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Lyme Disease and Human Anaplasmosis in Minnesota, 2003

While West Nile virus dominated vector-borne disease concerns in Minnesota during 2003, reports of the tick-borne diseases Lyme disease (*Borrelia burgdorferi*) and human anaplasmosis (HA: formerly known as human granulocytic ehrlichiosis) continued, although in lower numbers than in 2002. This article will summarize decreases in case numbers for both Lyme disease and HA from record levels in 2002 and present relevant updates in tick-borne disease epidemiology. For a more complete review of the epidemiology of these diseases, see the May 2003 (vol. 31, no. 3) issue of the *Disease Control Newsletter*.

2003 Summary

From 1983, when the Minnesota Department of Health (MDH) began Lyme disease surveillance, through 2003, 4,810 cases of Lyme disease were reported among Minnesota residents. In 2003, Lyme disease cases decreased to 473 from a record 867 in 2002 (Figure 1). As recently as 1999, Lyme disease incidence was 6.0 per 100,000 person-years; the incidence increased to 9.6 in 2001 and to 17.6 in 2002, before dropping back to 9.4 in 2003. During 2003, most case-patients (393 of 473, or 83%) had a history of erythema migrans (EM), the bullseye-like rash consistent with early-stage Lyme disease. However, 107 (23%) case-patients had developed a late manifestation of Lyme disease before they were diagnosed and began treatment. This proportion of late manifestation cases was higher than in previous years, but not unexpected given the large number of case-patients reported in 2002. (Many additional cases infected in 2002 likely went undetected until they developed a late manifestation of Lyme disease in 2003.)

HA cases also dropped during 2003, from a record 149 cases in 2002 (incidence of 3.0 per 100,000 person-years) to 78 cases (incidence of 1.6) (Figure 1). Five HA case-patients (6.4%) also had objective evidence of a co-infection with Lyme disease. The reasons for the decrease in Lyme disease and HA in 2003 are unclear, but limited tick sampling data and anecdotal reports suggest tick numbers may have decreased from 2002.

Most Minnesota residents who develop Lyme disease and/or HA contract these diseases through infected *Ixodes scapularis* ticks (deer ticks or black-legged ticks) in certain east-central Minnesota counties or in western Wisconsin (Figure 2). *I. scapularis* ticks are especially common

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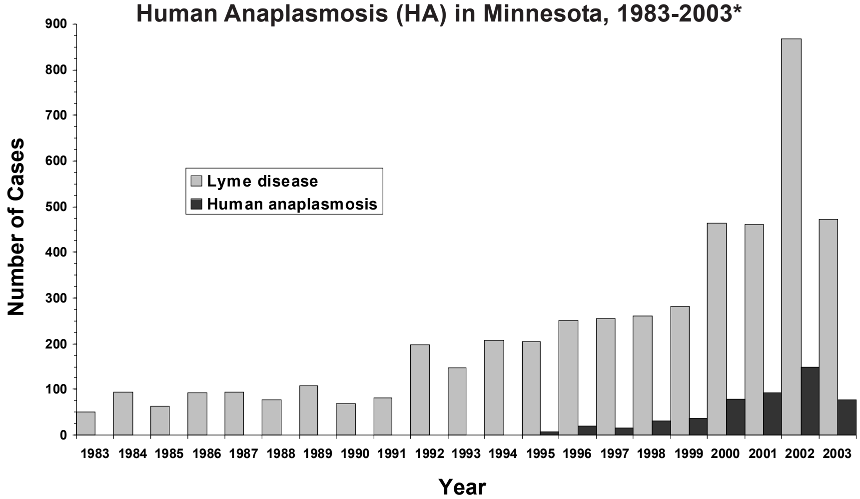
Figure 1. Reported Cases of Lyme Disease and Human Anaplasmosis (HA) in Minnesota, 1983-2003*



* Includes 4,810 Lyme disease cases, 509 HA cases. (HA reporting began in 1995.)

Inside:

in wooded and brushy habitats where humidity at ground level is sufficient to prevent their desiccation. People who engage in activities in wooded or brushy areas from May through July, the feeding period of *I. scapularis* nymphs, are at most risk. The nymphs are very small and often go unnoticed while feeding on humans. Risk is much lower during fall and early spring when adult *I. scapularis* ticks are feeding; adult ticks are much easier to find and remove before the 24 to 48 hours of tick attachment time needed for disease transmission to occur. During 2003, Lyme disease onsets peaked in July (39% of cases with known onset dates), just after the peak of the *I. scapularis* nymph feeding period. Similarly, 55% of HA cases in 2003 had their onsets in June or July.

