



Food-Safe Schools

Handbook for School Nurses

Prevention, Detection & Management
of Foodborne Illnesses



**AMERICAN NURSES
FOUNDATION**

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Management of Foodborne
Illnesses

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American Nurses Foundation

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Foreword

SCHOOL nurses have been battling communicable diseases in schools for over 100 years. In the early 20th century, poverty was a monumental risk factor for American school children. In the 21st century, children across the economic spectrum enrolled in schools that are in urban, suburban and rural communities are at risk infectious illness from food-borne illnesses. Why are school children at such risk? It can be attributed to a multitude of problems from decentralization of food services, out-sourcing food services and inadequate comprehensive school health programs to provide an infrastructure for food safety.

The Food-Safe Schools project was initiated by a cooperative agreement between the American Nurses Foundation and the Division of Adolescent and School Health at the Centers for Disease Control and Prevention. Additionally, the National Nursing Coalition for School Health (NNCSH) supported the project by providing advice from eight nursing organizations representing thousands of nurses who provide nursing care to American school children. This handbook provides comprehensive information on foodborne illness, prevention and early response. The leadership role of the school nurse in developing FOOD-SAFE SCHOOLS is identified, and a thorough and comprehensive guide is provided that is applicable in all school settings.

The NNCSH will partner with represented organizations to disseminate the Food-Safe Schools Handbook and again place school nurses and nurses caring for school children on the front line protecting American school children from one of this century's primary infectious risks.

Julia Muennich Cowell PhD, RN, FAAN
Representing the American Public Health Association
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Introduction

“Foodborne and waterborne infections are major public health problems. Each year, millions of people in the United States are infected with foodborne disease, and several thousand die...Preventing these diseases depends on understanding how food or water becomes contaminated and involves working with many partners to reduce or prevent contamination.”

National Center for Infectious Diseases, CDC (1)

FOOD SAFETY has been a growing national concern since the 1990’s. The safety of the nation’s food supply was the impetus for President Clinton in 1997 to launch a national food safety initiative to improve consumer education and knowledge, prevent foodborne illness, improve surveillance, and create a seamless food safety net. Twelve federal agencies share responsibility for monitoring, surveillance, inspection, enforcement, outbreak management, research, and education related to food safety. The issues are complex for all aspects of food safety—from farm to table.

Factors that influence the incidence of foodborne diseases have been changing and are likely to continue to change.

- Americans are eating more raw fruits and vegetables which are susceptible to contamination anywhere and anytime.
- Fresh produce (available year-round) is often imported from developing countries.
- Some emerging foodborne pathogens are found in food animals (cattle, poultry, fish and shellfish).
- Large-scale production of food products has attracted unskilled laborers many of whom work when ill because of the lack of health benefits and sick leave.
- Centrally processed food products may delay the recognition of an outbreak.
- Nationwide distribution of food products allows outbreaks to affect many people simultaneously over a large geographical area.
- Americans eat out more frequently than in the past, which supports an array of commercial food establishments and increases the potential for exposure to illness causing pathogens.

- Worldwide travel increases the risk of contact with unfamiliar foodborne pathogens and the introduction of these pathogens into new geographical areas.
- Improved laboratory testing is detecting the emergence and virulence of new pathogens.
- Known pathogens that have become resistant to antibiotics are reemerging.

These same factors that contribute to an increase in foodborne disease in the general population must also be considered factors that are significant in placing students at risk for foodborne illnesses.

Foodborne illness outbreaks in schools, particularly those caused by food prepared on school premises, result in considerable disease burden on a vulnerable population. (2). Between 1973 and 2000 there were 616 school-associated outbreaks reported to the Centers for Disease Control and Prevention (3). Approximately 10% of all outbreak illnesses resulted from school-associated outbreaks (3). This concern along with national media coverage of the school outbreaks has stimulated scrutiny of the federal school meal programs operated through the U.S. Department of Agriculture (USDA). Although the major focus has been on the school lunch program, some of the reported school cases were traced to foods prepared elsewhere and brought to school. Therefore, all foods served at school or school functions should be considered when planning for the prevention, detection, and management of foodborne illness.

Each day over 100,000 schools serve lunches to students and staff. Before being consumed the food items may have traversed a labyrinth with hundreds of workers behind the scenes who harvested, processed, and transported raw materials; or prepared foods that were stored, distributed to the school, reheated or thawed and served. Lunches are brought from home, some classrooms prepare foods, vendors sell foods at athletic events, and foods are brought in from multiple homes for special occasions. Foods served at school are at greater risk for contamination when prepared by individuals who do not understand and practice food safety.

A recent public health concern is the potential for intentional contamination of food by terrorists (4). Terrorists target the general populace to create panic and threaten civil order. (5). Any incident that would sicken large numbers of school-children would certainly anger the community and the country, and could tax the school system, public health, law enforcement and healthcare delivery systems. Thus, the terrorists would have accomplished their goal. Schools need to consider the possibility of food as a target of terrorist activity, and maintain vigilance in detection with early reporting of suspected foodborne illness to the health department.

Food safety practices focus on limiting the presence of naturally occurring contaminants and those acquired from cross-contamination and preventing growth of organisms resulting from time and temperature rules not being followed. Biosecurity practices focus on protection from acts of intentional use

of biological or chemical agents for the purpose of causing harm. More detailed information is found in the USDA publication, A Bioterrorism Checklist for School Food Service Programs, (6).

“between 1990 and 1999 CDC received reports of 292 outbreaks of foodborne illnesses in schools, which affected over 16,000 children”.

Food Safety. Continued vigilance needed to ensure safety of school meals. US General Accounting Office, (7).

The United States is acclaimed as having the safest food supply in the world. Therefore, the public expects that foods served to children in our schools will be safe and not make them sick. A school outbreak of “food poisoning” becomes media news and can be grounds for litigation.

The Food-Safe Schools Initiative is a collaborative program supported by CDC’s Division of Adolescent and School Health and other members of the National Coalition for Food-Safe Schools (NCFSS). NCFSS is a work group of representatives from a variety of renowned national organizations, associations, and government agencies concerned with reducing foodborne illness in the United States by improving food safety in schools. The goals of this national initiative are to promote the incorporation of food safety in coordinated school health programs and to provide information and resources to students, families and staff to prevent foodborne illness both at school and at home.

The Food-Safe Schools Initiative brought together the American Nurses Foundation, American School Food Services Association, National Association of County and City Health Officers, and National Environmental Health Association, along with the Rhode Island Department of Education and Kids First as partners to prevent foodborne illnesses in schools.

CDC contracted with ORC Macro to create a tool kit (guide) for schools that would assist school districts to become food safe. The Food-Safe School Action Guide (CDC Action Guide) was developed through collaboration with the CDC-funded partners, interviews with focus groups, extensive literature reviews, and expert panel reviews of materials. Segments of this comprehensive guide for schools can be downloaded from the Internet (8).

School nurses can be key players in promoting prevention of foodborne illnesses in schools. School nursing began in the early twentieth century as an effort by public health nurses to combat absenteeism due to communicable diseases. Since then vaccines have been developed to significantly reduce the incidence of most of the common childhood diseases.

Now school nurses are again called upon to reduce absenteeism by applying strategies to:

- prevent foodborne illnesses
- identify potential cases
- report suspicions to the health department, and
- promote collaboration in managing an outbreak of foodborne illness.

This document was developed by the Food-Safe Schools Project at the American Nurses Foundation, in collaboration with the National Nursing Coalition for School Health, as a companion document to the CDC Action Guide and a resource specifically for school nurses.

The Handbook for School Nurses is divided into three major sections: role of the school nurse, fundamentals for nurses, and appendixes.

Section 1

Role of the School Nurse

CHAPTER 1:
Prevention of Foodborne
Illnesses in Schools

CHAPTER 2:
Early Detection of Potential Cases

CHAPTER 3:
Management of an Outbreak

Chapter 1

Prevention of Foodborne Illnesses in Schools

SCHOOL nurses can assume an instrumental role in preventing outbreaks of foodborne illness. Prevention of foodborne illness in schools begins with awareness that the school population is at risk for a foodborne illness outbreak and of the measures that can significantly reduce that risk.

A **foodborne illness outbreak** is an incident in which two or more persons have the same disease, have similar clinical features, or have the same pathogen; and there is a time, place, or person association among these persons that is traceable to ingestion of a contaminated food.

A **suspected foodborne outbreak** is when two or more persons have similar onset and duration of symptoms usually associated with a foodborne illness, and there is a common connection with a food event.

