. Antimicrobials continue to be a major exposure source. In 2006, antimicrobials accounted for almost 40% of the confirmed occupational cases, including the one death and one of the two high-severity cases.

Nineteen (17.9%) of the exposed workers in 2006 were involved in crop production. Eleven (10.4%) worked in hospitals and ten (9.4%) were landscapers. Where activity of the exposed person was known, 48 (46.2%) were exposed to pesticides inadvertently while doing their regular work that did not involve applying pesticides.

Three events in 2006 were referred to the Michigan Department of Agriculture (MDA) for investigation of possible pesticide use violations. Nine events met the criteria for priority reporting to the National Institute for Occupational Safety and Health (NIOSH). Three events were referred for inclusion by Michigan's other occupational health surveillance programs. These events are described on pages 18 and 19.

Two hundred twenty-one non-occupationally exposed pesticide cases were identified, of which 101 (45.7%) met the definition of a confirmed case. One hundred thirty-seven reports (62.0%) were identified from poison control data. There was insufficient data to confirm many of these cases because MDCH did not have the legal authority or resources to follow-up with reported individuals. Rules giving MDCH that authority went into effect September 18, 2007.

Background

Acting on concerns about acute occupational pesticide-related illness, NIOSH began collecting standardized information about acute occupational pesticide exposure from selected states in 1998¹ under the Sentinel Event Notification System for Occupational Risk (SENSOR) program. An analysis of 1998-99 data provided by the SENSOR states demonstrated that the surveillance system was a useful tool to assess acute pesticide-related illness and to identify associated risk factors (Calvert, et al 2004).

In 2001, MDCH joined other NIOSH-funded states to institute an occupational pesticide illness and injury surveillance program. The intent of this surveillance was to identify the occurrence of adverse health effects and then intervene to prevent similar events from occurring in the future. MDCH recognized the need for data on work-related pesticide exposures and adverse health effects in Michigan. Agriculture is the second largest income-producing industry in Michigan, and pesticide use is widespread. The adverse health effects of pesticides are of concern to workers exposed in agricultural settings as well as those exposed in non-agricultural settings such as landscaping, structural applications, disinfectant use in health care or food service situations, and second-hand exposure during workplace pesticide applications.

The goals of the pesticide surveillance system are to characterize the occupational pesticide-poisoning problem in Michigan and to prevent others from experiencing adverse health effects from occupational pesticide exposures. The surveillance data are used to:

- Identify groups at risk for pesticide-related illnesses;
- Identify clusters/outbreaks of pesticide-related illnesses;
- Detect trends;
- Identify high-risk active ingredients;
- Identify illnesses that occur even when the pesticide is used correctly;
- Identify and refer cases to regulatory agencies for interventions at worksites;
- Provide information for planning and evaluating intervention programs.

¹ <http://www.cdc.gov/niosh/topics/pesticides/>

Methods

Occupational pesticide poisoning is reportable under the Public Health Code (Part 56 of Act 368 of 1978, as amended). This law requires health care providers (including Michigan's two Poison Control Centers), health care facilities, and employers to report information about individuals (including names) with suspected or confirmed work-related diseases to the state.

Pesticides are a category of chemicals that are used to kill or control insects, weeds, fungi, rodents, and microbes. There are over 600 different approved active ingredients that are sold in about 16,000 products used in the United States (Calvert, 2004).

In addition to information from reports submitted under the public health code, the surveillance system also collects information on individuals with occupational exposure to pesticides who have been reported to the Pesticide and Plant Pest Management Division of MDA. MDA receives complaints about pesticide misuse and health effects and is mandated to conduct investigations to address potential violations of pesticide laws. Other data sources include Michigan's Hazardous Substances Emergency Event Surveillance (HSEES)² program, coworkers, and worker advocates.

The MDCH work-related pesticide poisoning surveillance system is a case-based system. A reported individual must meet the case definition established by NIOSH and the participating states³ to be included as a confirmed case. Data are collected according to standardized variable definitions in a database developed for states that are conducting pesticide surveillance.

A suspected case is any person reported to have been exposed at work to a pesticide product. Individuals are interviewed to determine the circumstances of the reported pesticide exposure, the signs and symptoms they experienced, the name of the pesticide, the name of the workplace where the exposure occurred, and other details about the incident. When possible, medical records are obtained to confirm and clarify the conditions reported.

Suspected cases are then classified based on criteria related to (1) documentation of exposure, (2) documentation of adverse health effects, and (3) evidence supporting a causal relationship between pesticide exposure and health effects. The possible classifications are: definite, probable, possible, suspicious, unlikely, insufficient information, exposed but asymptomatic, or unrelated.⁴ Cases classified as definite, probable, possible, or suspicious are considered confirmed cases.

Confirmed cases are evaluated regarding the severity of the health effect: low, moderate, high and death. The severity index is based on the signs and symptoms experienced, whether medical care was sought, if a hospital stay was involved, and whether work time was lost.⁵

In 2006, a consensus was reached by the ten states conducting surveillance for pesticide illnesses and injuries to change the categories used for type of exposure. The category Spray was replaced

² http://www.michigan.gov/mdch/0,1607,7-132-2945_5105-110654--,00.html

³ http://www.cdc.gov/niosh/topics/pesticides/pdfs/casedef2003_revAPR2005.pdf page 1

⁴ http://www.cdc.gov/niosh/topics/pesticides/pdfs/casedef2003_revAPR2005.pdf pages 2-3

⁵ <http://www.cdc.gov/niosh/topics/pesticides/pdfs/pest-sevindexv6.pdf>

by Targeted, and expanded to include all releases at the target site. Contact was replaced with Leak/Spill and Other for exposures that may involve contact such as washing dishes in a disinfectant solution. Other also includes exposures that do not fit in any other category.

Work sites or work practices where other workers may be at risk are identified. When appropriate, referrals are made to two other state agencies with regulatory responsibility for worker health and pesticide use: the MDA and the Michigan Occupational Safety and Health Administration (MIOSHA) in the Michigan Department of Labor and Economic Growth (DLEG). MDA enforces state and federal legal requirements for the sale and use of pesticides, including training and licensing pesticide applicators. MDA also enforces the federal Environmental Protection Agency's (EPA) Worker Protection Standard, which includes requirements to protect agricultural workers from adverse health effects of pesticides. DLEG enforces MIOSHA standards and performs training in health and safety.

In addition, NIOSH is provided information about high priority events. The criteria for defining high priority events are:

- a. events that result in a hospitalization or death;
- b. events that involve four or more ill individuals;
- c. events that occur despite use according to the pesticide label; or
- d. events that indicate the presence of a recurrent problem at a particular workplace or employer.

With prompt reporting of these events by states involved in pesticide illness and injury surveillance, NIOSH can refer cases to the EPA as needed, identify clusters across states, and identify the need for national level interventions.

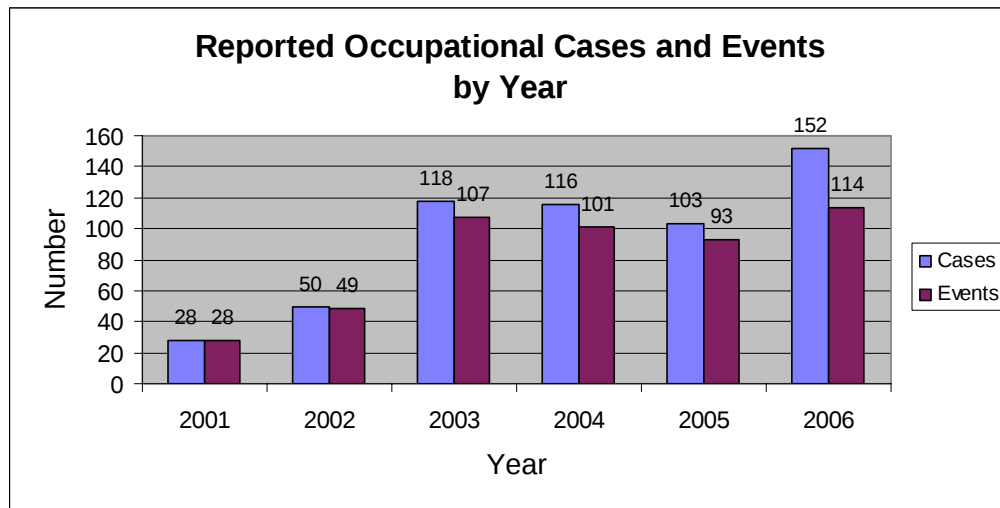
Finally, if appropriate, MDCH surveillance staff provide educational consultations to reported individuals and their employers about reducing hazards related to pesticide exposures.

Results

Reports

There were 567 reports of acute occupational pesticide poisonings from 2001 – 2006. These represent 491 separate events, 114 of which were reported in 2006. Figure 1 shows that since some events have multiple cases, the number of cases varies more than the number of events.

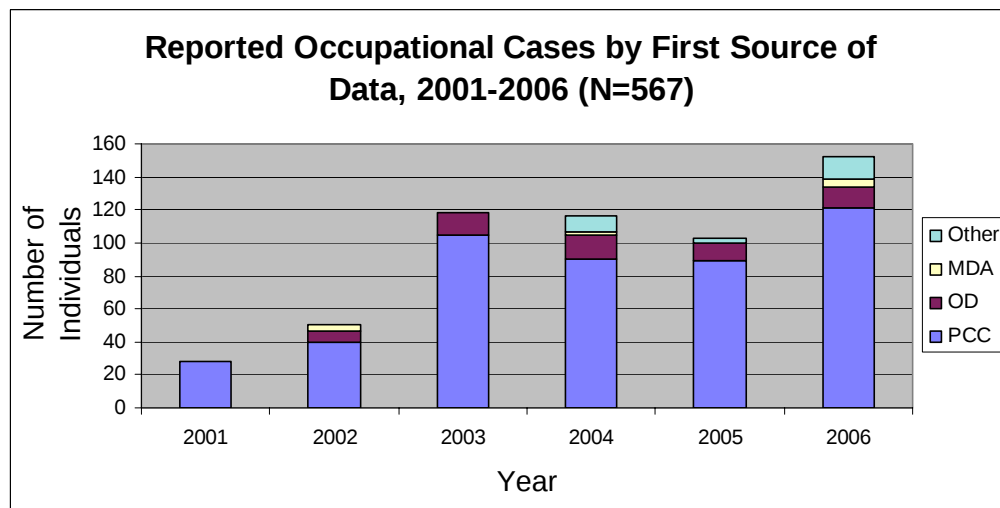
Figure 1



Data Source

The distribution of the sources of the case reports is shown in Figure 2. The Poison Control Centers (PCC) remain the major source of reports. In 2006, 121 (79.6% of the 152 reported) cases were reported by the PCCs. Thirteen (8.6%) cases were from occupational disease (OD) reports from a health care provider and five (3.3%) cases were reported by the MDA. Figure 2 indicates which data source first reported cases, by year. Some cases were reported by multiple sources.

Figure 2



The average time between the event and the report to the State varied by reporting source. One event with two cases, provided by HSEES, was reported the day of the event. The median time lag for PCCs was one day, the average was eight days, and 56 cases were reported the same day the event occurred. The OD reports had the longest time lag, with an average of 350 days between the incident and the date the report was received. This long time lag is secondary to the fact that most OD reports are from hospitals, which report all of their cases only once a year. Long time lags between the occurrence of the event and the time of the report reduce the likelihood that MDCH will be able to locate and contact the exposed persons for follow-up, and therefore to confirm cases.

Classification

Of the 567 occupational cases reported from 2001 through 2006, 396 (69.8%) met the criteria to be considered confirmed cases. In 2006, 113 (74.3%) cases were considered confirmed cases. See Table 1.