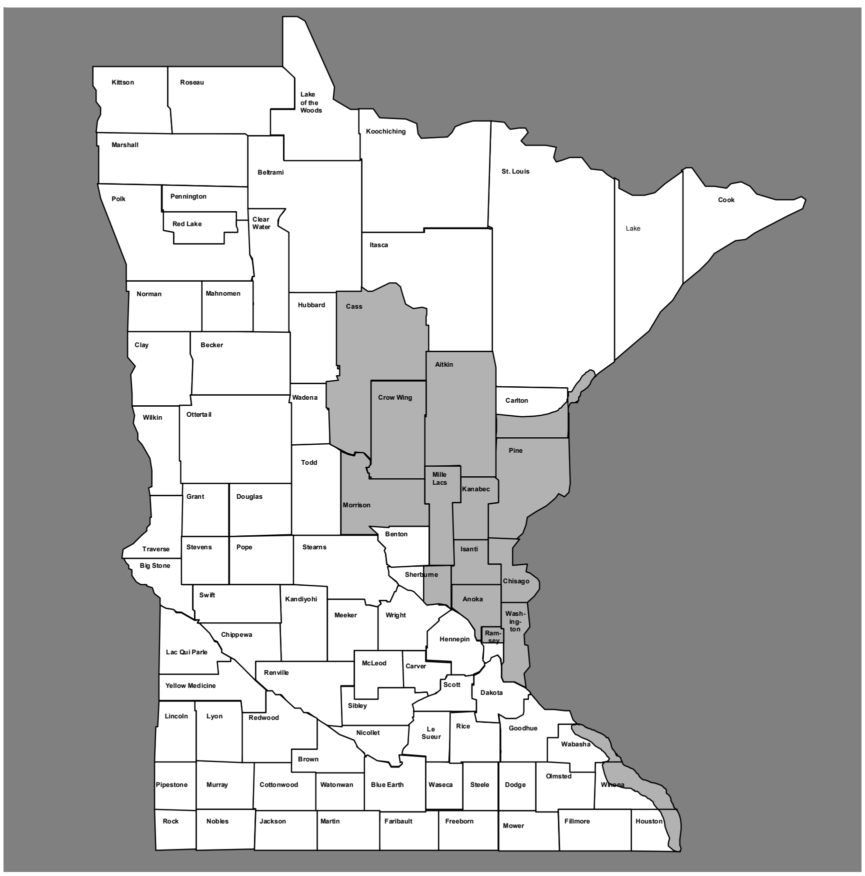
Prevention

To prevent tick-borne diseases, MDH continues to stress personal protection measures, such as using tick repellents (containing DEET or permethrin), wearing protective clothing, and checking frequently for ticks. There is no longer a Lyme disease vaccine on the market, and no large-scale tick control methods are available. People should take precautions when they spend significant time in wooded or brushy areas in east-central or southeastern Minnesota from mid-May through mid-July. They should also seek prompt diagnosis and treatment of early-stage Lyme disease to prevent late-stage Lyme manifestations.

MDH receives many inquiries from medical providers regarding prophylactic treatment of *I. scapularis* bites. Nadelman et al.[1] found that a single 200-mg dose of doxycycline given within 72 hours after an *I. scapularis* tick bite was 87% effective in preventing the development of Lyme disease. While this is treatment may be considered for known *I. scapularis* bites (especially when engorged ticks are found), MDH does not, in general, recommend it. Although the above study found that doxycycline can be effective, it also showed that in most instances the treatment isn't necessary. Only a low percentage of known tick bites actually result in Lyme disease. This study was conducted in a part of New York that has a much higher incidence of Lyme disease than does Minnesota. Yet in the study's placebo group, only 3.2 percent of tick bite patients went on to develop EM, suggesting that many of them likely found the attached ticks prior to disease transmission, or they were bitten by ticks that were not infected with *B. burgdorferi*. (Minnesota's tick infection rates have not been well studied, but they are thought to be less than in East Coast areas where up to 50% of *I. scapularis* ticks may be infected.) The study also documented more adverse effects, mainly nausea and vomiting, in the treatment group than in the placebo group.

Tick identification can be difficult, causing people to mistakenly believe they have been bitten by *I. scapularis* and thus seek unnecessary antibiotic treatment. Size alone cannot be used to identify *I. scapularis*, as other ticks also have small immature stages. In Minnesota, the larger adult stage of *Dermacentor variabilis* ticks (wood ticks) frequently bite people, but ticks of an immature stage of other, less common ticks can also be found on people. The tiny larval stage of *I. scapularis* (larvae have 6 legs instead of the 8 found on nymphs and adults) sometimes bites people, but such bites are not medically important, as they are not yet infected with *B. burgdorferi.* People who never see the tick that bit them are at greater risk of disease. In 2002, for example, a tick bite was recalled in only 234 of 867 (27%) Lyme disease cases in Minnesota.

Figure 2. Areas of Highest Risk for Lyme Disease in Minnesota



The designation of highest-risk areas is based on 2,668 Minnesota residents who contracted Lyme disease from 1996 to 2003 and who indicated their likely exposure to deer ticks could be determined.

- The majority (70%) of cases were exposed in the areas of Minnesota highlighted on the map: all of Aitkin, Anoka, Cass, Chisago, Crow Wing, Isanti, Kanabec, Mille Lacs, Morrison, Pine, and Washington counties; portions of Carlton and southern St. Louis counties; the eastern-most portions of Houston, Sherburne, Wabasha, and Winona counties; and northern Ramsey County.
- Twenty-three percent of Minnesota cases were exposed in the western half of Wisconsin. Among Wisconsin residents, the majority of recently reported cases occurred in northwestern Wisconsin, although cases have been reported throughout the western half of the state.
- A small proportion (6%) of cases likely were exposed in several other Minnesota counties (primarily those adjacent to endemic counties), and 1% were exposed in states other than Minnesota and Wisconsin or in other countries.

1. Nadelman RB, Nowakowski J, Fish D, et al. Prophylaxis with single-dose doxycycline for the prevention of Lyme disease after an *Ixodes scapularis* tick bite. *N Engl J Med.* 2001;345:79-84.

Health of Refugees in Minnesota, 1999-2003

The Minnesota Department of Health (MDH) collaborates with local public health and healthcare providers statewide to provide a health screening exam to all primary refugees entering the state. This domestic screening focuses on the detection and treatment of infectious disease as well as on the assessment of preventive health needs.

Refugees have a unique immigration status in that they are forced to leave their homeland because of civil strife, war, famine, or natural disaster. The Department of Homeland Security (DHS) defines refugees as foreign-born persons fleeing their country of origin because of persecution or a well-founded fear of persecution due to race, religion, nationality, political opinion, or membership in a particular social group.

This report provides information on refugee demographics, health screening results, and recommendations to providers who screen refugees in Minnesota.

A Shifting Population

The MDH Refugee Health Program was notified of 14,161 refugee arrivals from 1999 through 2003. Individuals from Sub-Saharan Africa accounted for more than three fourths of arrivals (77%) during this period, followed by refugees from the former Soviet Union (11%) and Eastern Europe (8%).

The origin of Minnesota's refugee population has changed significantly since refugees first began entering the state in the late 1970s (Figure 1). During the period 1979-1995, 84% of refugees came from Southeast Asia (i.e., Cambodia, Laos, and Vietnam). This trend was followed by an influx of Eastern European refugees in 1996-1998. During these three years, almost 40% of refugees arrived from Eastern Europe, 32% came from Sub-Saharan Africa, 16% from Southeast Asia, and 10% from the former Soviet Union.

After September 11, 2001, refugee arrivals were dramatically reduced. During 2002, net refugee arrivals were less than half (1,033) of the total number in 2001 (2,791). Though many refugees now have clearance to come to the United States, their arrival is delayed due to security screening and new travel restrictions. Background checks and verification of family reunification claims have become more rigorous.

Refugee Health Screening Results

Due to precarious living conditions in refugee camps or during forced migration, refugees often arrive in Minnesota with numerous health concerns. Many refugees arrive from areas in which infectious diseases are endemic. Many have not had access to medical care for prolonged periods. The MDH Refugee Health Program tracks infectious diseases, such as tuberculosis, hepatitis B, intestinal parasites, and HIV as well as more chronic health concerns, such as anemia. Referrals for vision, hearing, and dental work are common.