Food safety in the school or district requires comprehensive planning by a team of key people qualified to assess the level of risk (strengths and weaknesses) of school activities involving all areas of food preparation, handling and consumption.

Are Foods in Your School Safe?

- Bake sales
- Cafeteria
- Classroom
- Field trips
- Fundraisers
- Lunch bags
- Parties
- Pot lucks
- School stores
- Sporting events
- Vendors

The CDC Action Guide clearly states “No one person in a school can ensure that the school is food-safe” and provides the Food-Safe School Needs Assessment and Planning Guide to assist a local Food-Safe School Team in developing an action plan (9). The action plan promotes short- and long-term goals, measurable objectives, and specific program and evaluation activities.

The team should suggest actions that can then be prioritized into a plan with an ultimate goal of increasing both the safety of foods and the protection of students, staff, and others from exposure to contaminants in foods or to secondary transmission of infection from ill individuals. Exposure to such contaminants can cause mild to severe illness or even death. Developing and implementing a food safety plan requires the motivation and collaboration of school administration and staff, students, families, food service workers, health care providers, and health department staff.

A school nurse’s knowledge and skills can be critical to the Food-Safe School Team in promoting prevention strategies; identifying a potential foodborne illness or outbreak; reinforcing key food safety and handwashing policies or procedures; monitoring infection control; assessing and managing care of ill students; and communicating with other health professionals, school administrators, and parents.

This chapter provides information for school nurses on:

- working as a team with key people,
- assessing a school for safe food practices, and
- developing strategies to reduce transmission of foodborne pathogens.

Working with a Food-Safe School Team

Prevention begins with an active food safety planning team. Ensuring food safety in schools affects many individuals and groups: administrators and office staff, food service managers and workers, classroom teachers and aides, facilities managers and employees, health services staff, health care providers, policymakers, students, families, health departments and other community agencies. An effective Food-Safe School Team should have representatives from most, if not all, of these groups. Each representative will bring a unique knowledge base and/or skill to the planning and implementation of a coordinated food-safe school program. The school nurse may be selected as the leader or coordinator of the team or participate actively as a team member.

The food-safe school coordinator rallies support for food safety, is responsible for uniting the team members, interacts with the principal and the community, and ensures that improvements are accomplished. This individual may be appointed by the school administration or selected by consensus of the team to assume coordination of team efforts and ensure that food safety plans are accomplished.

- The school principal or administrator participation ensures an understanding of the issues, and to gives administrative support for

implementing procedures that ensure food-safe events and monitoring changes for effectiveness.

- Policymakers— school board member or community leader add experience in drafting policies, identifying community and/or school priorities, and advocating for child and health-related issues.
- School foodservice manager and workers are critical members because of their primary role in preventing foodborne illness by following food safety guidelines during the preparation, handling, storage, and serving of foods.
- The school district risk manager has knowledge of the relevance of team action planning to risk of liability and district insurance coverage.
- The school nurse is necessary for planning for the early identification, reporting, and management of potential cases of foodborne illness; and for planning prevention strategies to control the spread of infections in the general school population, such as promotion of handwashing.
- Teachers have a major effect on students' attitudes about food safety and good personal hygiene practices through education and role modeling.
- Families and students represent a large population that can incorporate food safety lessons into their own actions and behaviors at home and at work.
- The local health department has a key role in helping to plan the school's food safety procedures, conducting regular inspections of the school areas where foods are prepared, and consulting on, or investigating an outbreak of foodborne illness.
- The cooperative extension agency can be an excellent resource for both educational materials and consultation on issues of food safety.
- The facilities manager brings knowledge of maintenance of the school environment and of potential risks or barriers to change found in kitchens, classrooms, bathrooms and hand-washing facilities.

A sample work sheet to assist a school nurse in identifying local members for a Food-Safe School Team is in Appendix 2.

A more in-depth discussion of the importance of having a Food-Safe School Team, how to establish the team and the roles and responsibilities of the key team members is included in the Action Guide (9).

Assessing a School's Risk

One of the team's first priorities will be to collect information about the safety of foods served at school and the prevention measures already in place. Collecting this information may identify potential problems in the schools. Collection can be informal, - gathered from individuals on the team,-or done more formally via developing a written needs assessment that is distributed throughout the school.

Documentation of each assessed area is important to establish an objective basis for a school- wide plan. A sample assessment tool for a school nurse is given in Appendix 2. School nurses or the team can adapt this tool to fit the needs of a school or school district. The CDC Action Guide contains an expanded school needs assessment and planning tool that can be downloaded from the Internet (10).

The use of a structured approach —a SWOT Analysis— can facilitate the drafting of a plan by identifying positive factors (strengths), negative factors (weaknesses), changes that can be implemented and where they can be implemented (opportunities), and barriers to change (threats).

The following 12 areas were identified by the Food-Safe Schools Initiative to be assessed for strengths and weaknesses related to the prevention and management of foodborne illness in schools:

- written school policies for food-safety,
- outbreak management plan,
- plan for informing staff of responsibilities in prevention and management,
- plan for educating staff about food safety and hand-washing,
- qualification of foodservice manager,
- training of foodservice staff,
- qualification of staff who prepare and/or serve foods in the classroom,
- adequacy of foodservice facilities,
- adequacy of hand-washing facilities,
- adequacy of health clinic,
- plan for educating students about food safety and hand-washing, and
- plan for educating parents and families in food safety and hand-washing.

School nurse participation on the school food safety team is crucial. As a health professional the nurse brings a unique perspective to both the discussion of issues and formulation of plans that are realistic for the school. The school nurse has relevant knowledge of health services at the school that can be shared with the team:

- current practices of student health assessment and interventions,
- documentation and confidentiality of student health information,
- procedures to control the spread of infectious diseases,
- the number of students with chronic conditions who may be at increased risk,
- existing referral and reporting protocols,
- triage and management during an illness outbreak and issues of secondary transmission, and
- potential problems in a crisis incident with multiple victims.

The school nurse is well aware of the capacity and the limitations of the health room or school health office (staffing, supplies and equipment) and should share this information with the team. Through a collaborative interdisciplinary approach the nurse will also become more informed regarding other issues and

concerns related to the school's status in food safety and the prevention of foodborne illnesses as presented by team members.

As a member of the Food-Safe School Team, the school nurse may have many opportunities to assist with data collection and the development of a school food safety plan. Some examples of possible concerns or questions from a school nurse participating on a team are provided in Table 1. They are organized around the areas of assessment for school food safety.

These examples are presented only to prompt school nurses to reflect on concerns or questions that they may have about their own school's strengths, weaknesses, opportunities, and threats in prevention or management of foodborne illnesses. Each school nurse is encouraged to develop a locally relevant list of questions to present to the planning team.

Table 1: Team Discussion of Critical Areas

Assessment Area and Goal	Related School Nurse Concerns or Questions
<p>Written school policies for food safety</p> <p>Goal: School policies for food safety focus on ensuring maximum safety in the preparation and serving of foods and responding to outbreaks of illness.</p>	<ul style="list-style-type: none"> • Fact: Zero risk is unattainable! • Does the school have policies addressing a safe environment? • Are there other policies that could include food safety? • What codes or state regulations pertain to food establishments in schools? • What is the development and review process for school policies? • Other?
<p>Outbreak management plan</p> <p>Goal: Team response plan includes assessment and management steps for care of ill students, notification protocols, and school and community support systems.</p>	<ul style="list-style-type: none"> • What role does the health department play in the plan? • Are there contingency plans to cover when people assigned to key roles are absent? • Has bioterrorism or intentional contamination been considered as a connection to foodborne illnesses? • If a nurse covers more than one school is there consistency among schools within the district policy? • Other?
<p>Plan for informing staff of responsibilities in prevention and management</p> <p>Goal: Staff oriented to and given copies of policies and plans.</p>	<ul style="list-style-type: none"> • What concerns have been expressed by staff? • Can major barriers be identified and possibly removed? • Have all staff been adequately represented on planning team? • Other?