Table 1

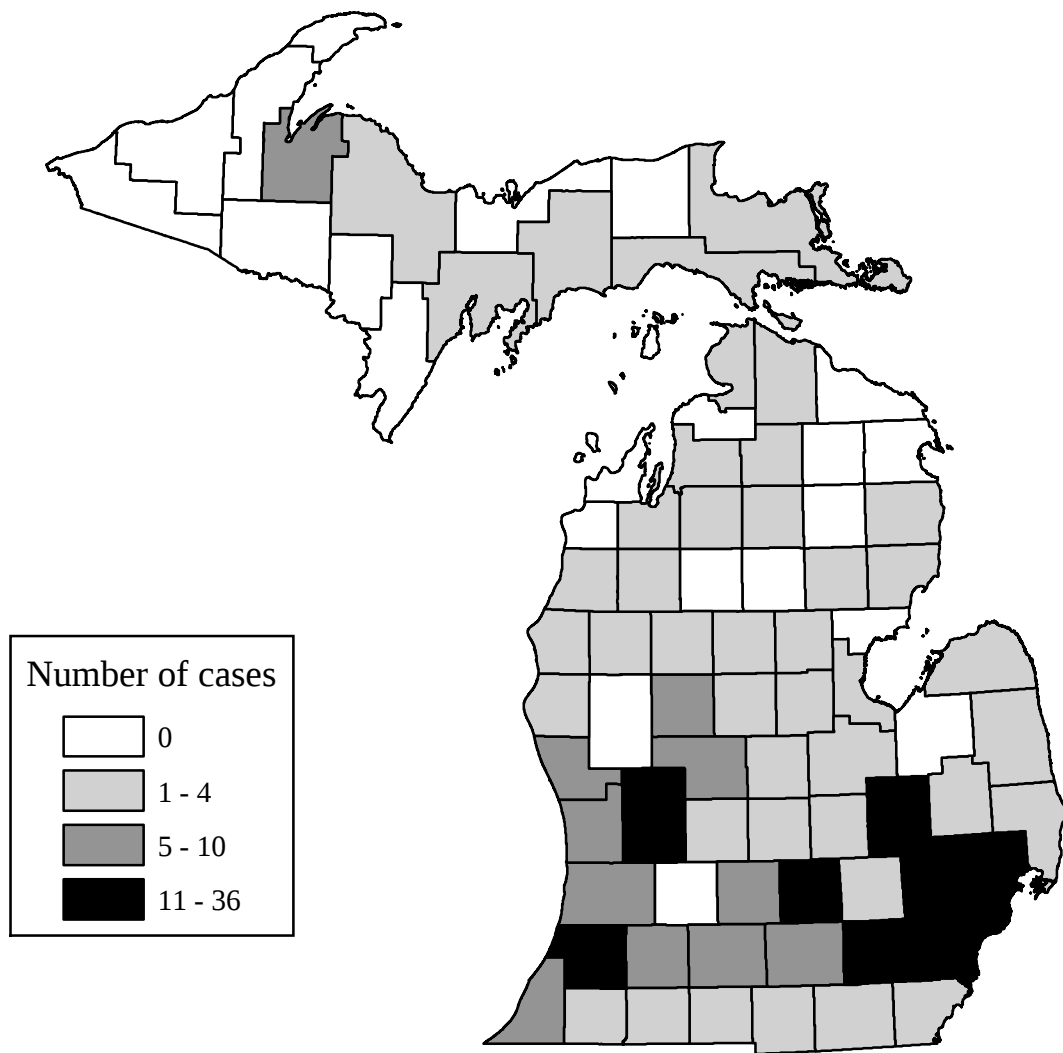
Reported Occupational Cases by Classification, 2006 and 2001-2006				
	2006		2001-2006	
Classification	Number	Percent	Number	Percent
Confirmed cases				
Definite	16	10.5	64	11.3
Probable	33	21.7	87	15.3
Possible	60	39.5	232	40.9
Suspicious	4	2.6	13	2.3
<i>total confirmed</i>	<i>113</i>	<i>74.3</i>	<i>396</i>	<i>69.8</i>
Not confirmed				
Unlikely	0	0.0	2	0.4
Insufficient Information	37	24.3	138	24.3
Exposed, Asymptomatic	1	0.7	24	4.2
Unrelated	1	0.7	7	1.2
<i>total not confirmed</i>	<i>39</i>	<i>25.7</i>	<i>171</i>	<i>30.2</i>
Total	152	100.0	567	100.0

Location in State

In 2006, there were no confirmed cases in 56.6% of Michigan's counties (47 of 83 counties). For 15 (13.3%) confirmed cases in 2006, county of exposure was unknown. Van Buren County had 13 confirmed cases (12 from one event), Wayne County had 11 confirmed cases, and Kent and Oakland Counties each had 8 confirmed cases in 2006. Since the numbers per county are low, Figure 3 shows the distribution of all confirmed cases (2001-2006) to preserve anonymity. For that time period, the county of exposure was unknown for 74 (18.7%) confirmed cases.

Figure 3

Confirmed Occupational Pesticide Poisoning Cases, by County of Exposure, 2001 - 2006
(N=322*)



* County of exposure was unknown for 74 cases.

The summary information that follows includes data on the 113 confirmed occupational cases reported in 2006. These represent 92 events. Appendix 2 contains a brief narrative of each confirmed case from 2006. See the previous annual reports for brief narratives of confirmed cases from previous years.

Demographics

Gender

Of the 113 persons with confirmed work-related pesticide illnesses or injuries, 57 (50.4%) were men and 56 (49.6%) were women.

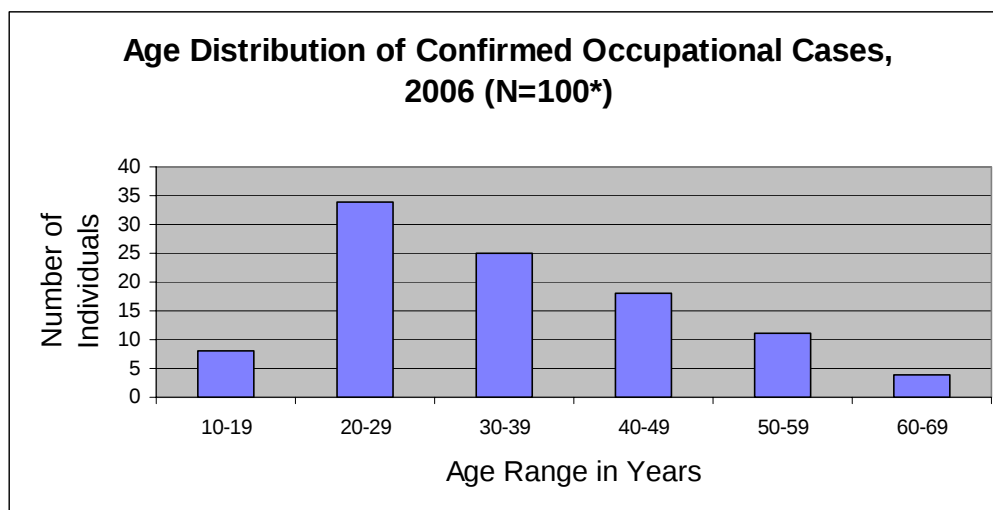
Race and Ethnicity

For 54 (47.8%) individuals, race was unknown. Where race was known, 46 (78.0%) were white. Ethnicity was unknown for 46 (40.7%) cases. Where it was known, 16 (23.9%) were Hispanic.

Age

The age distribution of the individuals where the age was known is shown in Figure 4. The median age was 33, with a range of 12 to 64. Most (61.3%) of the exposed individuals were young adults, 20 – 39 years old.

Figure 4



* Age was unknown for 13 of the confirmed occupational cases.

Industry⁶

The type of industry where individuals were employed provides information on where to target interventions. Industry of employment was known for 106 (93.8%) of the 113 confirmed cases.

As table 2 shows, the industry category with the most persons exposed to a pesticide in 2006 was Agriculture, Forestry, and Fisheries, with 34 workers. Nineteen of those worked in crop

⁶ Categorized based on 1990 US Bureau of Census Industry Codes

production, one in livestock production and four in veterinary services. In 2005, there were a total of 11 workers in Agriculture, Forestry, and Fisheries and 16 in 2004. The number of workers in Retail Trade also increased over previous years, from 12 in 2004 and nine in 2005 to 21 in 2006. A recent paper⁷ provides more information about acute pesticide poisonings in retail.

Of the 22 workers in Professional and Related Services, half (11) worked in hospitals. Five of the six workers in the Business and Repair Services category were in the ‘Services to Dwellings and Other Buildings’ subcategory, which includes structural pesticide applicators.

Table 2

Industry of Confirmed Cases, 2006 (N=106*)		
Type of Industry	Number	Percent
Agriculture, Forestry, and Fisheries	34	32.1
Professional and Related Services	22	20.8
Retail Trade	21	19.8
Manufacturing	7	6.6
Business and Repair Services	6	5.7
Miscellaneous	16	15.1
Total	106	100.0

* Industry was unknown for seven confirmed cases

Occupation⁸

The occupation of the workers who become ill provides additional information that may help to direct interventions and activities. Occupation was known for 90 (79.6%) of the 113 confirmed cases and is shown in Table 3.

The most common Service Occupations were pest control occupations (nine), followed by cleaners/housekeepers (seven) generally exposed to antimicrobials. Most (14) of the Farming, Forestry, and Fishing workers were farm workers. Twelve of them were exposed in the same event.

Table 3

Occupation of 2006 Confirmed Cases (N=90*)		
Occupation	Number	Percent
Service Occupations	34	37.8
Farming, Forestry, and Fishing Occupations	26	28.9
Technical, Sales and Administrative Support Occupations	13	14.4
Operators, Fabricators, and Laborers	12	13.3
Managerial and Professional Specialty Occupations	3	3.3
Precision Production, Craft, and Repair Occupations	2	2.2
Total	90	100.0

* Occupation was unknown for 23 confirmed cases

⁷ Calvert GM, Petersen AM, Sievert J, Ball C, Mehler LN, Das R, Harter LC, Romoli C, Becker A, Ball C, Male D, Schwartz A, Lackovic M. Acute pesticide poisoning in the US retail industry, 1998-2004. Public Health Rep 2007; 122:232-244.

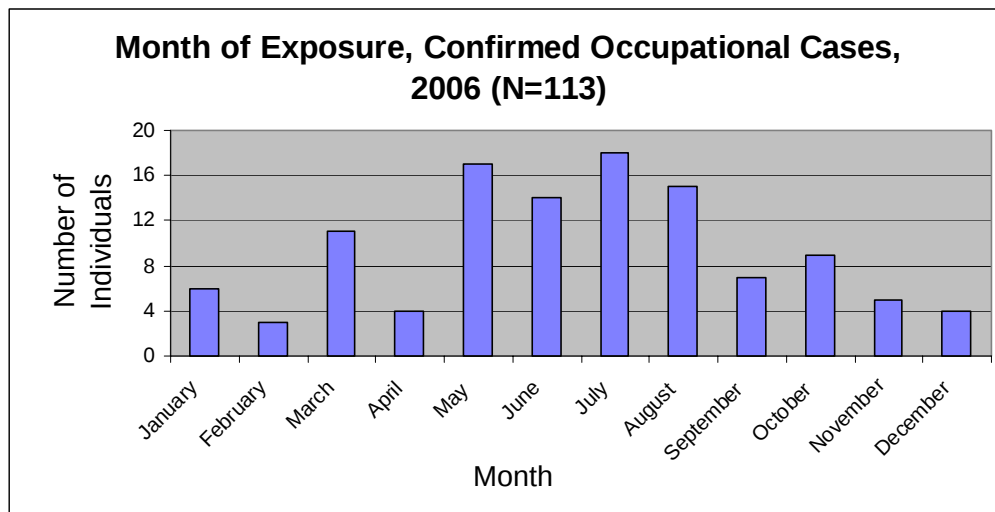
⁸ Categorized based on 1990 US Bureau of Census Occupation Codes

Exposures

Month of Exposure

Figure 5 shows that confirmed cases were more likely to be exposed in the spring and summer months.