All refugees should receive a health screening within 90 days of arrival in the United States. For those with HIV infection or any acute condition, the appointment with a healthcare provider should take place as soon as possible. Detailed screening recommendations can be found in the *Minnesota Refugee Health Provider Guide,* which is available from the MDH Refugee Health Program.

Figure 2 summarizes refugee health-screening results by condition, followed by key recommendations for providers who perform the screening. All results are for the period from 1999 through the first 6 months of 2003.

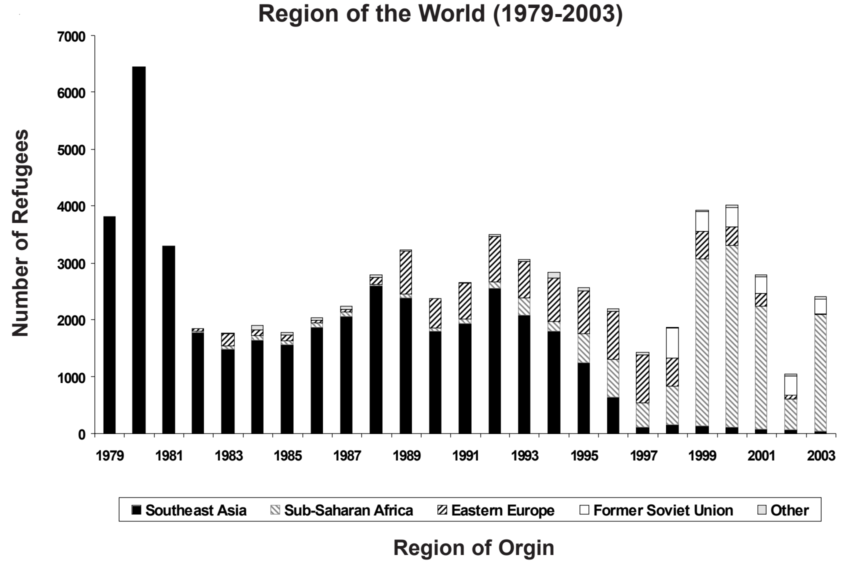
Tuberculosis (TB)

Of 9,939 refugees screened for TB from 1999 through the first 6 months of 2003, 9,824 (99%) received a tuberculin skin test (TST). Of those tested, 50% had a positive TST. Refugees from Sub-Saharan Africa had the highest infection rate (52%), followed by individuals from Southeast Asia (44%) and Eastern Europe (41%) (Figure 2).

Since 1988, Minnesota has experienced a steady increase in the number of reported TB cases. In 2002, a total of 237 cases were reported to MDH compared to 91 cases in 1988. Approximately 80% of Minnesota's TB cases occur in foreign-born individuals who come from areas of the world where TB infection is common—primarily Sub-Saharan Africa, Southeast Asia, and Latin America.

All refugees should receive a TST as part of their health screening, regardless of a prior history of Bacille Calmette-Guerin (BCG) vaccination. A reaction of 10 mm or greater of induration is considered positive and should be followed up with a chest x-ray and medical evaluation. Also, Class B (TB) conditions (i.e., abnormal chest X-ray and negative sputum smears or no sputum smear; or evidence of extrapulmonary TB) may

Figure 1. Refugee Arrivals to Minnesota by Region of the World (1979-2003)



be identified prior to U.S. arrival in the overseas health examination. These refugees need follow-up within 30 days of U.S. arrival. If active TB disease is identified, multi-drug therapy should be initiated. For persons found to have latent TB infection, preventive therapy should be strongly considered. Medications to treat latent or active TB are available free of charge from MDH for any patient in Minnesota.

Hepatitis B
From 1999 through the first 6 months of 2003, 7% of all refugees tested positive for hepatitis B surface antigen (HBsAg). The highest rates of hepatitis B virus (HBV) infection were found among refugees from Sub-Saharan Africa (8%) and Southeast Asia (8%) (Figure 2).

Serologic testing for HBV infection includes tests for HBsAg, hepatitis B surface antigen antibody (anti-HBs), and hepatitis B core antigen antibody (anti-HBc). If an individual is infected, all susceptible household contacts should be screened for HBV and provided vaccination as needed.

Pathogenic Parasitic Infection
Of refugees who received parasite screening from 1999 through the first 6 months of 2003, 27% had at least 1 pathogenic intestinal parasite. Refugees from Sub-Saharan Africa had the highest infection rate (29%) (Figure 2). The most common pathogenic parasites detected were *Trichuris trichiura* (34%), *Giardia lamblia* (30%), Schistosoma (11%), and *Entamoeba histolytica* (10%). According to the World Health Organization, chronic parasitic infections may contribute to reduced growth rates during childhood, impaired nutrient utilization, and iron deficiency.

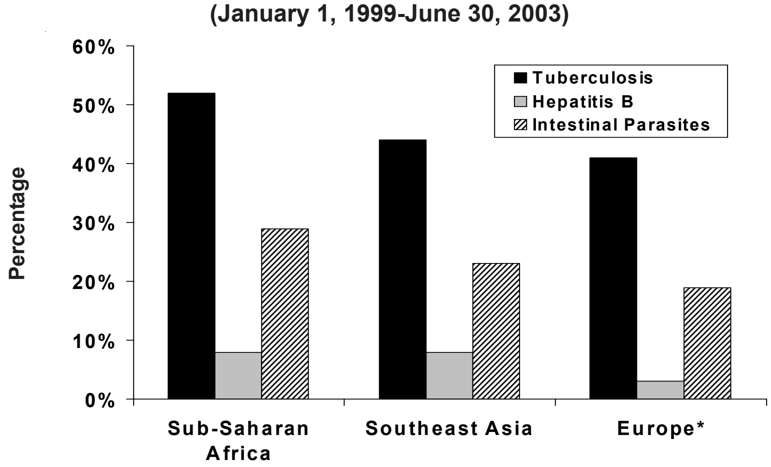
To complete a parasite screening, refugees should be instructed to submit 3 stool samples obtained more than 24 hours apart. In addition, a complete blood count with differential should be obtained. The presence of eosinophilia may indicate parasitic infection. To determine response to treatment once parasites are identified, 2 stool specimens obtained more than 24 hours apart should be collected 2 to 3 weeks after completion of therapy.

Malaria
A total of 222 refugees were screened for malaria with 27 cases (12%) found from 1999 through the first 6 months of 2003. All of the cases were from Africa. Refugees from Liberia who received a malaria screening had the highest infection rate (92%), followed by those from Ethiopia (4%) and Togo (4%).