<p>Plan for educating staff about food safety and hand washing</p> <p>Goal: Staff support school efforts for food safety and are role models for students.</p>	<ul style="list-style-type: none"> • What mechanisms for risk communication have worked with staff in the past? • Does the staff practice hand washing to reduce risk? • What is the staff's level of comprehension regarding food safety measures? • Is time allotted in the school schedule to wash hands before eating? • What educational materials would be helpful? • Other?
<p>Qualification of foodservice manager</p> <p>Goal: A food service-related degree and credential from state and/or national programs are required.</p>	<ul style="list-style-type: none"> • Is the manager on-site or at a central location? • What formal and informal training has prepared the manager to ensure the safety of foods from the cafeteria? • What is the ratio of manager/supervisor to food service staff? • How does the manager monitor for hazardous situations? • Other?
<p>Training of foodservice staff</p> <p>Goal: All food service staff receive basic sanitation and Hazard Analysis and Critical Control Point (HACCP) training at orientation before working in the cafeteria.</p>	<ul style="list-style-type: none"> • How is the practice of safe food handling and personal hygiene of food service staff monitored? • What is the policy for returning to work after a gastrointestinal illness with nausea, vomiting or diarrhea? • What if a family member has a gastrointestinal illness? • Is there a disciplinary policy for unsanitary practices? • Other?
<p>Qualification of staff who prepare and or serve foods in the classroom</p> <p>Goal: Food and Drug Administration (FDA) food code and HACCP guidelines are followed.</p>	<ul style="list-style-type: none"> • Where is food prepared/served in school? • Which teachers prepare foods? • What food safety training have they had? • How often and under what circumstances do teachers serve foods in the classroom that have been prepared elsewhere? • Are there restrictions on foods brought from home? • What training is provided about the prevention of anaphylaxis from food allergens? • Other?
<p>Adequacy of food service facilities</p> <p>Goal: Inspections are carried out regularly by the health department, equipment is in good-working order, and FDA guidelines are followed.</p>	<ul style="list-style-type: none"> • Are inspections done regularly and/or complaint driven? • What types of inspections are conducted? • Who conducts the inspection? • If unsafe practices are found, what actions are taken? • Are written reports available for school administrators? • Other?

<p>Adequacy of handwashing facilities</p> <p>Goal: Sinks with warm water, soap and supplies are available to all students and staff.</p>	<ul style="list-style-type: none"> • What are the barriers for practicing handwashing by students and staff? • How important is handwashing to students? Staff? Foodservice worker? • Is there adequate time built into schedule to wash hands? • Should waterless hand rubs be an option? • Other?
<p>Adequacy of health clinic to manage an outbreak</p> <p>Goal: A school nurse conducts a focused assessment on students suspected of foodborne illness. Consultation and coordination of services with the local health department are available. A notification plan is in place for key people.</p>	<ul style="list-style-type: none"> • What are the staffing levels in the Clinic? • How many cases of gastrointestinal illness have been seen in the past 3 months? 6 months? 12 months? • How would the clinic staff manage more than eight students with acute gastroenteritis? • What measures are taken to identify and document potential foodborne illnesses? • Does the school have the capacity to track specific reasons for absenteeism? • Are there protocols for consulting with or reporting suspected cases to the health department? for notifying administration, food service manager, parents, staff, students? • What supplies and equipment are needed? • Other?
<p>Plan for educating students about food safety and hand washing</p> <p>Goal: Education is reinforced at all grade levels.</p>	<ul style="list-style-type: none"> • What is included in the curriculum? • What grade level? • How is it evaluated? • How effective has it been? • What monitoring practices are in place for student handwashing? • Is student handwashing a priority for staff? • Other?
<p>Plan for educating parents and families about food safety and hand washing</p> <p>Goal: Opportunities are provided to learn safe practices through materials sent home and distributed at school activities.</p>	<ul style="list-style-type: none"> • What activities are focused on educating families about food safety and hand-washing vigilance? • Are parents provided with guidelines for bringing foods into school? • What educational activities are available in the community? • Other?

Identified weaknesses in the school's food safety practices should be reviewed individually by the team to determine whether change can be accomplished as a short-term goal within the existing system or whether major change, such as, appropriation of funds or school policy revisions, is required. All Food-Safe School Team discussions, suggestions, and decisions should be documented and reported periodically to the appropriate administrator.

Developing Strategies to Prevent Foodborne Illness

Prevention of foodborne illness begins with the team correcting identified areas of weakness in the schools food safety practices. To maintain food safety and prevent foodborne illness, school staff must understand the principles of food safety and continuously monitor factors that may place foods prepared or served at school at risk for contamination. School nurses have a key role to play in promoting prevention strategies in many areas in schools, especially in implementing the practice of hand washing by students, staff and food service workers.

Handwashing is critically important as a strategy for preventing foodborne illnesses. According to a report by CDC, hands may be the most important means by which enteric viruses are transmitted. Implementation of a school-wide policy that supports frequent hand washing by students and staff is one of the best ways to prevent the spread of infectious diseases (11,12). Adherence to hand hygiene (i.e., handwashing with soap and water or use of alcohol-based hand rubs) reduces transmission of anti-microbial-resistant organisms and overall incidence of infections. The nurse may have many opportunities to educate staff and students about how important it is to wash hands when they are dirty, before eating, after using the bathroom, and after handling animals or animal waste, and how important it is to do so more frequently when family, classmates or friends are sick.

It is equally important to educate individuals who prepare or serve foods in the school to wash their hands before, during, and after preparing foods. Food workers' hands may transmit pathogens to food from a contaminated surface, another food, or poor personal hygiene (13). Therefore, the contact of bare hands with ready-to-eat foods (food that is edible without washing, cooking, or additional preparation) is a potentially important mechanism for food contamination. Use of gloves does not eliminate the need for hand hygiene, nor does hand hygiene eliminate the need for gloves (11,14). Gloves, used appropriately, can reduce contamination, reduce transmission of infection, and prevent cross-contamination.

Prevention strategies focus on careful handling of ingredients and finished food by everyone involved. Proper handling is essential to ensure that food is safe. This is a key concern for all foods that are prepared at school and/or served at school. School policies for foods brought into the school should be the same as for foods prepared at the school.

The risk of foodborne disease can be significantly reduced by these general food-handling precautions:

- thorough heating which will kill most pathogens;
- refrigeration which will greatly reduce the growth of most pathogens;
- washing hands before preparation, as well as washing foods that will be eaten raw (fruits and vegetables) which will reduce contamination; and
- separating raw and cooked foods, which will avoid cross-contamination.

For more detailed information on food safety practices see Section Two: Chapter 3. Food safety information is also available online (15).

Safe food practices need to be institutionalized to reduce the opportunity for contaminants to be transferred to food or for pathogens to grow and multiply on or in foods. Food safety in schools needs the collaborative efforts and motivational commitment of many individuals to be effective.

Table 2 provides suggestions for strategies to strengthen the local food-safe school program.

Table 2: Preventive Strategies for Specific Areas of Concern in Schools

Specific Concerns	Preventive Strategies
School cafeterias and centralized kitchens	<ul style="list-style-type: none"> • Have the local regulatory agency inspect kitchens and serving areas at least twice a year to monitor and control risk factors. • Certify food service managers for food safety and monitor compliance in all phases of food processing. • Train cafeteria workers periodically in safe food preparation, handling, and serving and monitor for compliance. • Monitor the health status and hygiene practices of all food handlers for potential risk factors.
Foods prepared in classrooms	<ul style="list-style-type: none"> • Monitor food preparation and hold to the standards of safe food practices. • Certify teachers in food safety or, at a minimum, ensure that they have documented knowledge of risk factors and incorporate food safety preventive actions. • Require that safe food practices are part of the learning objectives for students.

Foods brought to school for special events	<ul style="list-style-type: none">• Ensure that all foods meet school policy criteria for safe food preparation, transportation and temperature control.• Accept no hazardous foods that are prepared a day or more ahead of time or that include leftovers.• Do not serve unpasteurized milk or juice products at any school function.• Use commercially precooked foods whenever possible.• Make school food safety guidelines available and distribute them to all.
Hand-washing is required for all students and staff	<ul style="list-style-type: none">• Require handwashing before preparing foods, especially foods that will not be cooked before serving.• Schedule time for handwashing for students and staff before meals or snacks.• Promote handwashing after restroom use.
Food safety education	<ul style="list-style-type: none">• Encourage individuals to practice food safety in their daily routine.• Provide age appropriate educational materials to students, staff, and families.
Foodborne illness outbreak response plan	<ul style="list-style-type: none">• Prepare school team for a foodborne illness outbreak.• Establish and inform all staff of a chain-of-command.• Define roles and responsibilities and designate to specific staff for these.• Have written procedures available for alerting key school and local health department personnel.• Put protocols in place for assessing, managing, and referring ill students and staff.• Have protocols available for prompt assessment of the level and extent of an outbreak.• Define procedures for communicating the situation to different audiences and designate specific staff to be responsible for communication.