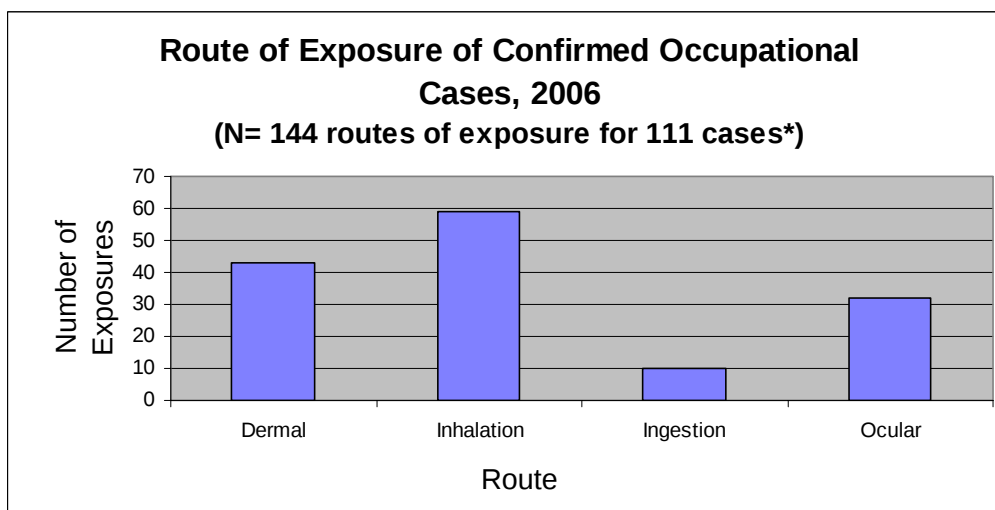
Figure 5



Route of Exposure

Route of exposure indicates how the pesticide entered the body. Figure 6 shows that 111 individuals identified one or more routes of exposure for a total of 144 routes, including 59 inhalation exposures, 43 dermal exposures and 32 ocular exposures. Seventeen individuals were exposed through two different routes. Five had three routes of exposure and two had four routes.

Figure 6

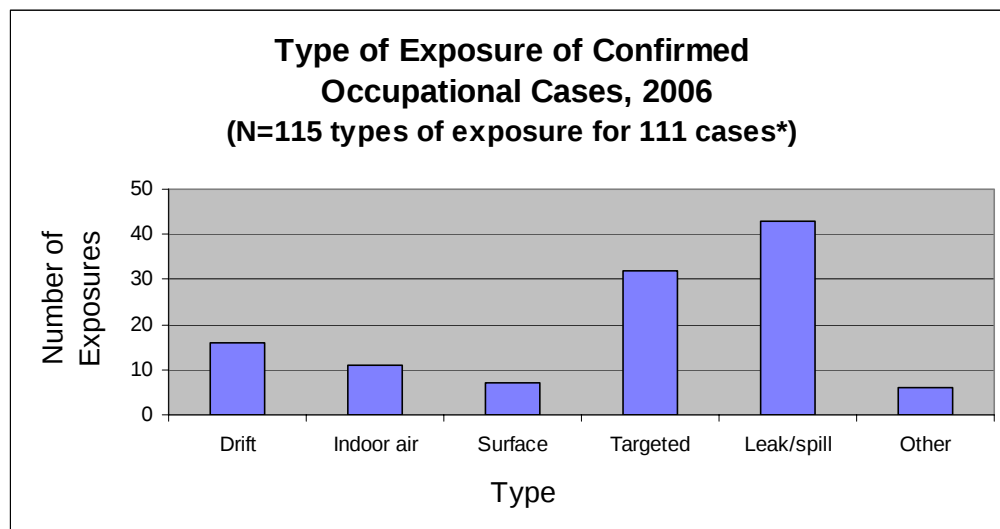


*Route of exposure was unknown for two confirmed cases; 24 had multiple routes of exposure.

Type of Exposure

Figure 7 shows how workers who became ill were exposed to pesticides. Exposure from an accidental leak or spill accounted for 43 exposures. Exposure during a targeted application accounted for an additional 32 exposures. For two cases, the type of exposure was unknown. Five workers experienced two types of exposure.

Figure 7

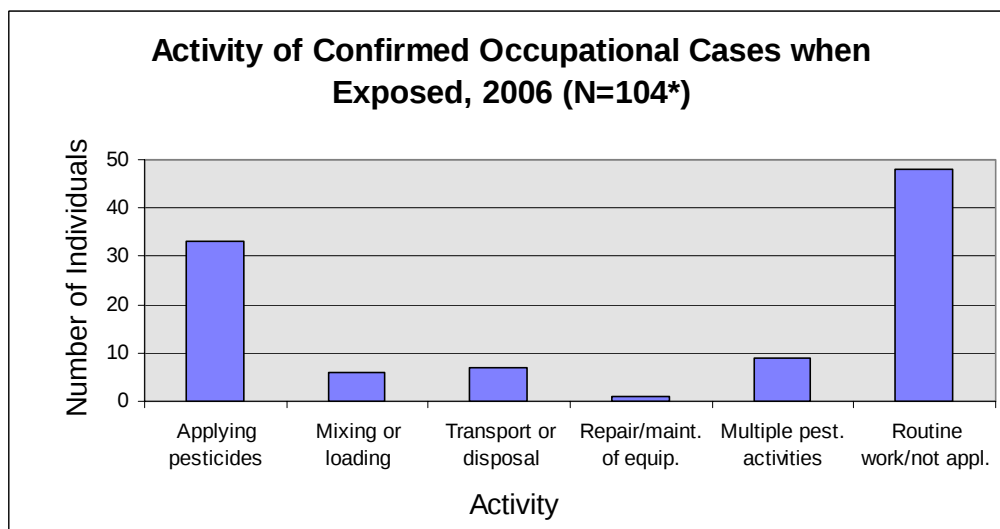


*Type of exposure was unknown for two confirmed cases; five cases had more than one type of exposure.

Activity at Time of Exposure

Activity at time of exposure was determined for 104 (92.0%) of the confirmed cases. Of those, Figure 8 shows that 48 (46.2%) were doing work activities that did not involve pesticide applications and thus had “bystander” exposure. Thirty-three (31.7%) individuals who became ill were applying pesticides when they were exposed.

Figure 8



* Activity was unknown for 9 cases

Medical Care

Table 4 shows where confirmed cases first sought medical care. Thirty-nine (34.8%) of the cases first sought medical advice from an emergency department; in many instances medical personnel consulted with poison control which then reported the case to MDCH.

Table 4

First Source of Medical Care of Confirmed Cases, 2006 (N=112*)		
First Care	Number	Percent
Advice from poison control	42	37.5
Emergency room/urgent care	39	34.8
Ambulance	13	11.6
No medical care sought	8	7.1
Occupational health clinic	6	5.4
Physician office visit	4	3.6
Total	112	100.0

* First care sought was unknown for one case

Product Used

Among confirmed cases, the most common exposure was to antimicrobials (38.9%), followed by insecticides (34.5%) and then herbicides (16.8%). See Table 5

Table 5

Product Type of Confirmed Cases, 2006 (N=113)		
Product Type	Number	Percent
Antimicrobial	44	38.9
Insecticide	39	34.5
Herbicide	19	16.8
Fumigant	5	4.4
Other	5	4.4
Mixture	1	0.9
Total	113	100.0

Severity

Table 6 shows the severity of the case by the type of product used. In 2006, one death resulted from a person with a history of asthma using bleach to clean mold in a water-damaged house. For more information on this death and the two high severity cases, see MI00544, MI00536, and MI00779 in Appendix 2.

Table 6

Severity by Product Type of Confirmed Cases, 2006 (N=113)								
Product Type	Low		Moderate		High		Death	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Antimicrobial	35	36.8	7	46.7	1	50.0	1	100.0
Insecticide	35	36.8	4	26.7	0	0.0	0	0.0
Herbicide	14	14.7	4	26.7	1	50.0	0	0.0
Fumigant	5	5.3	0	0.0	0	0.0	0	0.0
Other	5	5.3	0	0.0	0	0.0	0	0.0
Mixture	1	1.1	0	0.0	0	0.0	0	0.0
Total	95	100.0	15	100.0	2	100.0	1	100

Antimicrobials

Antimicrobials accounted for almost 40% of the 2006 confirmed occupational cases, including the one death and one of the two high-severity cases.

Antimicrobial pesticides are substances or mixtures of substances used to destroy or suppress the growth of microorganisms such as bacteria, viruses, or fungi on inanimate objects and surfaces.⁹ Antimicrobials are registered by the EPA, just as other pesticides are. Antimicrobials include:

- sterilizers, which destroy microbes including fungi, viruses, bacteria, and their spores;
- disinfectants, which destroy or inactivate fungi and bacteria, but not necessarily their spores; and
- sanitizers, which reduce microorganisms from inanimate objects to levels considered safe.

Type of Antimicrobial

Where the type of antimicrobial used was known, the most commonly reported type was disinfectant (82.6%). See Table 7.

Table 7

Antimicrobial Type of Confirmed Cases, 2006 (N=33*)		
Type	Number	Percent
Sterilizer	2	6.1
Disinfectant	27	81.8
Sanitizer	4	12.1
Total	33	100.0

* Type of antimicrobial was unknown for 11 cases

Confirmed cases from 2006 with antimicrobial pesticide exposures were compared to cases with exposures to other pesticides:

⁹ http://www.epa.gov/oppad001/ad_info.htm "What Are Antimicrobial Pesticides?"

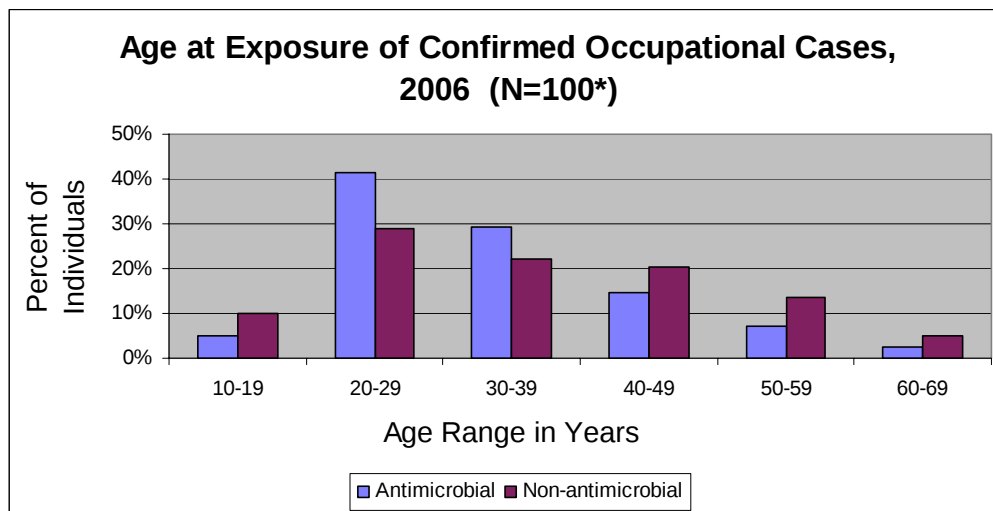
Gender

Women were more likely to be exposed to antimicrobial pesticides, with 56.8% of antimicrobial exposures, whereas only 44.9% of the non-antimicrobial exposures were women.

Age

Figure 9 shows that workers exposed to antimicrobials tended to be younger than those exposed to other pesticides.

Figure 9

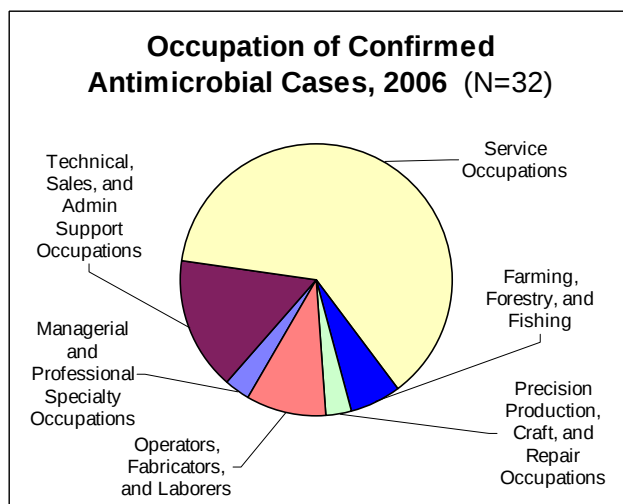


* Age was unknown for 13 of the confirmed cases.