Clinicians should have a high index of suspicion for malaria, particularly for refugees from tropical and subtropical areas who have fever of unknown origin. Other characteristic symptoms include headaches, muscle aches, nausea, and vomiting. Still, some cases of parasitemia may be asymptomatic. Clinicians should use clinical judgment and consider the region from which the refugee has arrived in making a decision regarding malaria screening.

If malaria is suspected, a smear of peripheral blood should be examined for parasites. Accurate diagnosis depends on the quality of the blood film and the expertise of laboratory personnel. Because treatment varies by species of *Plasmodium*, diagnosis should be confirmed by experienced personnel.

Figure 2. Tuberculosis, Hepatitis B, and Intestinal Parasite Infection Rates by Region of Origin Among Refugee Arrivals Screened in Minnesota (January 1, 1999-June 30, 2003)



*Europe includes Eastern Europe and the former Soviet Union.

HIV
Since 2000, HIV-infected refugees have been approved to immigrate to the United States under a special medical waiver. Within 14 days of U.S. arrival, these refugees are required to see a healthcare provider. The MDH Refugee Health Program works closely with infectious disease clinics to ensure comprehensive HIV care for refugees.

From January 1, 2000, through June 30, 2003, 45 HIV-infected refugees arrived in Minnesota. Of these, 62% arrived from Ethiopia, 15% from Liberia, 15% from Somalia, and 2%, respectively, from Sudan, Nigeria, and Sierra Leone.

In general, individuals arriving in Minnesota from areas endemic for HIV—such as Sub-Saharan Africa—should be screened. Specific testing for HIV type 1 and type 2 antibody should be conducted. (See "Testing for HIV-1/HIV-2 in Minnesota" in the May 2003 [vol. 31, no. 3] issue of the *Disease Control Newsletter.)* All patients tested for HIV must receive appropriate pre- and post-test counseling.

Guidance on Using Interpreters
Providing patients with access to quality medical interpreters is a cornerstone of culturally competent health care. In 2000, the U.S. Department of Health and Human Services Office for Civil Rights (HHS/OCR) published its *Guidance to Federal Financial Assistance Recipients Regarding Title VI Prohibition Against National Origin Discrimination Affecting Limited English Proficient Persons.* This guidance on the Civil Rights Act of 1964 requires that all physicians and others who are recipients of federal financial assistance from HHS provide "meaningful access" to services for limited-English-proficient (LEP) persons. "Meaningful access" is defined as the provision of appropriate oral language services and translated written materials. Recipients of federal funds have a legal duty to provide competent interpreters at no cost to

LEP persons. In Minnesota, Medical Assistance and most private insurance plans reimburse for interpreters. For more information on the HHS/OCR's *Guidance,* visit www.hhs.gov/ocr/lep.

Screening Updates 2004

A new version of the refugee screening form (the "pink form") will be released in late spring 2004. Screening for lead levels in children aged 0 through 5 years will be added to the new form.

For More Information

For information about refugee health, visit www.health.state.mn.us/refugee. For information on TB, visit www.health.state.mn.us/tb. To contact either the MDH Refugee Health Program or the Tuberculosis (TB) Prevention and Control Program, call (612) 676-5414.

Lead Poisoning in Minnesota Refugee Children, 2000-2002

Over the past 23 years, Minnesota has welcomed 65,340 "primary refugees"—people who have fled their homeland and cannot return because of persecution (or a well-founded fear of persecution) due to their race, religion, nationality, membership in a particular social group, or political opinion. Communicable diseases are the primary concern for newly arrived refugees in Minnesota. However, lead poisoning is an important health issue facing children around the world, and refugees may be at special risk.

While exposure of U.S. children to lead occurs primarily from lead-based paint chips and dust in older homes, in many parts of the world lead exposure still occurs through contact with dust from atmospheric emissions. The sources of such emissions are many: combustion of leaded gasoline; smelters; chemical and battery plants; ammunition manufacturing and use; and burning of fossil fuels and solid waste. Other sources include the use of lead as a bearing element in rural flour mills, and non-Western traditional remedies or foods, where lead compounds are added to increase weight or as a dye. Several factors increase the potential for lead exposure in developing countries, including poor hygiene, poor nutrition, environmental pollution, absent or lax environmental regulations, hot climates that imply a prolonged stay in the outdoor environment, airy housing construction, and concentration of populations around traffic arteries.

There is no safe level of lead for children, and the effects of lead depend on the dose. High lead levels are associated with toxicity to all major organ systems and can cause death, while lower levels are associated with deficits in neurological development and changes in behavior. A child's lead exposure may begin *in utero* due to mobilization of lead stores in the mother's bones and the mother's ongoing exposure to lead. Neurotoxic and behavioral effects of lead are irreversible and may not be observed until the child enters school, even though exposure occurred *in utero* or during the first 2 years of life. Younger children are more susceptible to lead poisoning than older children due to their higher gastrointestinal absorption, their greater hand-to-mouth activity, and their proclivity to spend time on or near floors where lead dust may be present.

In the United States, the acceptable blood lead level has been successively

Table 1. Health Screening, Lead Testing, and Elevated Blood Lead Levels in Refugee Children Under 6 Years Old by Region of Origin

Region of Origin	Total Number	No. Health Screened (%)*	No. Lead Tested (%)†	No. Tested Within 3 Months of Arrival (%)‡	No. with Elevated Lead Levels (%)§
Sub-Saharan Africa	309	261 (84%)	215 (70%)	167 (54%)	56 (26%)
South/Southeast Asia	26	24 (96%)	17 (65%)	15 (58%)	2 (12%)
Eastern Europe	126	95 (75%)	64 (51%)	46 (37%)	7 (11%)
North Africa/ Middle East	7	4 (57%)	3 (42%)	3 (33%)	0 (0%)
Latin America/ Carribean	1	0 (0%)	0 (0%)	0 (0%)	0 N/A
Totals	469	384 (82%)	299 (64%)	231 (49%)	65 (22%)

*The percentage of children health screened was calculated as the number health screened divided by the total number in the refugee database.

†The percentage of children tested for lead was calculated as the number lead tested divided by the total number in the refugee database.

‡The percentage of children tested within 3 months of arrival was calculated as the number of children tested within 3 months of arrival divided by the total number in the refugee database.