Chapter 2

Early Detection of Potential Cases

SCHOOL nurses play a critical role in illness surveillance for any disease outbreak. The goal is to quickly identify illnesses that have outbreak potential and take actions to prevent the spread of the illness/disease among the school population or community. Surveillance systems are dependent on data collection and analyses. Surveillance for foodborne illnesses is complicated by:

- underreporting of potential cases,
- insufficient referrals for medical diagnosis, and
- lack of laboratory testing for a specific pathogen or agent.

Estimates from CDC place the annual incidence of foodborne disease at approximately 76 million cases, 325,000 hospitalizations and 5,000 deaths (16). Only a small percentage of incidents is reported and of those reported, only one-third result in identification of the causative agent.

School nurses must acquire and maintain current information about foodborne illnesses and skill in both identifying suspected cases and managing an outbreak at school. A review of the nature and cause of foodborne diseases is located in Section Two, Chapter 2.

Although more than 250 foodborne diseases commonly present with diarrhea and vomiting, symptoms vary widely depending on the causative agent. Bacteria and their toxins, viruses, parasites, marine organisms and fungi and their related toxins, and

chemical contaminants can cause a foodborne illness. Important clues about the cause of a foodborne illness are the:

- incubation period,
- duration of the illness,
- predominant symptoms, and
- population involved in the outbreak (17).

The incubation period for agents that cause foodborne illness varies. For example, it is 1 - 8 days for *Escherichia coli* 0157:H7, 1 – 6 hours for *Staphylococcus aureus* (preformed toxin), 12 – 48 hours for *Norovirus*, 15 – 50 days for *hepatitis A*, and a few minutes – few hours for pesticides. Information on incubation period, symptoms, duration of illness, associated foods, diagnostic tests and treatments is presented in Appendix 1 (17). The tables provide a quick reference for school nurses. Transmission of foodborne infectious agents may be from ingestion of a contaminated food, from the environment (hand-to-mouth route), or by secondary transmission from person to person (fecal-oral route). Secondary transmission has implications for vehicles other than food.

Early detection of potential cases of foodborne illness at school requires vigilance. A nurse must maintain a constant suspicion that any student or adult who presents with typical symptoms of acute gastroenteritis (nausea, vomiting and diarrhea) may have a foodborne illness etiology and may be the index case for a foodborne illness outbreak.

Suspicious of foodborne illness, based on a nurse’s assessment of signs and symptoms, should be reported to the public health authority, as early as possible. Early warnings of potential outbreaks allow for investigations to proceed before a clinical diagnosis is made. Many new surveillance systems, loosely termed syndromic surveillance systems, are being initiated in a number of states and communities as an early warning of possible biological or chemical terrorist attacks. School nurses should be informed of any local surveillance systems in place or being planned to establish a collaborative connection.

Focused Nursing Assessment for Foodborne Illnesses

A focused nursing assessment for potential foodborne illness may detect early signs of possible foodborne illness and indicate a need for action. The assessment collects pertinent data including a detailed history of recent events, initial symptoms, and the progression of symptoms. Information about the onset, frequency, duration and severity of symptoms are important. Date and time of the nurse’s assessment should be noted and can be significant if symptoms change, the illness worsens, or other students or staff are discovered with similar complaints and history. The potential relevance of findings from a focused nursing assessment to a foodborne illness or disease is listed in Table 3.

Table 3: Assessment Findings and Relevance to Foodborne Disease

Findings	Potential Relevance
Nausea	<ul style="list-style-type: none"> Nausea may be the initial symptom or the only symptom.
Nausea with unusual tastes/burning sensation in mouth	<ul style="list-style-type: none"> This may indicate possible ingestion of foods/drinks contaminated with chemicals.
Vomiting	<ul style="list-style-type: none"> Vomiting may be the <u>first</u> symptom of a foodborne illness. Onset time and frequency are significant. Acute onset or projectile vomiting is a key to some specific organisms such as Norovirus, preformed toxins, and chemicals. Chemical poisoning can cause coloration of vomitus: e.g., milky from lead, blue or green from copper. Vomiting is more prevalent in children, whereas a greater number of adults present with diarrhea.
Decreased intake or appetite	<ul style="list-style-type: none"> Nausea, vomiting, and diarrhea reduce intake of foods and fluids. If prolonged or recurrent the student may be at risk for dehydration.
Abdominal pain	<ul style="list-style-type: none"> Abdominal cramps and pain are symptoms commonly associated with diarrhea. Pain is related to the increased activity and irritation in the bowel.
Diarrhea	<ul style="list-style-type: none"> Diarrhea is an extremely common symptom that affects millions of Americans every year. Often it is self-limiting and is not always caused by ingestion of organisms, toxins, or poisons. Most enteric pathogens or toxins cause diarrhea by stimulating secretion of fluids in the small bowel, and irritating and invading the colon. Having blood in the stool and similar symptoms having occurred before are significant.
Headache	<ul style="list-style-type: none"> Headache is usually associated with foodborne illnesses that include symptoms of gastroenteritis and fever or chills.
General Malaise	<ul style="list-style-type: none"> This common nonspecific complaint may accompany symptoms of gastroenteritis. Severity of the pathogen and duration of profuse (watery or bloody) diarrhea could progress to weakness, fatigue, drowsiness or prostration.

Muscle and joints	<ul style="list-style-type: none">• Muscular and joint pain are common with some food-borne illnesses.• Muscular weakness and myalgia are not common with food-borne illnesses.• Muscular and joint pain are significant for determining a diagnosis when accompanied by nausea, vomiting, and diarrhea.
Allergies, chronic disease, or medications	<ul style="list-style-type: none">• Underlying conditions or current or recent medications may be causative or contributing factors.
Weight loss	<ul style="list-style-type: none">• Weight loss is usually related to fluid loss and lack of appetite.• Prolonged symptoms of chronic diarrhea, fatigue and weight loss may be related to an underlying medical condition, repeated infection from person to person, or an untreated parasitic infection.
Dehydration	<ul style="list-style-type: none">• Signs of dehydration are dry mucous membranes, decrease in skin turgor, dizziness when sitting up or standing, and a feeling of weakness or a rapid heart rate.• This is a major concern with fluid loss from prolonged vomiting and watery diarrhea.• Signs of even mild dehydration require medical evaluation and intervention.
Fever	<ul style="list-style-type: none">• Elevated temperature may indicate that an organism has invasive properties and has created a local or systemic infection.• Some diarrheal illnesses may progress from afebrile with watery diarrhea to fever with bacteremia or blood or mucous in the stool.• History of recent vomiting and/or diarrhea indicate need to refer for diagnosis and treatment.
Hypoactive bowel sounds with severe abdominal pain	<ul style="list-style-type: none">• These are ominous signs even without signs of gastroenteritis• Transport for medical diagnosis and intervention should be immediate.

- Neurological abnormalities**
- Neurological symptoms such as parasthesia, motor weaknesses, double vision, tingling and numbness of lips or fingertips, and difficulty swallowing may accompany a few foodborne illnesses.
 - These symptoms constitute an emergency requiring monitoring of vital signs, emergency medical system transport, and immediate medical diagnosis and management of care.
 - If these symptoms were preceded by or accompany gastrointestinal symptoms, food poisoning by ingestion of contaminated foods containing certain lethal toxins or chemical poisoning, is possible.
 - Such toxic symptoms can progress, requiring aggressive treatment and availability of life-support systems.

- Urinary output**
- A decrease in urinary output may be secondary to loss of fluids from vomiting and diarrhea.
 - Dark urine is associated with hepatitis A infection.
 - Blood in the urine after an illness with nausea, vomiting and diarrhea is significant (requires **urgent** referral for medical diagnosis and follow-up) and may indicate hemolytic uremic syndrome (HUS), as the sequelae of an *E. coli* infection.
- Note: Antibiotic exposure increases the release of cytotoxins from *E.coli* and is a major risk factor for hemolytic uremic syndrome in children (18).

Recent activities Activities as a source of foodborne illness

- Camping**
- Increased risk arises during camping from untreated water, unsanitary toilet facilities, improperly stored foods, and close contact with ill individuals.

- Participation in a special event**
- Participation provides opportunities to consume foods from an atypical source such as street vendors, carnivals, picnics, and events with catered foods.

- Visiting or living on a farm**
- A farm can provide opportunities for contact with infected animals, and objects contaminated with animal feces, and consumption of unpasteurized milk and apple juice.