Occupation

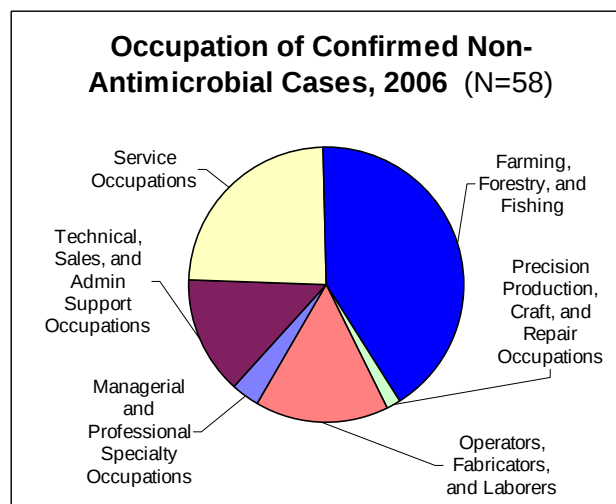
In over 60% of the antimicrobial cases, the exposed person was working in a Service Occupation. Among other pesticide cases, the largest group was in Farming, Forestry, and Fishing Occupations. See Figures 10 and 11.

Figure 10



* Occupation was unknown for 12 antimicrobial cases

Figure 11



* Occupation was unknown for 11 non-antimicrobial cases

Outreach, Education, and Prevention Activities

Publications and Presentations

Staff members of Occupational Pesticide Illness and Injury Program sought many avenues to provide information about the program and pesticide safety to stakeholders and the general public. In 2006:

- A staff member of the surveillance program represented MDCH on the MDA Pesticide Advisory Committee and provided an activity report each quarter.
- The 2004 and 2005 Pesticide annual reports were completed, distributed to stakeholders, and made available on the Division of Environmental Health's website.
- Information about antimicrobial cases was shared at the "Winterfest" meeting of states participating in the pesticide surveillance program in January 2006.
- An update of the project, with results, was presented at the annual meeting with MDCH and Michigan's Poison Control Centers.
- Information about Michigan's Occupational Pesticide Illness and Injury Surveillance Program's antimicrobial cases was presented at the annual Michigan Epidemiology conference in March 2006.
- Information about the program, pesticide safety, and occupational disease reporting requirements was provided to migrant health clinics in June 2006.
- Program materials and pesticide information was made available at tables at the Michigan Safety Conference, Ag Expo, and the Michigan Growers and Farmworkers conference.
- The MDCH surveillance program contributed to a NIOSH draft article about cases occurring in agriculture.
- MDCH staff shared information about programs and resources with Migrant Health Promotions via a conference call in September 2006.

MDA Reports

Two cases were reported to MDA in 2006. MI00588, where an applicator was neither registered nor certified and was not under constant supervision by a certified applicator, and MI00725, because of concern that a company was not following regulations regarding storage and disposal of pesticides and containers.

In addition, an incident that was not confirmed as a case because we were unable to identify the pesticide that had been sprayed was also reported to MDA. A truck driver was repairing a starter next to a stand of apple trees that were being sprayed. That night he had foaming from his nose and mouth and difficulty breathing. The case was reported because the person spraying did not turn off the sprayer near the truck driver to avoid exposing him.

NIOSH Reports

Nine events met the criteria for priority reporting to NIOSH, seven occupational and two non-occupational. One work-related event resulted in a death. A man was using bleach to clean water and mold damage in a vacant house. He was found dead at the house, and the cause of death was listed as acute pulmonary edema due to exposure to chlorinated fumes. In addition to being reported to NIOSH, the case was referred to the Michigan Fatality Assessment and Control Evaluation (MIFACE)¹⁰ program. See MI00544 in Appendix 2.

Five events were reported because four or more individuals became ill. One event with multiple exposures occurred when an organophosphate insecticide drifted onto workers picking blueberries from a farm across the road. When the applicator started spraying some drifted over and the crew leader asked the applicator to stop spraying, but he did not immediately stop. There were about 40 workers in the field. Twelve of these workers were confirmed cases – see MI00645, MI00646, MI00647, MI00648, MI00649, MI00650, MI00651, MI00652, MI00663, MI00665, MI00666, and MI00682 in Appendix 2). The farmer employing the pickers reported the incident to MDA prior to our being informed of the exposures. MDA found evidence of drift, failure to display the required pesticide application information in a central location, failure to provide decontamination services for workers and handlers, failure to notify workers of the pesticide application, and failure to provide pesticide safety information and training to workers and handlers. The farmer involved in the application settled with MDA, agreeing to refrain from future violations and paying a \$2,000 fine.

Another event involved a veterinary clinic where employees were exposed to phosphine gas when vomiting was induced in a poisoned dog. Two of the veterinary clinic employees were considered confirmed cases (MI00565 and MI00566). Four other of the exposed clinic employees only had one symptom each, and thus were not considered confirmed cases.

Another multiple exposure event involved workers entering an insecticide-treated building. One individual, MI00699, had a burning sensation in his eyes and throat, developed a headache, dizziness, and blurred vision. Six coworkers were also exposed and developed coughing.

Another event with multiple exposures took place in an office where diatomaceous earth was applied to eliminate flying ants. The housekeeper was then told to vacuum up the ants, releasing the diatomaceous dust into the air. Five people developed symptoms. See MI00770, MI00771, MI00772, MI00773, and MI00791 in the appendix for more details.

The final event involving multiple individuals happened when a surgical processing technician in a hospital brushed against a partially used ethylene oxide (ETO) fumigant canister which had been improperly placed on the ETO machine, causing it to fall to the floor. It cracked and released ETO. Fifteen people were evacuated from the area and decontaminated. There were four confirmed symptomatic individuals: MI00785, MI00786, MI00787, and MI00789.

¹⁰ A program funded by NIOSH to investigate work-related fatalities in Michigan.
<http://www.oem.msu.edu/miface.asp>

One case, MI00613, was reported because the product was defective. A greenhouse owner picked up what should have been a spent fogger. It had not completely discharged and some of the insecticide got on her hands. She said 14 of the foggers from that lot did not completely discharge.

In addition, two non-occupational cases were reported. A 47-year-old man was cleaning his garage, and picked up and handled a bag with organophosphate insecticide powder. It ripped and a cloud of vapor went into his face. He showered and changed clothes, but about an hour later felt dizzy, began vomiting, sweating, had stomach cramps, diarrhea, and bradycardia. He was treated with atropine by EMS. He received atropine again in an emergency department, as well as pralidoxime and was admitted to a hospital for three days.

Another non-occupational case was reported because even though the label directions on a flea fogger were followed correctly, a member of the household developed nausea and a headache.

Discussion

Surveillance Data

In 2006, the number of pesticide exposure reports from the Poison Control Centers increased from 2004 and 2005 (89 and 90, respectively), to 121 reports in 2006, while the number of reports from health care providers remained about the same. Some of this increase in reported cases is a result of there being more events in 2006 with multiple individuals. But in looking at confirmed occupational cases from all reporting sources, there was a 47.6% increase in reported cases from 2005 to 2006 (103 and 152, respectively) and a 22.6% increase in the number of events, from 93 to 114.

Almost half of the confirmed cases in 2006 were engaged in activities not related to pesticide application. Better education of users of pesticides on safe pesticide application is needed to prevent inadvertent workplace exposures.

The number of exposures to antimicrobials remains high. Workers exposed to antimicrobials were predominantly female and the majority worked in service occupations. Antimicrobial exposure cases had a higher percentage of moderate and high severity cases, as well as the one death, although the numbers of moderate, severe, and death cases were small (seven, one, and one, respectively). Antimicrobial exposures remain an area of ongoing concern.

The surveillance system has been expanded to include non-occupational pesticide injuries and illnesses. Appendix 1 summarizes data on the 221 reported non-occupational cases. Regulations to require the reporting of all pesticide injuries and illnesses went into effect September 18, 2007. This will provide the authority to follow-up on selected cases.

Interventions

MDCH has continued to refer cases to MDA for investigation of possible safety violations. MDCH also worked to improve pesticide education for individuals and groups through the activities listed above. Education must remain a priority for both certified and non-certified pesticide applicators, since both groups may be exposed or expose other workers.

Challenges to Surveillance

Pesticide poisoning is a complex condition for surveillance because it encompasses many kinds of illnesses and injuries from skin rash to nerve toxicity. In addition, health care providers receive limited education in the toxic effects of pesticides and pesticide-related illnesses are frequently overlooked. The potential for pesticides to harm people depends in part on the dose (length of exposure and chemical concentration), and the route of entry into the body. It is also related to the specific chemicals in each product. Pesticide products are often mixtures including one or more active ingredients, as well as other ingredients that may also be toxic. Depending on the chemicals involved, pesticides can have short- and long-term adverse health effects on different organ systems, including the skin, gastrointestinal, respiratory, nervous, and reproductive systems.

The problem of identifying pesticide-related illness for public health surveillance begins with difficulties in recognition and diagnosis, because the diverse signs and symptoms experienced

can resemble an acute upper respiratory illness, acute conjunctivitis, or acute gastrointestinal illness, among other conditions. In these cases, patients may not seek medical care, or may not be correctly diagnosed if an occupational and environmental history that asks about pesticide exposure is not taken (Calvert, 2004). Migrant workers face additional barriers such as language difficulties, lack of access to care, and fear of job loss or deportation if they are not legal residents. Another problem is that even when diagnosed, pesticide-related illnesses and injuries may not be reported due to the reluctance on the part of workers and their health care providers to involve state agencies because of concerns about job security, lack of knowledge of the public health code reporting requirements, or lack of time to report (Calvert et al, 2001). Additional education to promote recognition of pesticide poisoning and compliance with the reporting requirement is needed.

More outreach is needed to educate health care providers on the importance of recognizing and reporting instances of occupational pesticide illnesses and injuries. While the emergency department was the first source of care for 39 (34.8%) of confirmed cases in 2006, the hospital submitted an occupational disease report for only 9 (8.0%) of those cases. The remaining cases were brought to the program's attention by the PCC, but if the health care providers in the hospital do not call the PCC for advice, the case is unlikely to be identified by the surveillance system.

As in many other occupational disease and illness surveillance systems,¹¹ the Michigan occupational pesticide surveillance data are likely a significant undercount of the true number of work-related pesticide poisoning cases in Michigan. A 2004 study done in the State of Washington found that the primary barrier for migrant farm workers in seeking health care was economic. Workers could not afford to take time off to seek medical care and were afraid that they might lose their jobs if they did so. That study also found that only 20-30 percent of pesticide-related illnesses among farm workers who filed a workers' compensation claim were given a diagnosis code that indicated pesticide poisoning. (Michigan's workers' compensation data identify poisonings as a group but are not specific enough to capture pesticide exposures.)

This surveillance system continues to face some challenges due to the time lag between the occurrence and the reporting of the incident for OD and MDA reports. This presents difficulties in following up with reported cases because of worker mobility, especially among seasonal farm workers. PCC reports are received promptly, but do not always contain sufficient information to allow contact with the exposed individual. Lack of information from follow-up often results in a case classification of "insufficient information."

Notwithstanding these limitations, the Michigan occupational pesticide surveillance system is receiving and investigating reports of occupational pesticide illness and injury, including follow-up prevention activities. In addition, the surveillance system has expanded to include non-occupational cases, doubling the cases evaluated.