§The percentage of children with elevated blood lead level was calculated as the number of children with at least 1 blood lead level of 10 μg/dL or greater divided by the total number lead tested.

lowered over the past 33 years and is currently set at 10 µg/dl by the Centers for Disease Control and Prevention (CDC). Recent evidence of intellectual impairment at blood lead levels below 10 µg/dl has challenged this level. Minnesota Department of Health (MDH) data has suggested that up to 30% of newly arrived refugee children less than 6 years old in Minnesota have elevated lead levels. Therefore, the MDH Childhood Lead Poisoning Prevention Program (MN CLPPP) recommended in March 2000 that all refugee children less than 6 years old arriving in Minnesota receive a blood lead test.

By matching information from refugee and lead surveillance databases, the analysis described in this article attempts to 1) identify whether each child received lead testing, 2) quantify the prevalence of lead poisoning in refugee children younger than 6 years, 3) identify factors related to elevated blood lead levels, and 4) suggest ways to improve lead screening in refugees.

Methods
Since 1979, the MDH Refugee Health Program has been collecting communicable disease information on refugees. The CDC Division of Global Migration and Quarantine notifies Minnesota authorities of the arrival of each refugee, and MDH recommends that primary refugees undergo a comprehensive health screening within 3 months of their arrival. Laboratories performing blood lead analysis for any Minnesotan are required by the Lead Poisoning Prevention Act of 1992 to report results to the MDH Environmental Health Division.

Evaluation efforts suggest that MDH receives reports for approximately 90% of lead tests performed on Minnesotans. These reports are entered into the Minnesota Blood Lead Surveillance database, which, as of January 2004, contained approximately 574,000 results from 390,000 individuals. Refugee children less than 6 years old who arrived in the United States between July 1, 2000, and June 30, 2002, were identified in the MDH Refugee Health database. The Lead Surveillance database was then searched for each of these individuals to determine if he or she had received a lead test and to link lead test information. Linking criteria were first and last name, birth date, and gender.

Table 2. Lead Testing at Clinics Serving Refugee Children

Clinic Code	Number Health Screened	Number Lead Tested	
A	210	185	(88%)
B	44	22	(50%)
C	28	25	(89%)
D	18	8	(44%)
Remaining 34 clinics	84	34	(40%)
Total	384	274*	(71%)

*Table 2 contains only children who received refugee health screening. The number of children lead tested is lower than the total in Table 1 because some children were tested without health screening.

Minor misspelling of names between databases was acceptable if birth date and gender were identical. Once refugee children were linked with their lead test information, all names were deleted to protect privacy.

In the analysis described below, the highest blood lead value was used for children with multiple tests. Age was calculated as the difference between birth date and the end of the study period. Lag time of lead testing after arrival in Minnesota was calculated by subtracting blood lead sample date from U.S. arrival date. If a clinic code was present in the refugee database, the child was considered "health screened"; if a lead test was found in the lead surveillance system, the child was considered "lead tested."

Results
Between July 1, 2000, and June 30, 2002, 469 refugee children arrived in Minnesota, with an average age of 5 years. Children came from 25 countries and were grouped into 5 geographic regions for comparison (Table 1). Nearly two thirds of the children were from Africa (66%), led by Somalis (40%), and one fifth of refugee children were from Eastern Europe (22%).

Health screening
Of the 469 refugee children, 384 (82%) received health screening (Table 1). When children who were not eligible (those who died, did not actually arrive, moved to another state, or were not located by public health authorities) were removed from the calculation, 88% of the refugee children were found to have been screened. Southeast Asian children were screened most frequently (96%). The lowest rates were among refugee children from Russia; 12 of 23 (52%) received health screening. A total of 38 clinics performed health screening for the 384 refugee children: 300 children (78%) were seen at 4 clinics, and 1 of these clinics accounted for 55% of all refugee health screenings (Table 2). Each of the remaining 34 clinics saw only 1-9 refugee children during the 2-year period studied.

Lead testing
Lead testing was given to 299 (64%) of the refugee children. Some (25) of the lead-tested children were not seen for health screening; therefore, Table 2 contains fewer lead-tested children than Table 1. The 384 health-screened children were approximately twice as likely to be tested for lead (71% tested) than the 85 children who were not health screened (28%, chi-square $p < 0.0001$). Only 77% of tested children had lead tests within the recommended period of 90 days after arrival in the United States. The overall mean time to lead test was 103 days. The mean time to lead test for the 274 health-screened children was 93 days, with a median of 52 days, while the mean time to lead test for the 25 children who were not health screened was 218 days, with a median of 100 days. This difference was statistically significant (hazard ratio = 2.0, 95% confidence interval, 1.45-3.00).

Twenty-seven of the 38 clinics that performed health screening ordered lead tests, and 4 of those clinics performed 88% of all lead tests in health-screened refugee children (Table 2). The 34 clinics that saw refugees infrequently tested a disproportionately low percentage of children during their health screenings. Because they cannot be assigned to a specific clinic, non-health-screened children are not included in Table 2. Twenty-five children were lead tested at a later time than health screening.

Children from Sub-Saharan Africa were tested for lead most frequently (70%), followed by Southeast Asia (65%) and Eastern Europe (51%). Children from North Africa/Middle East and Latin America/Caribbean were tested least frequently. However, there were very few refugee children from these 2 regions during the period analyzed.

Lead levels

The majority of tested children had blood lead levels less than 10 µg/dl and, therefore, did not have lead poisoning. However, 65 (22%) children had elevated blood lead levels. The recommended follow-up efforts for these children included a medical history aimed at identifying sources of lead, repeat lead testing within 3 months, guidance and education, and evaluation of other children in the home. Twenty-nine children (10%) had lead levels from 10 µg/dl to 14.9 µg/dl;15 children (5%) had levels from 15 µg/dl to 19.9 µg/dl. Twenty-one children (7%) had levels from 20 µg/dl to 44.9 µg/dl; 19 of these children were from Sub-Saharan Africa and the remaining 2 were from Bosnia and Herzegovina. For a venous level of 20 µg/dl or greater, state law requires a home visit by either the state or local public health department, including an investigation into the source of lead exposure, and follow-up testing within 1 month is recommended. None of the refugee children in the time period analyzed had lead levels of 45 µg/dl or greater. Elevated blood lead levels were more common in health-screened children (23%) than in non-health-screened children (13%), although this finding was not statistically significant.