- Pets in home or visited a petting zoo**
- Animals may be carriers or reservoirs of organisms that are known to infect humans.
 - Contact with animal feces or saliva (or inanimate objects that have been in contact with these) may transmit the organisms.

- Travel beyond usual environment**
- A visit to coastal areas where raw or undercooked fish are eaten could be a factor.
 - Food preparation in foreign countries may not be controlled as in this country.
 - Foodborne illnesses may not be uncommon in visited areas.

Consumption of certain risky foods	<ul style="list-style-type: none">• Risky foods include undercooked egg, meat, or fish; home canned goods; unwashed fresh produce; unpasteurized fruit juices, milk, or cheeses; and improperly stored or prepared foods.• Food handlers can contaminate foods during preparation.• Risk is increased when foods are not cooked following preparation (e.g., salads, sandwiches, cut-up fruit) and when the food is a semi-liquid food (mayonnaise, cake frosting) that can spread a small amount of pathogens to many individuals.
Contact with ill family or friend	<ul style="list-style-type: none">• Contact increases opportunities to transmit many of the causative organisms from one person to another by direct contact, on food or inanimate objects, or via the fecal-to-oral route.• Infected individuals may not be symptomatic but have the potential for shedding virus or bacteria.• Young children and those who are immuno-compromised are at greatest risk for severe reactions and death.
Food history (past 72 hours)	<ul style="list-style-type: none">• Any information on food and drink consumed in the past 3-4 days and the source of that food could be very important.• Events where food was served are of interest.• The list need not be exhaustive, only what the student can recall during the initial assessment.• Detailed information may be collected by the health department, if an investigation is warranted.

A focused nursing assessment of a student suspected of a foodborne illness may provide clues to the transmission route and the contaminant. Always take a good food history for the past 72 hours. If nausea and vomiting are the major symptoms, ask about foods and drinks ingested in the past 6 hours; if diarrhea and abdominal cramps without fever are the chief complaint, ask about foods eaten 6 - 20 hours before onset of symptoms; and if diarrhea is associated with fever and chills, ask about foods ingested 12 - 72 hours before onset of symptoms.

Documentation of Relevant Information

Good documentation is recognized as being fundamental to good nursing care. From a legal perspective, “if it wasn’t documented it wasn’t done” (19). Documentation has been an important part of the standards of professional nurses for over 30 years and is mentioned repeatedly in *Nursing: Scope and Standards of Practice* (20). *Scope and Standards of Professional School Nursing Practice* outlines the professional standards of the school nurse (21). These standards require school nurses to document each phase of the nursing process in a standardized language and a retrievable format.

After a foodborne illness outbreak at school, the nurse's documentation of care may be invaluable as defense against liability in a negligence action against the school nurse and/or the school district. Liability in a negligence action requires proof that the defendant's conduct did not conform with a standard of care (22).

Objective documentation of the nurse's findings from a focused nursing assessment can significantly facilitate investigation and management by public health authorities, as well as prevent the spread of a foodborne illness in the school population. The nurse's assessment and diagnosis will determine appropriate management and disposition of the ill person (whether an ill student will be sent home, isolated from others to control spread of infection, referred to a clinician for diagnosis and treatment, or transported via emergency services to an emergency room for immediate care).

Pertinent information must be documented on individual student records as well as organized into aggregate information for the health department to facilitate an investigation. Collecting data to determine the extent of this occurrence of illness in the school population will be important information for the health department and school administration.

When a case of foodborne illness is suspected in the school population the nurse should collect other relevant information for the health department by asking questions such as:

- Is this an isolated case?
- Are the symptoms unusual?
- Has this person had symptoms before?
- Has a family member had a similar illness?
- Are there other students and staff who currently have similar symptoms?
- Are there any associations or contacts among those with similar illnesses?

Recent increases in absences should be reviewed for possible similar illnesses. Consultation should have already begun with the health department regarding reporting of suspicious findings and use of health department protocols for identifying a potential foodborne illness outbreak. For consistency in establishing a collaborative relationship one person, preferably a school nurse or school physician, should be designated the primary contact with the health department.

Sample documentation forms that require a minimum of writing are provided in Appendix 3 to facilitate documentation and reporting of critical information of a suspected foodborne illness. The format also facilitates retrieval of data that may be requested in an investigation.

The School Nurse Documentation and Referral Form: Suspicion of Foodborne Illness (Sample #1, pages 88-89) is planned for use by the school nurse to quickly document findings from a focused nursing assessment. Guidance on use of the form is provided (pages 90-92). The School Documentation Form: Suspicion of Foodborne Illness, (Sample #2, pages 93-94), is an abbreviated form for use by school staff, when a school nurse is not

available to do a focused assessment. These forms can be adapted for computerized records or to meet local policies of the school district and health department protocols.

It may be appropriate to give a copy of this initial documentation to a parent or guardian for the child's health record or to share the information with a primary care provider and/or a public health investigator. School policy or protocols provide guidance for sharing of school health records.

Reporting Findings

If this is not an isolated case and others are symptomatic; if one individual has serious complications accompanying nausea, vomiting and diarrhea; or if possible associations indicate a potential foodborne illness outbreak, the school nurse should immediately alert the school administrator or team coordinator and the health department of the initial findings (number of ill persons, possible associations, predominant symptoms and suspect food or meal, if known). Other key people such as the school food service manager, parent, staff, or facilities manager should be informed according to school policy.

The health department will be looking for associations among the ill individuals. Associations of time, place and person are important for investigators to make a preliminary decision of a possible outbreak and formulate a hypothesis about the causal factors. Report the following information concerning possible associations:

- time: onset of symptoms of ill students are within a few hours or days of each other;
- place: where and when individuals ate at the same place, (e.g., cafeteria),
 - purchased the same food, (e.g., at a vending machine, or from a bake sale),
 - attended the same event (e.g., field trip), or
 - resided or worked in a place common to all (e.g., a classroom), and
- person: shared a personal characteristic (e.g., bus route, team member, family).

In the absence of a school nurse, a designated staff person should collect initial information of a potential foodborne illness outbreak to facilitate notification of the health department by the school administrator. Minimal information to report to the health department should include

- the number of ill students and staff and major symptoms and complaints,
- the approximate date and time of onset of symptoms, and
- any associations among ill individuals and consumption of foods.

Communicating the information via a written report is recommended in addition to verbal telephone notification. The written document provides an

objective record for the school and may be needed for future reference. A sample general notification form for recording a suspected foodborne illness outbreak in a school is provided in Appendix 2 (page 96).

Confidentiality of student health records should be protected and school policy should be followed. Parental permission may be required to share or release specific individual illness-related information to the health department, but health department authority for investigation of foodborne illness outbreaks may overrule school policy on release of such information. A protocol should be developed by the school district and the health department before a suspected foodborne illness is suspected in the schools.

The release of aggregate data, such as the number of students ill and the symptoms and signs, should not require parental permission and can provide important initial information to the health department while protecting the privacy of the individual student's health record. Parental informed consent should be requested before release of identifiable health information from a child's school health record. Local rules and policies on protection of student school and health records should be followed.

Staff should be vigilant for potential indicators of a foodborne illness outbreak and report any information or concerns to the school nurse or other designated school person as soon as possible. The following are examples of potential indicators:

- An unusual number of students and/or staff have a sudden onset of gastrointestinal tract symptoms (nausea, vomiting, cramps, and diarrhea) at school or out of school.
- Unusual symptoms accompany typical gastrointestinal complaints of nausea, vomiting, or diarrhea, such as bloody diarrhea, dizziness, fever, malaise, severe abdominal pain, muscle weakness, and numbness.
- Absences due to similar acute or prolonged gastrointestinal tract symptoms increase markedly within a specific time period.
- An association is noted among ill persons (e.g., classmates, friends, team members, or family ate the same food, ate at the same place, attended the same event where food was served).
- Someone says that a student or staff person has been diagnosed with a foodborne illness and that possibly others at school may be infected.

A sample tracking form to facilitate documentation and transfer of critical information from a number of ill students or staff is provided in Appendix 2 (page 95). This form allows for easy identification of the number of individuals involved, whether they are students or staff, where the exposure occurred, date and time of onset of symptoms, and signs and symptoms for each individual. This information is immediately retrievable, providing a quick picture of aggregate data of the suspected outbreak without breaching confidentiality of individuals. The form becomes an important record for the school.

During an investigation the health department may require additional information from participants who did not become ill after an activity or event that is suspected to have been a source of a foodborne illness outbreak. The school nurse or administrator can facilitate identification of students and staff who may have participated in the event but have not complained of similar symptoms.