¹¹ Azaroff LS, Levenstein C, Wegman D. Occupational injury and illness surveillance: Conceptual filters explain underreporting. *Am J Public Health* 2002. 92:1421-1429

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Additional Resources

MDCH Division of Environmental Health pesticide information: www.michigan.gov/mdch-toxics

NIOSH occupational pesticide poisoning surveillance system: www.cdc.gov/niosh/topics/pesticides/

Pesticide-Related Illness and Injury Surveillance: A How-To Guide for State-Based Programs DHHS (NIOSH) publication number 2006-102. October 2005 <http://www.cdc.gov/niosh/docs/2006-102/>

Exttoxnet Pesticide Information Profiles: <http://exttoxnet.orst.edu/pips/ghindex.html>

EPA Pesticide Product Label System: <http://oaspub.epa.gov/pestlabl/ppls.home>

Information on pesticide products registered for use in Michigan: <http://state.ceris.purdue.edu/>

Information on licensing and registration for pesticide application businesses, credentials for certified technicians, and laws and regulations for pesticide application: www.michigan.gov/mda/0,1607,7-125-1569_16988---,00.html

Information on the federal Worker Protection Standard (worker exposure to pesticides in agriculture): www.epa.gov/pesticides/health/worker.htm. In Michigan, call the Pesticide and Plant Pest Management Division, MDA, at (517) 373-1087.

Michigan State University's Pesticide Education Program: www.pested.msu.edu

To report occupational pesticide exposures in Michigan: <http://oem.msu.edu/>

Appendix 1

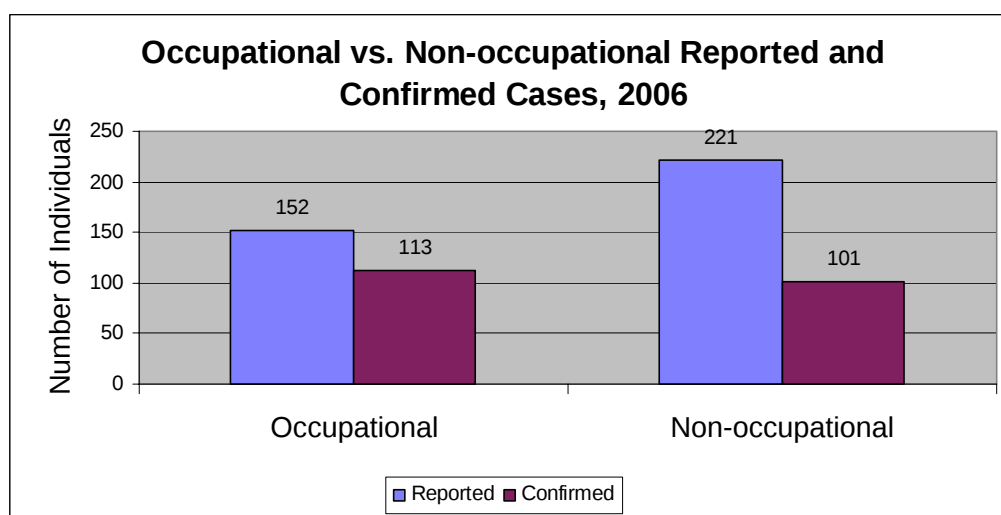
Non-occupational Exposures

In 2006, to better characterize the impact of pesticide use in Michigan, the MDCH pesticide surveillance program began collecting information about non-occupational exposures. The occupational case definition and data sources were used for these cases as well.

Reports

In 2006, there were 221 reported non-occupational cases, 101 of which were confirmed. Due to limited resources, no case follow-up was done, resulting in a lower percentage of confirmed cases. See Figure 13.

Figure 13



Classification

Of the 221 non-occupational cases reported in 2006, fewer than half (101 or 45.7%) met the criteria to be considered confirmed cases. More than half the non-occupational cases had insufficient information to be confirmed as cases, while fewer than a quarter of the occupational cases were classified as insufficient information. (Table 8.)

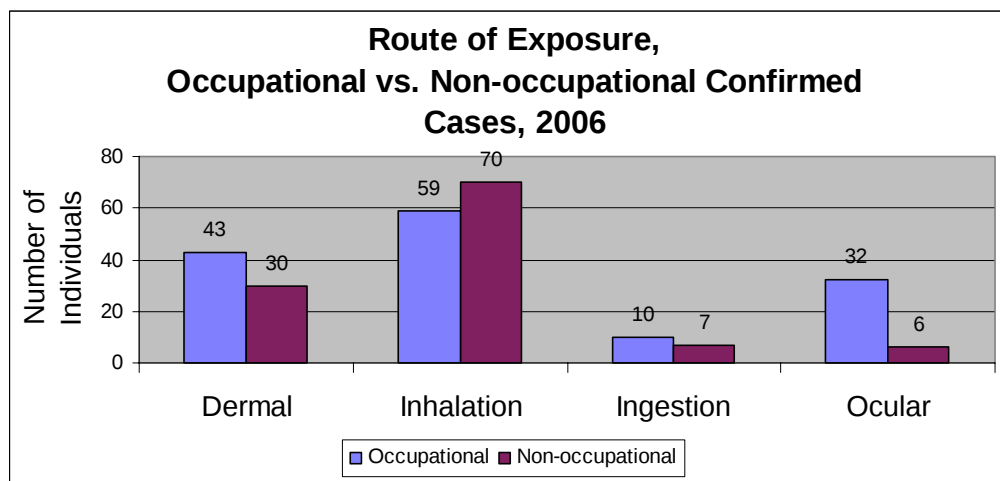
Table 8

Reported Cases by Classification, Occupational vs. Non-occupational, 2006				
Classification	Occupational		Non-occupational	
	Number	Percent	Number	Percent
Confirmed cases				
Definite	16	10.5	3	1.4
Probable	33	21.7	10	4.5
Possible	60	39.5	81	36.7
Suspicious	4	2.6	7	3.2
<i>total confirmed</i>	<i>113</i>	<i>74.3</i>	<i>101</i>	<i>45.7</i>
Not confirmed				
Unlikely	0	0.0	1	0.5
Insufficient Information	37	24.3	117	52.9
Exposed, Asymptomatic	1	0.7	1	0.5
Unrelated	1	0.7	1	0.5
<i>total not confirmed</i>	<i>39</i>	<i>25.7</i>	<i>120</i>	<i>54.3</i>
Total	152	100.0	221	100.0

Route of Exposure

Route of exposure was identified for the 101 confirmed non-occupational cases. There were 113 identified routes of exposure. The route was unknown for four cases, while for 14 there were two routes of exposure, and one case had three routes. The most common route was inhalation (70), followed by dermal (30), ingestion (7) and ocular (6). See Figure 14 for a comparison of routes of exposure for occupational and non-occupational cases.

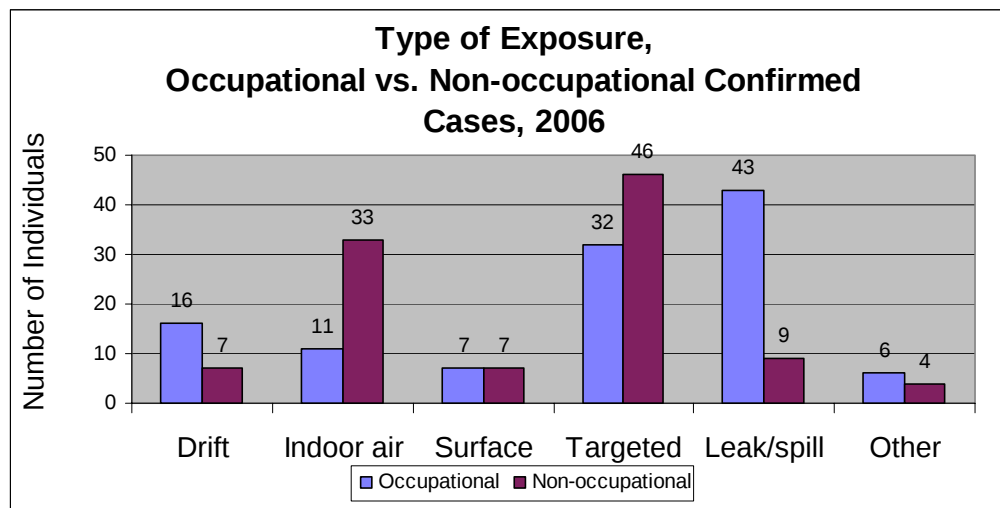
Figure 14



Type of Exposure

Type of exposure was also identified for the 101 confirmed non-occupational cases. There were 106 identified types of exposure. In nine instances, the type was unknown. Most cases (81) had one type, while for eight there were two types of exposure, and three cases had three types. For non-occupational cases, the most common type of exposure was from a targeted application (41), followed by exposure to indoor air (33). These two types of exposures account for 73.3% of all exposures. See Figure 15 for a comparison of type of exposure for occupational and non-occupational cases.

Figure 15



Product Used

Table 9 compares the products to which confirmed occupational cases and confirmed non-occupational cases were exposed. While antimicrobials were the most common exposure for occupational cases, non-occupational exposures were most likely to be due to insecticides.

Table 9

Product Type of Confirmed Cases, 2006						
Product Type	Occupational		Non-Occupational		Total	
	Number	Percent	Number	Percent	Number	Percent
Insecticide	39	34.5	51	50.5	90	42.1
Antimicrobial	44	38.9	17	16.8	61	28.5
Herbicide	19	16.8	13	12.9	32	15.0
Insect repellent	2	1.8	10	9.9	12	5.6
Fumigant	5	4.4	0	0.0	5	2.3
Fungicide	0	0.0	5	5.0	5	2.3
Other	3	1.8	3	3.0	6	2.8
Mixture	1	0.9	2	2.0	3	1.4
Total	113	100.0	101	100.0	214	100.0

Severity

Table 10 compares the severity of confirmed occupational cases with confirmed non-occupational cases.

Table 10

Severity of Confirmed Cases, 2006				
	Occupational		Non-occupational	
Severity	Number	Percent	Number	Percent
Death	1	0.9	0	0.0
High	2	1.8	3	3.0
Moderate	15	13.3	6	5.9
Low	95	84.1	92	91.1
Total	113	100.0	101	100.0

Activity at Time of Exposure

Half of all non-occupational cases (50 or 49.5%) were not involved with the pesticide application when they were exposed. Two-thirds (33) of these bystander cases were exposed indoors.

Comparison of Occupational and Non-occupational Exposures

There were a number of similarities between occupational and non-occupational cases in Michigan. Most cases, both occupational (84.1%) and non-occupational (91.1%), were classified as low severity. The majority of exposures were through inhalation (53.2% of occupational cases and 69.3% of non-occupational cases). Exposed individuals were frequently bystanders, rather than pesticide applicants (46.2 % of occupational cases and 49.5% of non-occupational cases).

There were also some differences between the two populations. Figure 15 shows some variations in type of exposure with leaks and spills being the most common type of exposure for occupational cases (38.1%), but relatively uncommon for non-occupational cases (8.9%). Indoor air was a more common type of exposure for non-occupational cases (32.7%), but relatively uncommon for workers (9.7%). The type of product the individual was exposed to also differed, with 60.4% of non-occupational cases being exposed to insecticides or insect repellents, while only 16.8% were exposed to antimicrobials.

Appendix 2

Case Narratives, 2006 Confirmed Occupational Cases

Below are descriptions of the confirmed occupational cases reported in 2006. The narratives are organized by product type and include a description of the signs and symptoms that resulted from the exposure and medical resources used. Where known, age, gender, industry, and occupation are included. In addition, more specific information about the product such as chemical class or the signal word for acute toxicity assigned by the EPA, is provided when known. The signal word is assigned based on the highest hazard of all possible routes of exposure. Caution means the product is slightly toxic if eaten, absorbed through the skin, or can cause slight eye or skin irritation. Warning means the product is moderately toxic if eaten, absorbed through the skin, or can cause moderate eye or skin irritation. Danger means the product is highly toxic. It is corrosive or causes severe burning to the eye or skin that can result in irreversible damage.