Discussion

The rate of health screening in this refugee population (88%) was similar to the screening rate of eligible refugees previously reported by MDH in 2001. While a lead-testing rate of 64% is lower than recommended, it is similar to the rate observed for refugees in previous years and is substantially higher than the lead-testing rate for other high-risk groups in Minnesota. For instance, only 26% of Medicaid children in Minnesota were lead tested at 1- and 2-year well-child visits in 2002, even though federal regulations require that all children on Medicaid be lead tested at these times. This means many cases of lead poisoning are likely being missed throughout the state. In addition to their potentially devastating effect on families, these missed cases of lead poisoning have economic significance, due to the cost of support services for developmentally and behaviorally affected children and missed earning potential in children with lowered IQ.

The 22% lead-poisoning prevalence rate in Minnesota refugee children for 2000-2002 is 10 times higher than the rate in the U.S population of children less than 6 years old, based on national survey data (1999 National Health and Nutrition Examination Survey). For comparison, 3.5% of children under age 6 in the Lead Surveillance database had blood lead levels of 10 µg/dl or above in 2002. However, this is not a statewide prevalence rate, since blood lead testing is not performed at random. The rate of lead poisoning seen in Minnesota refugee children is similar to published figures from a larger cohort in Miami (23%) and a smaller cohort in Maine (17%), and is twice as high as the rate found in a comparable refugee cohort in Massachusetts for 1995-1999. The high lead-poisoning rate in Minnesota refugee children underscores the urgent need for lead testing every refugee child.

African refugee children had the highest rates of elevated lead levels; they also had higher rates of testing. The high rate of elevated blood lead levels in Africans is presumably due to environmental situations, dusty conditions, and poor nutrition. Children from Russia had the lowest rates of lead poisoning. Compared to refugees from war zones in Central Europe and from developing countries in tropical climates, Russian refugee families may have a higher education level, a better nutrition status, and a greater access to hygiene prior to their arrival in the United States. Persons in the former Soviet Union who are either Jews or fundamental/evangelical Christians can be given refugee status based upon their ethnic/religious identification. They do not flee their homeland, nor have they suffered war as many other refugees have. This perceived lower risk might be responsible for the lower rates of health screening and lead testing among Russian refugee children.

Interestingly, the prevalence of lead poisoning in children who had not been health screened was lower than that in the overall cohort. One of the reasons may be the temporal delay. Children who were not health screened were tested, on average, 7 months after arrival, and only 1 child tested for lead 6 months or more after arrival had an elevated level. This finding could suggest that resettling in Minnesota had removed the children from widespread lead sources, allowing their blood lead levels to drop. When there is such a time delay in testing, elevated lead levels most likely reflect exposure to new sources of lead, such as deteriorating paint in old buildings, as well as continued exposure to lead-containing foods and home remedies.

Conclusion

This analysis underscores the high risk of lead poisoning in refugee children and suggests that every refugee child should be tested for blood lead upon entering the United States. Although lead exposure should be prevented in all children, lead testing of refugees will help identify children who require medical intervention or additional effort to avoid continued lead exposure. Further efforts to improve lead testing in refugees should include refugee-specific information about lead poisoning in clinic education efforts by the MDH Refugee Health Program and MN CLPPP. The recent addition of lead testing to the refugee health screening form will help assure that the rate of lead testing in refugees continues to improve.

For more information and resources about refugee health, contact the MDH Refugee Health Program at (612) 676-5414 or visit www.health.state.mn.us/refugee. Lead poisoning prevention information (including blood lead screening guidelines) may be obtained through MN CLPPP at (651) 215-0890 or at www.health.state.mn.us/divs/eh/lead.

Syndromic Surveillance: A New Tool to Detect Disease Outbreaks

Disease surveillance is broadly defined as the ongoing and systematic collection, analysis, interpretation, and dissemination of data regarding a health-related event that allows public health authorities to intervene in order to reduce morbidity and mortality. Traditionally, this surveillance has served a variety of functions, from the investigation of infectious disease outbreaks, to the implementation of control measures, to informing policy decision makers.

The potential for bioterrorism-related disease events and the increasing incidence of emerging infectious diseases have identified the need for another form of surveillance within the field of public health: the ability to rapidly detect an abnormal increase in illness in a population prior to the determination of a specific diagnosis or etiology. Infectious disease outbreaks are typically recognized through individual case reports to health departments by astute clinicians or laboratories, or through self-reporting by the public. Syndromic surveillance, the detection of illness or a syndrome rather than of a specifically defined disease, is an emerging method of detecting disease outbreaks that may enhance current efforts and allow for the earlier detection of outbreaks.

To date, syndromic surveillance has used a variety of data sources and numerous analytic approaches. Perhaps one of the best working definitions of the method comes from the Centers for Disease Control and Prevention, which defines syndromic surveillance as “the public health term applied to the systematic collection, analysis, and interpretation of data that precedes diagnosis and that can signal a sufficient probability of an outbreak to warrant public health investigation.”

The Minnesota Department of Health (MDH) has established guidelines for data suitable for syndromic surveillance. These guidelines are:

1. Data are collected and exist for reasons other than bioterrorism surveillance.
2. Data are recorded and accessible in a recognized and consistent electronic format.
3. Data are available for analysis shortly after patient presentation.
4. Data are validated against existing traditional data sources.
5. Thresholds set for these systems should achieve high sensitivity for detecting outbreaks and disease clustering.

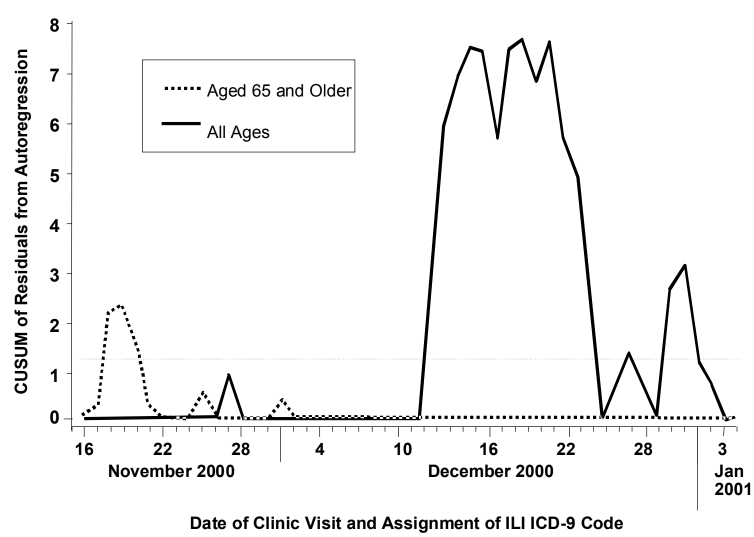
Successful syndromic surveillance relies primarily on the first 3 criteria. The sustainability of these systems is dependent on their ability to use existing data streams with automated transfer, analysis, and reporting of results. This is achievable only if the data being analyzed are in a preexisting database and can be rapidly accessed for transfer to MDH. Because the goal is the rapid detection of increases in illness in the population, the timely transfer and analysis of data is critical; in most cases, data should be available no more than 48 hours after patient presentation.