Requirements for reporting foodborne diseases and conditions are mandated by state and territorial laws and regulations. Differences exist among states and territories as to which diseases and conditions must be reported. School nurses can stay informed about reporting requirements by contacting the local or state health department or using the Internet (23).

Of the hundreds of known foodborne diseases and conditions national notification to CDC was required of 15 in 2003 (Table 4).

Table 4: Nationally Notifiable Foodborne Diseases and Conditions

Type	Disease or condition
Bacterial	Anthrax
	Botulism
	Brucellosis
	Cholera
	Enterohemorrhagic Escherichia coli
	Hemolytic uremic syndrome, post-diarrheal
	Listeriosis
	Salmonellosis (other than S. Typhi)
	Shigellosis
	Typhoid fever (S. Typhi and S. Paratyphi)
Viral	Hepatitis A
Parasitic	Cryptosporidiosis
	Cyclosporiasis
	Giardiasis
	Trichinellosis

Chapter 3

Management of an Outbreak

AN outbreak response plan is key to the management of foodborne illnesses in schools. The plan should be written, approved by the proper authorities (school administrator, school physician or medical advisor, and the health department) and implemented by the health services staff and the Food-Safe School Team or other key personnel.

In most instances, school nurses will respond as they would when a student becomes ill at school or absences markedly increase. Knowledge of the symptoms and incubation periods of the more common agents of foodborne illnesses will raise a nurse's suspicions that the cause of an illness may be food related. The AMA Foodborne Illnesses Tables are provided in Appendix 1 (pages 63-78) as a quick-check reference of symptoms and agents. Documentation of triage decisions and focused nursing assessments is important (see Section One: Chapter 2).

The role of a school nurse in management of a suspected foodborne illness outbreak will be dictated by the circumstances and will vary depending on whether the nurse is on-site to assess and manage ill students or staff, overwhelmed with the number of simultaneously acutely ill students and the inadequacy of clinic space and supplies, or off-site and providing triage information to unlicensed staff via the telephone.

The role of the school nurse presented here is that of a nurse who is on-site and actively working with a team to prevent foodborne illnesses and assess and manage ill students, and who has a primary role in managing a suspected outbreak. It is recognized that all schools do not have a full-time nurse. A school without a full-time nurse on site must prepare a response plan that will manage a foodborne illness outbreak with existing staff in collaboration with the health department.

Important points to remember in managing a suspected foodborne outbreak:

- Foodborne illnesses result from contaminants being consumed by susceptible people. They comprise a multitude of acute syndromes, have symptoms ranging from discomfort to deadly reactions or chronic sequelae, may appear as an isolated case or a cluster of cases and over a period of time, are complex, and often unreported as possibly food related, and frequently do not have a causative food identified. They depend on many variables including the number of contaminants consumed, nature of the causative agent, susceptibility or resistance of the individual, and distribution of the causative agent within the food product.
- A suspected foodborne outbreak occurs when two or more persons have similar onset and duration of symptoms, symptoms are those usually associated with a foodborne illness, and there is a common connection with a food event.
- A foodborne illness outbreak is an incident in which two or more persons have the same disease, similar clinical features, or have the same pathogen; have a time, place, or person association; or contaminated food is traceable to ingestion by them.
- The health department is the regulatory agency charged with protection of the public from foodborne illnesses and will decide whether an incident should be investigated.

Role of the Health Department

The school should contact the foodborne disease unit or hot line at the health department as early as possible when signs or symptoms of illness are similar to those associated with foodborne illnesses. Even minimal information about a suspected foodborne illness will allow the health department personnel to log in the information, compare it with other complaints or alerts that may be related, interview ill persons or their families, promptly collect food samples and clinical specimens from individuals (when indicated), and prepare for initiating a full investigation if necessary.

The health department is also an excellent source for guidance on handling specific incidences of suspected foodborne illnesses. In some suspected outbreaks the nurse may be directed to obtain specimens of stool or vomitus from each ill person. The health department protocol for collecting specimens should be followed.

Public health officials will review the initial information and determine whether a foodborne illness outbreak is suspected and an investigation is warranted. Illness outbreaks may simulate a foodborne illness outbreak because highly communicable viruses and bacteria can be transmitted similarly, such as by person-to-person contact or via contaminated objects. Noroviruses are the most

common cause of gastroenteritis in the United States. Although noroviruses are known to be foodborne, recent reports emphasize their potential to cause large outbreaks in institutional settings through nonfoodborne transmission (22, 23).

If the health department decides that the findings do not indicate that food is the likely source of the illness, school health protocols for control of infectious diseases and guidance from public health should be followed.

Administrators at the school and the health department should be prepared to be designated public spokespersons, in case of a foodborne illness outbreak. Although most suspected outbreaks of food-related illnesses are not life-threatening emergencies, they are often highly emotional situations. Rumors will spread rapidly creating pressure on the school and health departments to come up with answers that are not readily available: What food is suspected? Was this intentional? What is the contaminant? What measures are being taken to control the outbreak? What treatment is available? How serious is the illness? How many have been affected? What are you doing to assure us that foods served at school are safe?

Media coverage of even a suspected outbreak of foodborne illness in a school is liable to be quite different from that for an outbreak of flu. Foodborne illnesses have one significant difference; the public's perception that foods should be safe and especially that foods served to young people should be free of any risks of foodborne illness. It is critical that official information is provided by designated spokespersons. Staff, nurses, teachers, and food service personnel should refer all questions to the official spokespersons.

Good communication goes hand-in-hand with good management of an outbreak. The establishment of an on-going collaboration between the school nurse, nurse supervisor or coordinator and key individuals at the health department will facilitate communication about current policies and practices related to the prevention of foodborne illnesses, early identification and reporting of potential cases, and appropriate management of a foodborne illness outbreak in the school community.

If the health department initiates an investigation it will most likely request that all symptomatic individuals be identified for interview or further data collection. It may also request the identification of others who are known to have associated with the ill students or participated in the same event and may have been infected but are now asymptomatic. The health department may want to interview individuals who are not ill (as controls) or persons at risk who did not become ill to conduct statistical analyses of outbreak data. The health department should follow school policy for interviews with minors.

Data Collection

To facilitate a foodborne illness outbreak investigation, data should be collected and made available to the health department investigation team in accordance with state and federal laws and local school policies. (See Section One: Chapter 2, pages xx-xx for more details on documentation and reporting).

- The school nurse should have a record of those who have been seen in the clinic and are ill with similar symptoms. The record should include: name, class/grade or worksite, school, parent/guardian name (students) and home address with telephone number, assessment findings (symptoms/signs with onset/duration, recent food history), and triage decisions. Two sample forms are included in Appendix 2.
- A school staff person (designated in the absence of a school nurse) should record who is ill during this incident, the major complaints, and recent food history.
- A tracking form is valuable for sharing general information with key school and health department people. Using numbers instead of names protects confidentiality and allows individual symptoms to be included. A sample form is included in Appendix 2.
- An initial notice for the health department can include the number of ill students and staff, major symptoms, onset (date/time), and possible common food events. A sample form is included in Appendix 2.
- Possible contacts during school-sponsored activities and with other students and adults before the activities (e.g., overnight field trip, visit to a farm or petting zoo, group meal at a restaurant or special event) should be recorded. The health department in an investigation may request a list with the names of all participants at an event.

An on-site investigation may be conducted to determine the source and method of contamination, and the survival or proliferation of the causative agent.

A complete epidemiological investigation of foodborne illness can be complex, staff intensive, and time consuming for collection of samples, laboratory testing, interviews, record reviews, hazard analysis of foods from source to table, etc. Additional information may be sought from health care providers, laboratory records for isolation of foodborne pathogens, calls to poison control centers, and visits to emergency rooms.

Ideally, the investigation report includes an explanation of the source of contamination along with the method by which the food became contaminated. Unfortunately, it is not unusual to complete an investigation without those key questions being answered.

Sample Collection

If food served recently at school is suspect, samples should be saved for testing, and any remaining portions of the food and the food containers should be immediately removed from circulation and refrigerated to await health department determination concerning an investigation. It is important to know

whether cafeteria workers follow a general policy to refrigerate samples of all meals and keep them for 48-72 hours.

Gloves should be worn and good hand hygiene practiced when potentially infectious materials are handled (14, 24). Specimens are usually collected in a clean jar or sealable plastic bag, sealed tightly, and labeled clearly with the name of the ill person and the date. All specimens should be stored in a second bag in a refrigerator (labeled and dated) in a refrigerator until collected by public health investigation staff.