Insecticides

MI00535 – A female market researcher in her 30s who worked for a business university unlocked her door one morning and smelled fumes from a pyrethroid insecticide (signal word Caution). She had an asthma attack and shortness of breath. She called poison control because she was concerned about transmission through her breast milk to her baby.

MI00546 – A man in his 20s was smoking at work and dropped his cigarette in a puddle of a carbamate insecticide. He picked it up and continued smoking. He developed a headache, abdominal pain, and sweating. He called poison control.

MI00577 – A male stock worker in his 20s who worked in a grocery store got some pyrethroid insecticide (signal word Caution) in his eye at work. He went to an emergency department where he was diagnosed with chemical conjunctivitis.

MI00583 – An adult male stocker at a department store got some carbamate insecticide (signal word Caution) on his hands. He washed them right away but they began to burn and itch. He went to an emergency department.

MI00612 – An adult male pesticide applicator for a lawn care company developed a sore throat and fever after using a pyrethroid insecticide (signal word Caution). He went to his doctor.

MI00613 – A female in her 40s who owned a greenhouse picked up what should have been a spent fogger. It had not completely discharged and some of the organophosphate and pyrethroid insecticide (signal word Warning) got on her hands. She then touched her face, and within a few minutes it started burning. In addition, it was red and a little swollen near her eyes. Her nose became very runny. She called poison control. This event was reported to NIOSH as a high priority event.

MI00644 – A male cashier in his 20s at a department store was exposed to mint oil from a ‘poison free’ insecticide when the display fell and one can released foam product. He was nauseous, vomited, had a headache, and blurred vision. He went to an emergency department.

MI00645 – A female farm worker in her 30s was picking blueberries in a field when an applicator started spraying an organophosphate insecticide (signal word Warning) and fertilizer mix at a farm across the road. Some drifted over and the crew leader asked the applicator to stop spraying, but he didn’t until after the workers left the field. The farmer whose workers were exposed reported the incident to MDA. MDA found evidence of drift and several other Worker Protection Standard violations. There were about 40 workers in the field. Eight went to the emergency department and several additional workers experienced symptoms but did not seek medical care. This worker developed numbness in her hands and arms; was nauseous and vomited; had a headache, difficulty breathing, and was lightheaded. She went to the emergency department and was admitted for observation overnight and discharged the next day. The following day she went back to the hospital because of continued vomiting. When she was interviewed nine days later, the interviewer observed that her hands and legs were still trembling and she said she still had difficulty breathing. She had not returned to work because of her symptoms. This event was reported to NIOSH as a high priority event.

MI00646 – A female farm worker in her 50s was also picking blueberries. See case MI00645. She felt achy, her chest was tight, she was nauseous and vomited, her throat was irritated, she had a headache, was dizzy and her body and legs were shaking. She went to an emergency department twice and lost three days of work.

MI00647 – A female farm worker in her 30s was also picking blueberries. See case MI00645. She developed a headache, blurred vision, nausea, dizziness, and muscle weakness. She went to an emergency department and lost one day of work.

MI00648 – A male farm worker in his 40s was also picking blueberries. See case MI00645. His nose and eyes were burning, he couldn’t breathe, he was nauseous, and had a headache. He went to an emergency department and lost one day of work.

MI00649 – A female farm worker in her 30s was also picking blueberries. See case MI00645. She developed a headache, stomachache, and nausea; felt feverish; had chest pain and problems urinating; and her eyes and nose were burning. She went to an emergency department, was released, and then was admitted to the hospital at a later date. She lost three days of work.

MI00650 – A male farm worker in his 20s was also picking blueberries. See case MI00645. He felt shaky and his face felt hot. He went to an emergency department and lost one day of work.

MI00651 – A male farm worker in his early teens was also picking blueberries. See case MI00645. He felt feverish, nauseous, had a headache, and his eyes and nose were burning. He went to an emergency department and lost one day of work, but felt sick (feverish) for about a week.

MI00652 – A male farm worker in his teens was also picking blueberries. See case MI00645. He felt sleepy and his tongue was numb. He went to an emergency department.

MI00663 – A female farm worker in her early teens was also picking blueberries. See case MI00645. She did not seek medical attention, but two weeks later still felt tired and had muscle pain.

MI00665 – A male farm worker in his teens was also picking blueberries. See case MI00645. He felt nauseous and vomited, but did not seek medical attention.

MI00666 – A pre-teen male farm worker was also picking blueberries. See case MI00645. He vomited for one whole day and felt tired, but did not seek medical attention.

MI00682 – A male farm worker in his 60s was also picking blueberries. See case MI00645. His eyes were swollen and he had skin problems. He did not seek medical care.

MI00659 – A male farm worker in his 40s was working with a pyrethroid insecticide (signal word Caution) when the pesticide pump blew into his face. His face was red and burning, his eyes tearing and burning. He called poison control and then went to an emergency department where he was diagnosed with chemical dermatitis.

MI00662 – A female logistics supervisor in her 40s at an import/export company was at her desk when an applicator sprayed a pyrethroid insecticide (signal word Caution) around her. There was no ventilation and she immediately felt lightheaded, nauseous, and developed a headache. She went out for air, but when she returned to her desk she had difficulty breathing. She went home and then to her doctor, where she continued to have difficulty breathing with wheezing and stridor. The doctor called EMS and she was transported to an emergency room. She lost 8 days of work.

MI00672 – A female bartender in her 20s was working when her boss sprayed a pyrethrin insecticide (signal word Caution) several times. She developed a headache about 45 minutes after the first spray. Later she became dizzy and confused and she vomited. She was driven home from work and called poison control.

MI00693 – A male landscape supply company owner in his 60s mixed a fly bait (signal word Caution) with Coca Cola to get rid of groundhogs. As soon as he mixed the products, a fog developed and he had difficulty breathing. He called EMS and was given oxygen for about 30 minutes. It took about 7-10 days for his breathing to feel completely normal again. In addition, his eyes teared for about three days, his nose was runny for about two weeks, and he had bad headaches for about two weeks. When interviewed three months later, he still had dull headaches. The case was referred to MDA because of the off-label use.

MI00699 – A male employee in his 50s at a wholesaler for home plumbing, lighting, and hardware entered the workplace the day after it had been treated with an insecticide (signal word Caution). He immediately had a burning sensation in his eyes and throat, developed a headache, dizziness, and blurred vision. He went to an emergency department two days later. Coworkers

were also exposed and one called poison control because they developed a cough. This event was reported to NIOSH as a high priority event.

MI00704 – An adult male employee for an electrical contractor slept in a trailer infested with fleas. He sprayed himself with a pyrethroid insecticide (signal word Caution) and developed skin irritation and vomited. His employer called poison control.

MI00712 – A female manager in her 20s at a pizza parlor was setting bug bombs for fruit flies and flies. One of the handles broke off. She fixed the fogger so it went off, but she was exposed to that fogger and one in another room as she left the restaurant. She developed a headache, which lasted through the next day, and nausea. Her boyfriend called poison control.

MI00714 – A teenage male pesticide applicator under the constant supervision of a certified applicator was spraying a mix of three products that included a carbaryl insecticide. The hose came off the container and he was sprayed in the face and eyes. He had blurred vision and his eyes were puffy. His face was red and burning. He went to an emergency department. Since his exposure, his employer began using a clamp on the hose.

MI00724 – A teenage male service clerk in a grocery store was cleaning the can return area when someone sprayed a pyrethroid insecticide (signal word Caution) in the area, and on him. Some got on his face and in his mouth, and he inhaled it as he walked out of the area. His arms started shaking, he felt hot, was dizzy, and had a bad headache that lasted two days. His mother called poison control. The product is no longer kept in an accessible place.

MI00725 – A male certified pesticide applicator in his 20s, working for a pest control company was spraying trees at a home for mosquitoes. He was using a pyrethroid insecticide (signal word Caution). Some got on his face as he was walking through the area spraying up in the trees. He wiped it off, but developed red, irritated, blistering skin, and irritated, tearing eyes. He called poison control and went to an emergency department where he was diagnosed with chemical irritation. The case was referred to MDA because of the human exposure and possible violations of the regulations regarding storage and disposal of pesticides and containers.

MI00734 – A female employee in her 30s at a humane society got some insecticide (signal word Warning) in her eye. It was irritated, puffy, and felt dry. The veterinarian called poison control and she went to an urgent care clinic.

MI00753 – A female manager in her 30s of a grocery store was moving trash in the parking lot. Bees were swarming from the trash bag, so she sprayed them with a pyrethroid insecticide (signal word Caution). The wind picked up and some blew back into her face. Her cheeks and eyelids became red and irritated. She later became nauseous and called poison control.

MI00756 – A male pesticide applicator in his 20s was spraying a pyrethroid insecticide (signal word Caution) when the wind blew up and he got some in his face. His face was red and burning, and his eyes hurt. He showered, but his face continued to burn. He called poison control but refused to go to an emergency department since his boss said he would be fine and should not go.

MI00770 – A female account manager in her 50s was present when a diatomaceous earth insecticide dust (signal word Caution) was applied near her desk for flying ants. The housekeeper was then told to vacuum up the ants, releasing the dust into the air. The manager was one of five people who developed symptoms. She developed a tingling sensation on her tongue and lips, a headache, sneezing, cough, congestion, and irritated eyes. In addition, her ears were plugged for a few days and she felt a film on her face and hands for about a week. EMS was called; all five were given O₂ and taken to an emergency department. She lost one day of work. This event was reported to NIOSH as a high priority event.

MI00771 – A male office worker in his 30s was present when a diatomaceous earth insecticide dust was applied and then vacuumed. See case MI00770. He developed shortness of breath and a cough. He was given O₂ and taken to an emergency department.

MI00772 – A female customer service representative in her 40s was at her desk when a diatomaceous earth insecticide dust was applied and then vacuumed. See case MI00770. She developed a headache, sneezing, congestion, her face felt warm, her ears were plugged, she felt a tingling sensation on her tongue, mouth and lips, and her breathing was labored. EMS was called; she was given O₂ and taken to an emergency department. When interviewed a few weeks after the exposure, she still had plugged ears, a sore throat, and head congestion.

MI00773 – A male office worker in his 30s was present when a diatomaceous earth insecticide dust was applied and then vacuumed. See case MI00770. He developed shortness of breath and a cough. He was given O₂ and taken to an emergency department.

MI00791 – An adult female was working in an office when a diatomaceous earth insecticide dust was applied and then vacuumed. See case MI00770. She developed shortness of breath and a cough. She was given O₂ and taken to an emergency department.

MI00795 – A female inventory auditor in her 20s was counting bags of a carbamate insecticide (signal word Caution). It was the end of the season and about half of them were open. As she moved one, some of the dust got on her hands, face, and clothes. She washed well, but her skin became irritated, red, and itchy. She went to an urgent care clinic where she was diagnosed with chemical dermatitis. She was sent information about safe storage and handling of pesticides in retail stores to share with her employer.

MI00812 – A female sales associate in her 40s at a pet supply store was picking up a flea and tick shampoo containing pyrethrins and pyrethroids (signal word Caution) that had dropped to the floor. It slipped out of her hand and opened; some splashed up into her face and eye. It started to burn and she rinsed it in the sink for three to four minutes. She then called poison control, which recommended going home to shower and rinse her eye for another 15-20 minutes followed by a visit to an outpatient clinic. Her eye was rinsed again at the clinic and she was diagnosed with chemical conjunctivitis.

Herbicides

MI00512 – A male field inspector in his 20s was working in a cornfield. The farmer opened a tank of herbicide nearby. He inhaled vapor and passed out. He was later able to get to the end of the row and called for an ambulance. He was taken to an emergency department.

MI00536 – A female receiving department manager in her 30s for a home center store disposed of a pallet of damaged, wet bags of a chlorophenoxy herbicide (signal word Caution) by throwing the bags into a compactor. They leaked on her thighs and the next day she developed a rash with swollen, painful joints. She also had blood and protein in her urine. She went to an emergency department and was referred to a rheumatologist. She was diagnosed with vasculitis and missed five days of work. Information about safe pesticide storage and disposal was sent to her, for her to give to her employer.