MDH is currently conducting syndromic surveillance with a variety of healthcare sources, including Hennepin County Medical Center, Minnesota Poison Control System (MPCS), HealthPartners Medical Group, Children’s Hospitals and Clinics, and the Emergency Medical Services Regulatory Board. These agencies and institutions all have established automated data transfer systems that allow de-identified data (i.e., patient count data only, without names) to be transferred to MDH for analysis and interpretation.

MDH has designed and implemented several novel statistical methods to analyze the syndromic data. Some processes identify increased illness counts by using time-series analyses along with the statistical processes that are employed in quality control (cumulative sum or CUSUM analysis). The counts are categorized by disease syndrome groups (e.g., influenza-like illness [ILI]) representing patients whom present to emergency rooms or within clinic networks. We have validated these methods. The identification of the onset of the 2000-2001 influenza season in Minnesota, for example, was identified by noting the increase in influenza-like illness in patients within the HealthPartners Medical Group clinic network (Figure 1).

In addition to the time-series analyses, data are analyzed using a geographic variable and a space-time permutation model analysis developed by Harvard University Medical School. The space-

Figure 1. Cumulative Sum (CUSUM) Control Chart Generated from Visits of Patients with Influenza-like Illness (ILI) to the HealthPartners Medical Group, 11/00-1/01

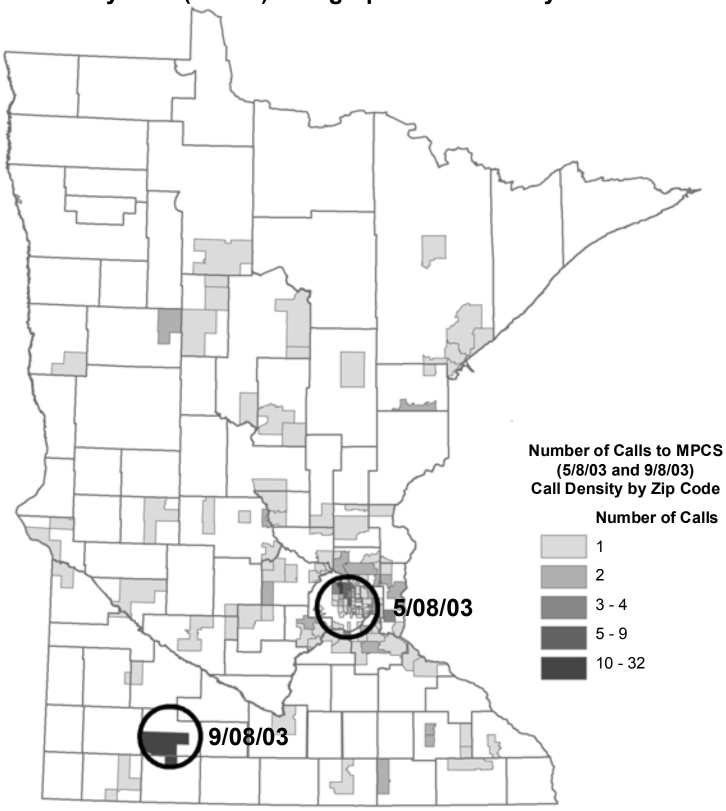


time permutation model allows for analysis with limited historical data and does not require specific denominator data. This analysis process has been applied to data received from the MPCS, and it successfully detected several clusters related to actual events (Figure 2). The first identified cluster occurred on May 8, 2003, when several thousand gallons of ethylene glycol entered a high school's water supply during a construction accident. Concerned students and parents placed numerous calls to the MPCS, and the increase in total call volume was detected by all syndromic surveillance analytic methods operating at MDH (Figure 2a). The second cluster was related to an increase in call volume to the MPCS from a group of individuals who had eaten at the same restaurant and complained of gastrointestinal illness. Possible exposure information and symptoms were recorded at the MPCS, and the callers were referred to the MDH foodborne illness hotline (Figure 2b).

These examples demonstrate the potential of these systems to rapidly identify increases in illnesses from a variety of data sources. Perhaps just as important as the shared data are the relationships that such systems help form between healthcare providers and MDH. Improved data sharing and better communication should support both the early detection of disease outbreaks and other public health surveillance efforts.

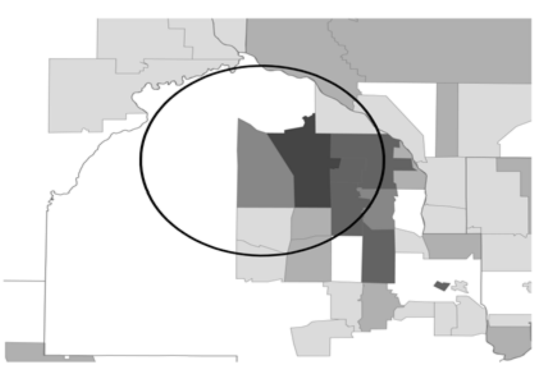
To participate or to learn more about syndromic surveillance at MDH, call Benjamin Miller at (612) 676-5414.

Figure 2. Clusters Detected from Calls to the Minnesota Poison Control System (MPCS) Using Space-Time Analysis



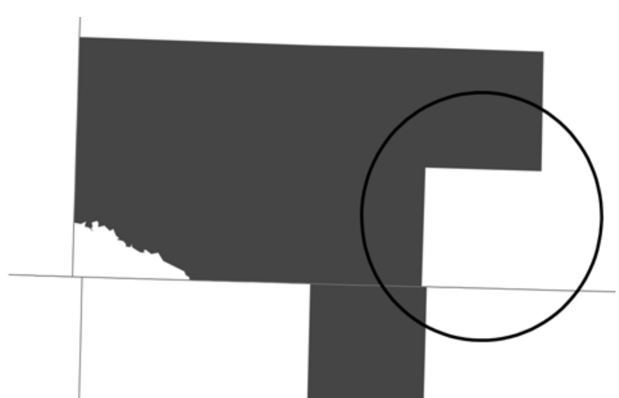
The cluster occuring on May 8, 2003, was related to a large exposure of ethylene glycol in a high school. The second cluster, on September 9, 2003, was related to persons complaining of gastrointestinal illness. The circles on the map indicate clustering of calls to MPCS at a level higher than expected.