Strategies for School Nurses

There is no universal strategy for managing a suspected foodborne illness outbreak in a school. Because of the complexities of diagnosing foodborne illnesses, the problems associated with identifying a causative food, and the wide variation in incubation periods and symptoms, five possible scenarios are presented to demonstrate the role of the school nurse and the variability in management.

Scenario 1: An unusual number of students and staff have abrupt onset of gastrointestinal tract symptoms in a short period of time.

Example: It is noontime and the clinic is quiet. Within 15 minutes, five students come to the health room after vomiting in the bathroom. All are complaining of severe nausea, two vomit a second time, four have abdominal cramps, and one has a headache. A teacher and two other students arrive with the same symptoms, followed by seven other students with similar symptoms. You are told that others are complaining of feeling nauseated and have cramping.

How should the school nurse respond?

- **Alert the principal to the emergency situation.** Ask the teacher to convey the following information:
 - Assistance is needed immediately in the clinic, i.e., 15 suddenly ill students and staff
 - More ill students and staff are expected,
 - The food service manager must be notified (suspect food/lunch)
 - The health department must be notified.
 - The nurse will have details of illnesses for the health department: number ill, times of onset, predominant symptoms, and possible connections (time, person, place).
 - Parents must be notified.
 - The media may have questions.

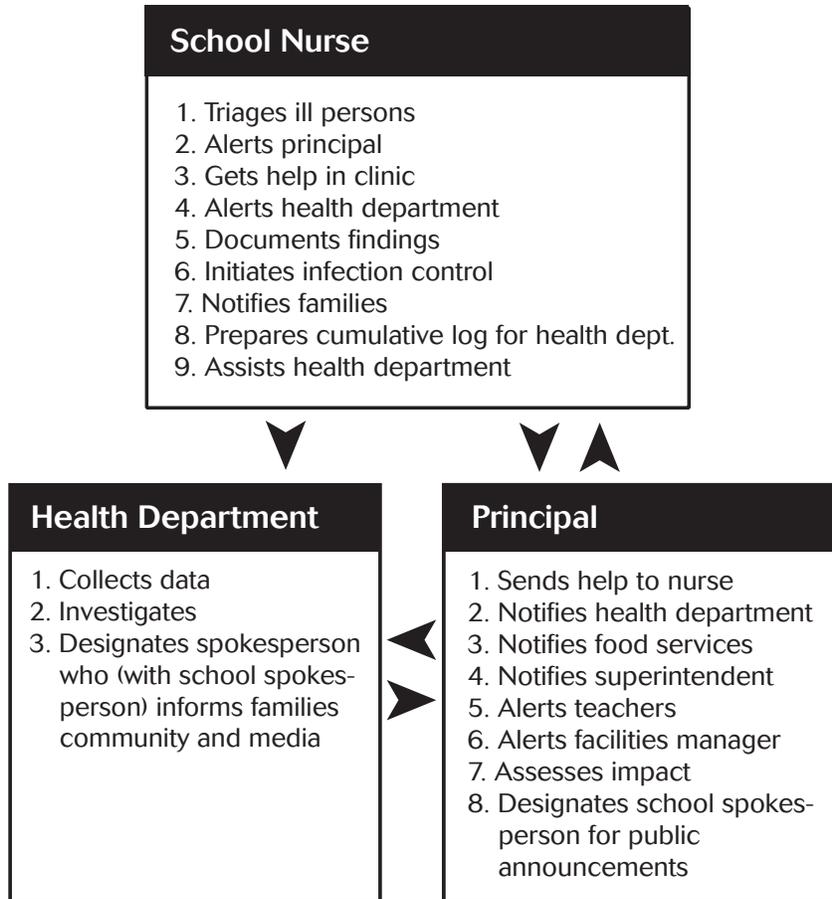
- **Care for clients: triage all ill individuals.** Assess signs (including temperature) and symptoms. Ask the following questions:
 - Who was the first to get sick?
 - How did you feel before this happened?
 - What was the first symptom?
 - Did you eat in the cafeteria?
 - What and when did you eat?
 - Do you all belong to one class?
 - If yes, any special activities this morning? Yesterday?

- **Document all findings on the student's health record.** Be prepared with aggregate data for the health department and school team that is within the laws and policies of confidentiality.
- **Initiate infection-control precautions** for the individuals (clients, nurse, staff) and the environment (clinic, bathrooms).
- **Prepare to triage an increasing number of ill clients** (Possibly collect samples of vomitus or stool, if directed by health department). Delegate non-nursing tasks to others.
- **Notify families that ill students need to be transported from school** and that they should consult their health care provider for follow-up care.
- **Create a data log that can be shared with the health department.** Identify each ill person by a number (to protect confidentiality) and then, for each, give the date and time of onset of first signs or symptoms, predominant current symptoms, and pertinent food history. (See sample tracking form in Appendix 2).
- **Assist the health department in rapid collection of data** on suspected cases to determine whether an investigation is warranted. An epidemiological association of time, place, and person exists with the sudden onset of similar symptoms in the first 15 people within a brief time period and with an association among students and teacher.

Scenario 1 Response Chart

scenario 1

Cluster of students and staff with sudden symptoms of foodborne illness



Scenario 2: A student or staff person presents with unusual symptoms accompanying the typical gastrointestinal symptoms of nausea, vomiting, and diarrhea, such as bloody diarrhea, malaise, abdominal pain, or neurological deficits.

Example: At 10:00 A.M. a senior class student comes to the nurse complaining of vomiting, diarrhea, blurred vision, and hoarseness. He felt well yesterday and had dinner at a friend's house last evening.

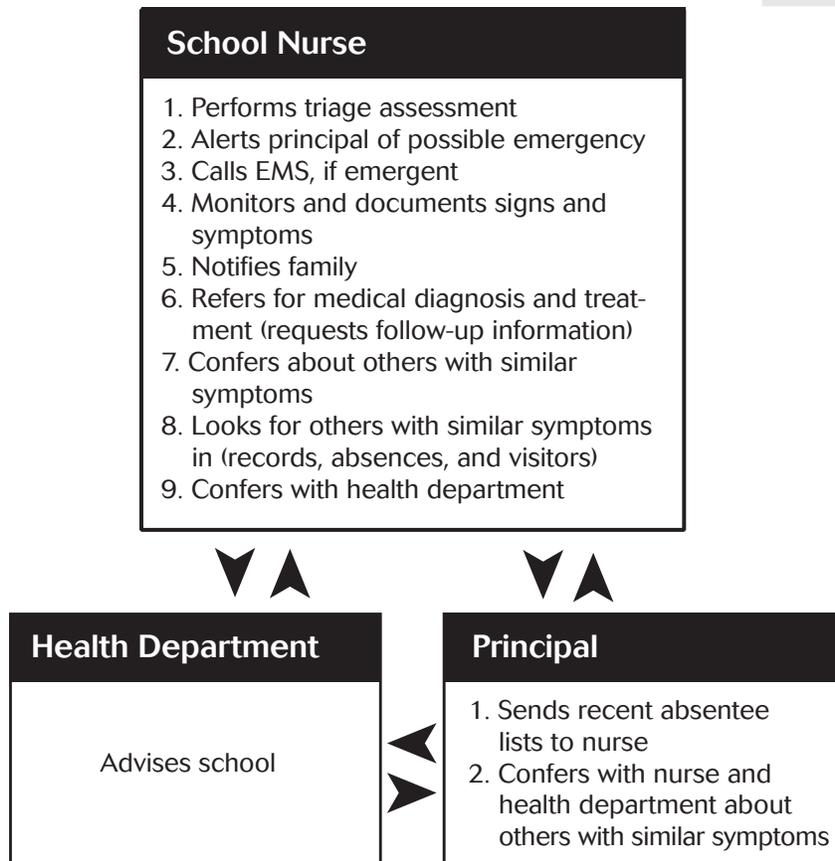
How should the school nurse respond?