MI00561 – A male applicator in his 30s for a lawn care company was fixing a hose nozzle and got splashed in the face and eye with 2,4-D herbicide (signal word Caution). He had some pain, blurry vision and dizziness. He went to an emergency department where his eyes were irrigated.

MI00580 – A woman in her 30s had several herbicides splash in her eye at work. She went to an emergency department and an eye clinic, where she was diagnosed with chemical conjunctivitis.

MI00474 – A male manager in his 40s of the weed killing and fertilizing department of a landscaping company was supervising a trainee who was pulling a hose off a machine. The plastic clamp on the hose broke and a mixture of herbicides (both with signal word Danger) sprayed out. He ran to shut off the machine and slipped on the grass that was wet from the spray. He was not wearing Personal Protective Equipment (PPE), and the herbicide got on his skin and in his eyes. He became nauseous, vomited, was short of breath, had a headache, watery eyes, sore throat, and his skin was red and burning. He went to an emergency department and lost three days from work. His co-worker, who was wearing PPE, also felt nauseous and had a headache. The plastic clamps were replaced with metal clamps.

MI00617 – An adult male trainee of a landscaping company in the same event as case #MI00474 above was wearing Personal Protective Equipment (PPE), but became nauseous and had a headache. He did not receive any medical care.

MI00585 – A male pesticide applicator in his 20s working for a landscaping company had been spreading a mixture of herbicide and fertilizer on lawns for a couple of weeks. He developed lung irritation, shortness of breath, a cough, skin irritation, and fatigue. He went to his primary care doctor and then an emergency department where they heard faint wheeze and diagnosed him with inhalation bronchitis. He lost two or three days from work.

MI00588 – A female pesticide applicator in her 20s working for a lawn service company was trying to fix a pump and sprayed some glyphosate herbicide onto her face and eyes. Her eyes burned for about a week, were swollen shut, and she was tearing. The tearing lasted about a year. She went to an emergency department and lost two weeks of work. Since she was not certified or registered and was unsupervised at the time, the case was referred to MDA.

MI00591 – A male pesticide applicator in his 20s working for a lawn care company stood up too quickly on a hot, humid day and fainted. He lay on the lawn that was wet with an herbicide (signal word Danger) for 15-20 minutes. The herbicide soaked through his clothing. Neighbors saw him and called 911 and threw water on him. He awoke in the ambulance and was taken to an emergency department. He was nauseous, dizzy, had abdominal cramps, sinus bradycardia, and dry mouth.

MI00690 – A man in his 30s was working with an herbicide (signal word Danger) and got some on his hands. He washed with soap and water within five minutes, but smoked a cigarette when he still had some of the herbicide on his hands. About 2 ½ hours later he developed stomach cramping and his lips felt numb. He called poison control.

MI00694 – A male farmer in his 50s who is a certified pesticide applicator was pumping water and a glyphosate herbicide into a sprayer. A truck needed to get by on the road, which was under construction, so he went to unhook the hose. He did not realize that the flow meter was plugged so the hose was under pressure, and he got sprayed in his face and mouth. He immediately washed off with water and then went home and showered. His eyes and mouth were irritated and he had a bad taste in his mouth for about a day. He called poison control and replaced the meter.

MI00711 – A female maintenance worker in her 50s for a school district who is a certified applicator sprayed three different herbicides at different schools (signal words Caution, Warning and Danger). She remembers loading the tractor and her eyes were burning. She does not remember driving, but was found unconscious in her van at the office. It was a warm day and the van windows were shut; the inside temperature in the van was very hot. She was transported by ambulance to an emergency department. She woke up after a few hours with memory loss. She lost 1 ½ days of work.

MI00713 – A male landscaper in his 20s walked by an exhaust fan while applying a diluted herbicide (signal word Danger). Some mist got in his face. He felt uncomfortable and his throat and chest were burning. Poison control was called.

MI00730 – A male golf club employee in his 20s mixed a glyphosate herbicide (signal word Caution) and sprayed sand traps with it for 6-8 hours. He developed a headache and had a sneezing fit while spraying. The next day he had a fever, muscle cramps, stomach pain, nausea, and vomited. He went to an emergency department and missed 1-2 days of work.

MI00744 – A teenage female clerk at a hardware store cleaned up a spill of a glyphosate containing herbicide (signal word Caution) with a napkin. She did not wash her hands, and could smell the herbicide from the thrown away napkin. She developed shortness of breath, chest pain, dizziness, and a stomachache. She went to an emergency department.

MI00748 – A farmer sprayed in his 60s a field after lunch with an herbicide (signal word Caution). His daughter found him around 4pm. He had been lying in the field about two hours, too dizzy to walk. He was dizzy and sleepy. His family called poison control; he refused to go to an emergency department.

MI00801 – A male state park officer in his 50s, who was a certified pesticide handler, was spraying a glyphosate containing herbicide around a sewage lagoon. The wind switched, blowing the herbicide back on him. This was followed by a sudden thunderstorm. The rain wet his clothes, which stuck to his skin and provided contact with the spray. He developed hives over his entire body and went to an emergency department.

MI00813 – An adult male farmer was working in a vegetable field with his son, when he witnessed, felt, tasted and smelled drift from cornfield that was being sprayed with a chlorophenoxy herbicide (signal word Caution). His eyes stung and he had a bad taste in his mouth. He reported the drift to MDA. MDA found evidence of the herbicide in samples collected from the buffer strip as well as recordkeeping violations and issued a Notice of Intent to file suit or pursue administrative fines against the applicator company, unless they came to a Consent Agreement.

MI00814 – A male farmer of unknown age was working in a vegetable field with his father (MI00813), when he witnessed, felt, tasted and smelled drift from cornfield that was being sprayed with a chlorophenoxy herbicide. His eyes stung and he had a bad taste in his mouth. His father reported the drift to MDA; see the previous case for results of the investigation.

Antimicrobials

MI00459 – A male nurse's aid trainee in his 20s was standing near his trainer who was wiping down an IV pole with a diluted quaternary ammonium chloride-based disinfectant (signal word Danger). Some disinfectant from her rag splashed in his eye. He had some initial eye pain and went to the emergency department where he was diagnosed with chemical conjunctivitis.

MI00461 – A female housekeeper in her 30s at a hospital was dumping some phenolic floor cleaner (signal word Danger) when some splashed on her face. She had an acne lesion that developed into cellulitis. Her face and neck were red, painful, and swollen; she had a fever, nausea, and difficulty swallowing. She went to the emergency department the day of her exposure and again the next day; the day after that she was admitted to the hospital for two days.

MI00465 – A female cleaner in her 20s used a disinfectant from 6pm to 2am. At about 3am she developed lethargy and vomited. She called poison control.

MI00466 – A female medical assistant in her 20s was in the area when her administrator mixed bleach and ammonia in a mop bucket. The solution was in the bucket 10-15 minutes until they dumped it. She developed headaches, trouble breathing, a cough, and felt congested. Most of the symptoms ended within two weeks, but she was still experiencing headaches when interviewed two months later. She went to a health clinic and lost two weeks from work.

MI00470 – A male residential advocate in his 30s in a group home was cleaning a bathroom with a quaternary ammonium chloride-based disinfectant (signal word Warning) when a resident distracted him. When he turned back, he walked into a cloud of the product and developed red, tearing, painful eyes and went to an emergency department. He had several follow-up visits with an eye specialist.

MI00474 – A maintenance technician in his 40s for a housing authority was working in a water treatment area. He mouth siphoned from a hose containing a sodium hypochlorite-based disinfectant (signal word Danger) and got a taste of it in his mouth. He had a sore throat and nausea and called poison control.

MI00475 – A female employee in her 20s in a group home mixed bleach with ammonia. She had shortness of breath, her lungs felt heavy, and her sinuses were congested. She called poison control.

MI00477 – A female housekeeper in her 30s in a hospital walked into a room that had been cleaned with a sodium hypochlorite-based disinfectant (signal word Warning) and a quaternary ammonium chloride-based disinfectant (signal word Danger). Her eyes began to burn and she developed a headache. She went to the emergency department.

MI00484 – A female secretary in her 50s in a hospital cleaned her desk with a sodium hypochlorite-based disinfectant (signal word Caution). Some got on her hands and then she rubbed her eyes. Her left eye began burning. She went to the emergency department with a red, swollen, stinging eye and was diagnosed with corneal micro abrasion. She missed one day of work.

MI00500 – A female veterinary hospital receptionist in her 30s was mopping up at the end of the day with a quaternary ammonium chloride-based disinfectant (signal word Danger). The solution may not have been appropriately diluted. The mop head fell off and she put it back on with her bare hands, although she should have been wearing gloves according to the label. She did not wash her hands afterwards. Later that day her hands became red and itchy and the following day the skin sloughed off. She called poison control.

MI00502 – A man in his 20s working for a food service supplier dropped a case of bleach (signal word Danger) he was carrying. A bleach bottle hit the floor and broke and some splashed in his eyes. His eyes were red and painful. He irrigated them at work, and then went to an emergency department where each eye was irrigated with four liters of saline. He was diagnosed with chemical conjunctivitis and right corneal burn.

MI00521 – A male prep cook in his 20s was throwing out garbage. Some diluted bleach splashed out of a bottle into his eye. It was red, irritated and teary. He irrigated it for about an hour and called poison control.

MI00522 – A female cashier in her 20s worked at a gas station where a portable container of gas was knocked over. The spill was cleaned with a variety of products, including bleach. She got some bleach on her skin while cleaning, and inhaled fumes for about five hours. She called poison control and then went to the emergency department with a sore throat and cough and was diagnosed with exposure to chemical fumes and treated with inhalers. She returned to the emergency department the next day, with a headache, difficulty breathing, and chills. She was diagnosed with chemical pneumonitis and prescribed a second inhaler. She used her inhalers every half hour initially, and was still using them, but only every 2-3 days when interviewed almost two months later. She had no prior history of asthma. She lost 2-3 days of work.

MI00524 – A female employee in her 20s at a day care center spilled some quaternary ammonium chloride-based disinfectant (signal word Danger) from a bottle onto her arm. The skin tingled and she had some blistering. She called the manufacturer.

MI00525 – A female cashier in her 20s at a gas station was on her way to a break when she leaned against a recently cleaned (with a quaternary ammonium chloride-based disinfectant) counter at the attached Subway shop. She developed a rash on her forearms and legs, which spread up her arms and up her legs to her back. The rash was so itchy that she scratched enough to cause bleeding. At that point she called poison control and was advised to go home and take a shower. After the shower, the rash stopped spreading but continued to be painful for about a week. (Signal word Danger.)

MI00526 – A male fire fighter in his 20s sat on a toilet bowl that had recently been cleaned with a quaternary ammonium chloride-based disinfectant (signal word Caution) and a phosphoric acid based disinfectant (signal word Danger). His genital area started burning, itching, swelling, and was red. He went to an occupational health clinic where he was diagnosed with a chemical burn. It took about a week for the symptoms to clear up.

MI00528 – A teenage male cart attendant in a department store was disinfecting a cart that a child had vomited in. He lifted the back of cart, but it was slippery because of the quaternary ammonium chloride-based disinfectant (signal word Danger) he had used. It slipped and fell and some disinfectant splashed into his eyes and on his face. He also inhaled the disinfectant. His eyes were red and stinging, the back of his throat burned, and he had a headache. He went to an emergency department where he was diagnosed with chemical conjunctivitis and was off work 2-3 days.

MI00529 – A male dishwasher in his 20s was washing dishes with a sodium hypochlorite solution. He was using gloves but had no respiratory protection and was working in a closed area with no ventilation. He started feeling dizzy, drowsy, and had a headache. He called poison control.