Figure 2a. Cluster Related to an Exposure to Ethylene Glycol in a High School (5/8/03)



This cluster represents an increase in calls to MPCS related to an exposure to ethylene glycol in a high school. The space-time analysis detected 81 calls from 46 unique zip codes occurring in a 12-km radius; only 8 calls from that area would be expected.

Figure 2b. Cluster Related to Complaints of Gastrointestinal Illness (9/8/03)



This cluster represents an increase in calls to MPCS related to gastrointestinal illness. The space-time analysis detected 11 calls from 1 unique zip code; less than 1 call from that area would be expected.

Colorectal Cancer Control in Minnesota

More Minnesotans die of colorectal (colon and rectum) cancer than either breast or prostate cancer. It is the second leading cause of cancer death—only lung cancer kills more people. In 2000, colorectal cancer was diagnosed in 2,010 Minnesotans; 926 died of this disease (Table 1).

More people died of colorectal cancer than either breast or prostate cancer in part because a lower proportion of colorectal cancers were diagnosed before they had spread to adjacent tissues or distant organs, when they could be more successfully treated. Only 41% of colorectal cancers were diagnosed at an early stage, compared to 69% of breast cancers and 92% of prostate cancers.

The tragedy is that many colorectal cancers could be prevented if more Minnesotans aged 50 years or older followed recommended screening guidelines. Colorectal cancer screening not only increases the likelihood of finding cancers at an early stage, but, unlike screening methods currently available for breast and prostate cancers, can also find abnormalities before they become cancerous and when the lesions can be removed on an outpatient basis.

Several methods of screening for colorectal cancer have been shown to be effective. (See "Colorectal Cancer in Minnesota" in the March/April 2002 [vol. 30, no. 2] issue of the *Disease Control Newsletter.*) The most commonly used methods are sigmoidoscopy and colonoscopy, examinations that view the interior of the colon and rectum. Telephone surveys of Minnesota adults indicate that use of these examinations increased significantly from 1999 to 2001 (Figure 1). In 2001, men and women in Minnesota were equally likely to report having had a sigmoidoscopy or colonoscopy exam during the previous 5 years (55% and 52%, respectively). Although increases from 1999 to 2001 were reported in both the Twin Cities Seven County Metropolitan Area (Metro Area) and elsewhere in the state, screening lags behind in areas outside of the Metro Area (Figure 1). It is clear that the potential for preventing colorectal cancer and reducing death from this disease is not being achieved.

The Minnesota Department of Health is collaborating with the Centers for Disease Control and Prevention to evaluate the ability of the state to meet the needs for colorectal cancer screening in various regions of the state. A survey of healthcare facilities will begin in late spring of 2004, and results should be available in early 2005. For more information on this study, contact Jane Korn at (612) 676-5556 or at jane.korn@health.state.mn.us.

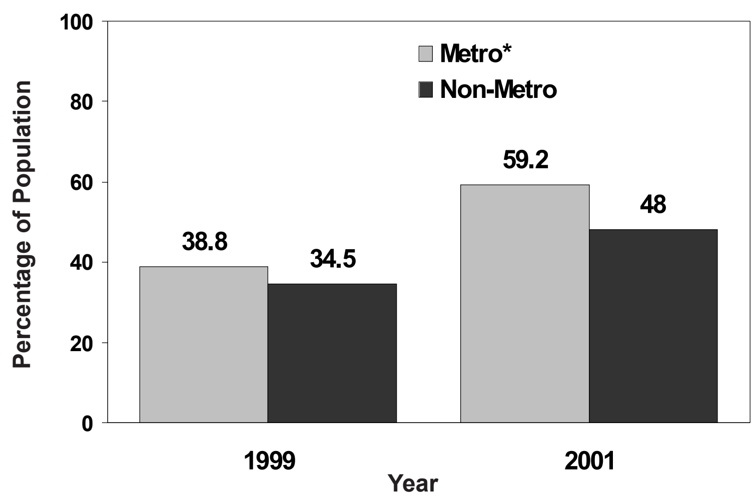
For more information about colorectal cancer in Minnesota, see *Minnesota Cancer Facts and Figures 2003* online at www.cancerplan.mn.org.

Table 1. Four Most Commonly Diagnosed Cancers, Minnesota, 2000

Types of Cancer	Number of New Cases*	Early Stages†	Number of Deaths
Lung and bronchus	2,695	24%	2,194
Colorectal	2,010	41%	926
Breast	4,412	69%	737
Prostate	4,072	92%	598

Source: Minnesota Cancer Surveillance System
*Includes *in situ* tumors.
† *In situ* or localized stage for lung, colorectal, and breast cancer; *in situ*, localized, or regional stage for prostate cancer

Figure 1: Minnesotans Aged 50 or Over Who Reported Having a Sigmoidoscopy or Colonoscopy During the Previous 5 Years



Source: Minnesota Behavioral Risk Factor Survey
*The Twin Cities Seven County Metropolitan Area

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Possible Changes to the Communicable Disease Reporting Rule

The Minnesota Department of Health (MDH) is currently requesting comments on possible changes to the Communicable Disease Reporting Rule, Minnesota Rules, Parts 4605.7500 to 4605.7900. MDH is making these changes to address diagnostic advances and issues surrounding new and emerging communicable diseases. Some of the changes include adding new diseases to the reporting rule, changing the type of materials submitted to the MDH laboratory, adding a requirement to report "unexplained critical illness" that may be caused by an infectious agent, and allowing the Commissioner to select certain diseases for sentinel surveillance.

For a detailed draft of the rule, call Patti Segal-Freeman at (612-676-5414) or visit www.health.state.mn.us/divs/idepc/dtopics/reportable/newrule/index.html. You can send comments on the rule to commdisrule@health.state.mn.us. Comments will be accepted until May 10, 2004.

Dianne Mandernach, Commissioner of Health

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The *Disease Control Newsletter* is available on the MDH Acute Disease Investigation and Control (ADIC) Section web site (http://www.health.state.mn.us/divs/dpc/ades/pub.htm).
If you require this document in another format such as large print, Braille, or cassette tape, call 612-676-5414 or, in Greater Minnesota, call 1-877-676-5414