MI00544 – A man in his 30s took a second job repairing a home and cleaning water and mold damage from a burst pipe. He went to the house to work one evening. When he didn't show up for his day job, his brother and a friend went to the house and found him dead. There was a strong bleach odor throughout the house, which was not well ventilated. He had recently been seen at an urgent care center for an upper respiratory infection. EMS and the police responded. He was taken to a hospital and pronounced dead. The medical examiner diagnosed acute pulmonary edema and dilated cardiomyopathy. The cause of death was listed as acute pulmonary edema due to exposure to chlorinated fumes. There were no other injuries or natural diseases contributing to his death. The case was referred to MIFACE and reported to NIOSH as a high priority event.

MI00547 – A female office cleaner in her 40s was squirting some disinfectant into a mop bucket. The top came off and some splashed in her eyes. Her eye was washed at work, again in an ambulance, and at the emergency department. She was diagnosed with corneal abrasion and

chemical conjunctivitis and missed two days of work. After her accident, her employer distributed goggles to all the cleaners.

MI00573 – An adult female medical assistant was working in an office where a small amount of a gluteraldehyhde sterilant (signal word Danger) had been spilled. She had burning and tearing eyes, a non-productive cough, and bronchospasm. Her employer called the manufacturer and poison control and paid for her to see a doctor. She missed three days from work.

MI00581 – A man in his 30s was cleaning a water main when some sodium hypochlorite (signal word Danger) got in his eyes. He rinsed his eyes at work, but had some haziness in his right eye. He went to an emergency department where his eyes were irrigated. His sclera were injected.

MI00604 – A female custodian in her 50s in a residential high school was cleaning a shower using a spray bottle of an acid-containing disinfectant (signal word Danger). Some splashed off the wall into her eye. Her eye burned, was tearing, and she had blurry vision. When interviewed two weeks later she still felt as if something was in her eye when she blinked. She went to an outpatient clinic and then to an eye clinic where she was diagnosed with a chemical burn to the left eye.

MI00605 – A woman in her 30s got some diluted ammonium chloride floor disinfectant on her hand through her gloves. She washed at work but it felt numb and tight. She went to an emergency department where her hand was washed again and aloe cream was applied. She was diagnosed with chemical exposure. (The signal word for the disinfectant is Danger.)

MI00630 – A male stockman in his 20s took a sip out of a pop bottle that he thought was his, but it contained a pine oil disinfectant someone else had brought in from home. His tongue was tingly and he felt shaky. He went to an emergency department. (The signal word for this product is Warning.)

MI00654 – A female janitor in her 40s for a university spilled some quaternary ammonium chloride-based disinfectant (signal word Danger) on herself. Her skin was red and irritated and she went to an emergency department.

MI00668 – A teenage female server at a nursing home developed a rash on her hands and arms from a diluted quaternary ammonium chloride-based disinfectant. She went to a medical clinic. (The signal word for this product was Danger.)

MI00688 – A male linen tech in his 30s at a hospital wiped his hands with a disinfectant wipe (signal word Caution), thinking it was just an ordinary hand wipe. The label said to wear protection such as gloves, gown, face mask, and eye covering. His skin became irritated and ‘rubbed off’. He called poison control.

MI00689 – A woman in her 20s cleaned a bowling center with a mix of sodium hypochlorite and pine oil disinfectants. This mix released chloramines gas, and she developed shortness of breath, dizziness, and a sore throat. She went to an emergency department where she was diagnosed with acute inhalation injury.

MI00695 – A female housekeeper in her 40s in a hospital wiped a table with a diluted quaternary ammonium chloride-based disinfectant (signal word Danger). She did not wring the cloth out well enough and a drop got in her eye. Her eye was red and burning. She went to the emergency department.

MI00731 – A woman in her 50s was cleaning and painting a house that had mold in it, using bleach (sodium hypochlorite) and another disinfectant. She developed trouble breathing, a cough, chest pain, runny nose and tearing eyes. She went to an emergency department and was admitted to intensive care due to “hemodynamic instability”. She was released after two days, but after one day at home was admitted to another hospital for a day. She lost about three weeks from work.

MI00747 – A female residential care aide in her 20s in an adult care home was getting something out of a closet where a phenolic disinfectant (signal word Danger) had spilled. She got some on her hands and arms and washed for at least 10 minutes. She developed tingling and numbness. She called poison control and then went to her doctor, where she was diagnosed with right ulnar neuropathy. The symptoms took about two weeks to resolve, and she missed one day of work.

MI00751 – An adult female employee of a telemarketing company filled a bottle with water from the drinking fountain. She drank some before noticing that it contained more chlorine than normal. She developed nausea and mouth and throat irritation and called poison control.

MI00754 – A male farm hand in his 20s on a dairy farm was cleaning buckets with a sodium hypochlorite sanitizer (signal word Danger). He dropped a bucket and some of the diluted sanitizer splashed in his right eye. His eye became red and irritated. He flushed it and went to urgent care and where he was diagnosed with chemical conjunctivitis.

MI00755 – A male worker in his 40s on a potato farm had concentrated sodium hypochlorite splash in his eye from a high-pressure canister. He developed a red, tearing, painful eye, blurred vision, dizziness, and nausea. He washed his eye throughout the day and went to an emergency department where he was diagnosed with chemical conjunctivitis and keratitis.

MI00761 – A male employee in his 20s at a warehouse store caught a falling container of a pine oil disinfectant (signal word Warning). Some squirted in his eye. He called poison control and went to an urgent care center where he was diagnosed with corneal abrasion. He lost two days of work.

MI00762 – A female nursing aid in her 40s at a nursing home sprayed a quaternary ammonium chloride-based disinfectant (signal word Danger) in a whirlpool. She immediately started coughing and later developed wheeze and burning in her sinuses, throat, and lungs. She called poison control and went to an emergency department. It took about three months for the symptoms to stop and she can still feel it in her sinuses when she enters the room after someone else has cleaned.

MI00764 – A female veterinary technician in her 20s was mixing a quaternary ammonium chloride-based disinfectant (signal word Danger) in a bucket. Some splashed in her eye, which began to sting. The pain got worse so she rinsed it and then went to an urgent care clinic. She was diagnosed with chemical conjunctivitis. She had not worn goggles, which were required by the label.

MI00779 – A male truck driver in his 60s was delivering sodium hypochlorite to a holding tank. The hose broke loose and the solution sprayed on the back of his legs. He rinsed with a saline solution from his truck and was driven to an urgent care center where he was diagnosed with first and second degree burns. He then drove the truck home to Illinois and went to a doctor there. By the next day he could not walk. His legs were bleeding and weeping and needed to be cleaned, treated with Silvedine cream, and wrapped twice a day. He was out of work for about a month.

MI00793 – An adult male worker in a juvenile detention center got some quaternary ammonium chloride-based disinfectant (signal word Danger) in his eye. He went to an emergency department.

MI00796 – A female dental assistant in her 30s was pouring a concentrated glutaraldehyde-containing sterilizing solution (signal word Warning) out of a gallon container and some splashed in her eye. She rinsed her eye for 15 minutes, but it still hurt so she went to an emergency department where her eye was rinsed again. She lost two days from work and now wears eye goggles when using the product.

MI00808 – A woman in her 20s got some quaternary ammonium chloride-based sanitizer (signal word Danger) in her eye at work. She washed for 15 minutes and went to an urgent care center where she was diagnosed with chemical conjunctivitis.

MI00848 – A male bartender in his 30s had some sodium hypochlorite sanitizer (signal word Danger) spilt on his foot. About four hours later, he washed it and saw that his foot was red and blistering. He called poison control.

MI00850 – A man in his 30s splashed a sodium hypochlorite sanitizer (signal word Danger) in his eyes. He rinsed them at work, but they became red and irritated and he went to an emergency department. His eyes were irrigated again and he was diagnosed with conjunctival injection and corneal abrasion.

Fumigants

MI00787 – A female surgical processing technician in her 20s who worked in a hospital brushed against a partially used ethylene oxide (ETO) fumigant canister (signal word Danger), which had been improperly placed on the ETO machine, causing it to fall to the floor of the surgical processing room. It cracked and released ETO. She picked it up and some got on her hands. She developed a cough, sore throat, headaches, and her hands were burned and discolored. She was sent to the recovery room where she showered and was given oxygen. She later went to the occupational health clinic, and will be followed periodically for a year. Fifteen people were evacuated from the area and decontaminated. She was one of six individuals with symptoms who were given oxygen and sent to occupational health. The ETO machine has been removed and a

different process is used to sterilize the surgical instruments. This event was reported to NIOSH as a high priority event.

MI00785 – A female surgical processing technician in her 50s was present when ethylene oxide was released. See case MI00787. She developed a headache, cough, and sore throat. She was sent to the recovery room where she showered and was given oxygen. She later went to the occupational health clinic, and will be followed periodically for a year.

MI00786 – A female instrument technician in her 40s was present when ethylene oxide was released. See case MI00787. She developed a headache, sore throat with blistering of tongue and throat, nausea, diarrhea, inability to focus, congestion, cough, vision problems, and tiredness. She was sent to the recovery room where she showered and was given oxygen. At interview, four months later, she still had a cough, congestion, and vision problems. She went to the occupational health clinic, and will be followed periodically for a year.

MI00789 – A female sterile processing technician in her 40s was present when ethylene oxide was released. See case MI00787. She developed a headache and nausea and was sent to the recovery room where she showered and was given oxygen. She later went to the occupational health clinic, and will be followed periodically for a year.

MI00816 – An adult male state police trooper investigated reports of pesticide drift from a potato farm. Several neighboring families were exposed and experienced eye and stomach irritation from exposure to a dithiocarbamate fumigant (signal word Danger) that was being applied to a nearby farm. While investigating, the trooper could smell a strong odor and his eyes were irritated and he had a bitter taste in his mouth. MDA investigated and prosecuted the farmer for pesticide misuse, drift, improper record keeping, insufficient posting violations of the worker protective standard, and hindering the investigation.

Other

MI00498 – A female camp employee in her 20s drank some water that had been spiked with an insect repellent (signal word Caution). Her lips started to burn and felt numb, her throat felt ‘thick’, and she had a headache. An ambulance was called to take her to an emergency department.

MI00565 – A female technical assistant in her 50s worked for a veterinarian who induced vomiting in a dog that had eaten zinc phosphide containing rodenticide pellets. She was exposed to phosphine gas from the vomit. She had a history of asthma and began having asthma symptoms as well as a headache and nausea. (The signal word for the product is Caution.) This event was reported to NIOSH as a high priority event.

MI00566 – A female office manager in her 60s, working for the veterinarian in case MI00565 was also exposed to phosphine gas from the dog vomit. She felt short of breath, lightheaded, and had a headache.

MI00572 – A female pharmacy worker in her 40s was pouring lindane lotion into a bottle and some got on her hands. She washed her hands and then touched her lip, which began to tingle. She also had a bad taste in her mouth. She called poison control.

MI00657 – A male truck driver in his 40s picked up a (truck-sized) container that was not labeled as having hazardous material inside. He drove it to a factory in Ohio, and when he opened it, got exposed to a gas cloud from clear crystals of naphthalene. His arms, lips, and eyes began to burn; he was nauseous and vomited three times; he had trouble breathing, with a cough and sore throat; his eyes were tearing and swollen almost shut; and he had a headache. He closed up the container and drove it back to Michigan, where he went to an emergency department. He was diagnosed with accidental poisoning from exposure to agricultural chemicals. It took about a week for all the symptoms to clear up and he needed two to three days off work.

Mixture

MI00760 – A female home care worker in her 40s came on shift after the house had been sprayed for spiders with an unknown insecticide and cleaned with pine-sol, bleach, and ammonia. She developed red, teary, swollen, itchy eyes. She also had a headache, congestion, chest tightness, shortness of breath, a cough, and a runny nose. She called poison control and lost three days of work. Information about pesticides and cleaning products was sent to her, to share with her employer.

*Michigan Department
of Community Health*



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One hundred fifty copies of this report were printed at \$3.49 each for a total cost of \$523.03.