- **Perform triage assessment for urgency of care.** Check for atypical symptoms; assess the potential for progressing to an emergency situation (blockage of airway, respiratory distress, increased neurological deficits)
- **Notify principal of impending emergency** if student needs urgent care. Note that the friend needs to be assessed also.
- **Monitor signs and symptoms** for airway, level of consciousness, and increased neurological deficits (motor weakness, numbness, loss of sensation).
- **Notify parent/guardian** if the student needs to be transported for medical care. Use emergency medical services if the student's condition worsens or the parent cannot provide transport.
- **Carefully document all findings**, including the onset and progression of all symptoms, a 3-day food history, and associations.
- **Refer for diagnosis and treatment.** Provide a copy of initial assessment data to parent or emergency medical system personnel. . Request follow-up information from the physician or emergency room.
- **Alert the health department and provide data for the incident.** Question the health department: Can it provide a time frame for other potential cases? Is there a possibility that symptoms are food related? What actions should the school take, if any at this time? Are there similar reports from the community?
- **Review clinic records and absentee lists** for individuals with similar symptoms. Assess the friend and identify absentees associated with this student.
- **Confer with administrator** about others known to be absent in the past few days. Is it known whether they have similar symptoms? What actions will be needed if this is diagnosed as a confirmed case of foodborne disease?
- **Develop an increased level of suspicion** and ask appropriate questions of students who come to the clinic with symptoms of foodborne illness.

Scenario 2 Response Chart

scenario 2

Student or staff with gastrointestinal and neurological symptoms



Scenario 3: A marked increase is seen in student and staff illnesses and absences due to acute or prolonged gastrointestinal tract symptoms within a specific time period.

Example: The nurse notes a dramatic increase in the number of students visiting the health room since the previous afternoon with vomiting, diarrhea, abdominal pain and low-grade fever. The numbers of ill students and staff in school continues to grow to the end of the week. Some are calling it the ‘winter gastrointestinal bug’.

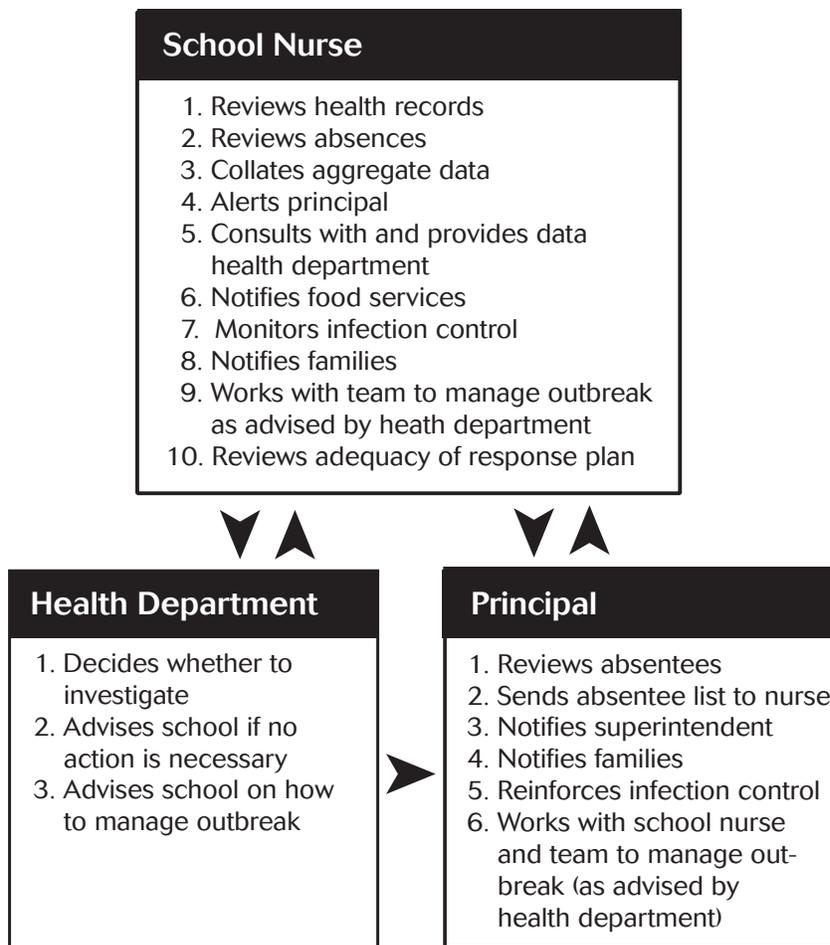
How should the school nurse respond?

- **Review the health records of students** whom you have seen in the past 2-3 weeks for similar patterns of illnesses.
- **Collate the aggregate data** into a list that includes the number of ill persons, onset and duration of illness, and major signs and symptoms.
- **Notify the principal that you suspect that the illnesses may be connected** and could indicate a cluster or outbreak of foodborne or infectious disease. Notify food services to hold food samples until notified by health department. Request data from those absent (during the same time period).
- **Consult with the health department** and share initial data. Notify principal of results.
- **Collaborate with administration and staff** to reinforce handwashing compliance and cleaning of bathrooms as preventive actions against secondary transmission.
- **Combine absentee data with clinic data** for a broader picture of the possible association of illnesses and related absences. Send a report to the principal and health department.
- **Notify families of increase in illnesses** and provide guidance to prevent spread to family members. Recommend that they either consult with their health care practitioner or make an appointment to have any ill family members evaluated.
- **Work with administration to follow health department advice** for management of the suspected outbreak and assist the health department if it decides to investigate.
- **Meet with key players to review and assess response** after the incident is resolved. Revise response plan as indicated.

Scenario 3 Response Chart

scenario 3

Increased incidence of gastrointestinal symptoms causing clinic visits and absences among students and staff



Scenario 4: A known association among ill persons, (classmates, team members, friends, family) at an activity (ate same food at a carnival) or place and time (catered lunch on a field trip).

Example: Two boys from the same homeroom have presented to the health room with similar complaints of nausea and vomiting overnight and currently have acute, watery diarrhea. Both boys are on the track team and had a meet 2 days before at a neighboring town. The team had dinner at a fast-food-restaurant.

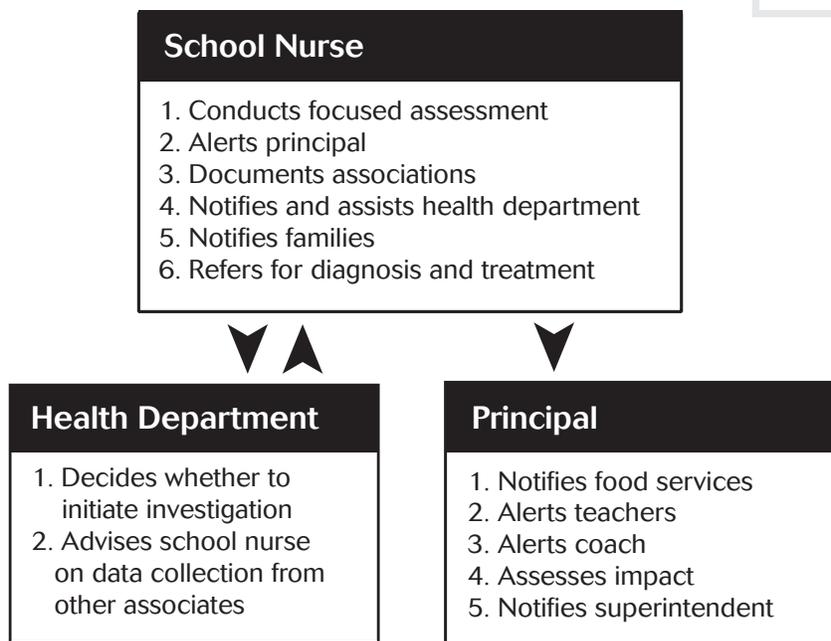
How should the school nurse respond?

- **Conduct a focused assessment of the two boys** including a detailed food history for the previous 3 days and the names of the other track team members.
- **Document findings in each student's record** and initiate a list for the health department of those who are symptomatic.
- **Alert principal of suspicions of foodborne illness** because of the association of timing, similarity of symptoms and possible exposure.
- **Notify parents that their child is ill and should be transported home.** Recommend that the student be seen by the family's health care provider and provide parents with a copy of your assessment results.
- **Notify the health department** and request advice on data collection from team members and classmates.

Scenario 4 Response Flow Chart

scenario 4

Event or food association between ill students or staff



Scenario 5: Notification from the health department, a healthcare provider or a family member that a student/staff person has been diagnosed with a foodborne disease, either confirmed or presumptive from laboratory tests, and that others at school may be affected.

Example: A local pediatrician calls to notify you that a 10 year old fifth grader from your school was hospitalized today with hemolytic uremic syndrome secondary to a recently diagnosed case of *E. coli* 0157:H7. The student had been ill for 6 days before seeing the doctor and specimens had been sent to the laboratory 4 days previously for identification of a causative organism. The health department has been notified.

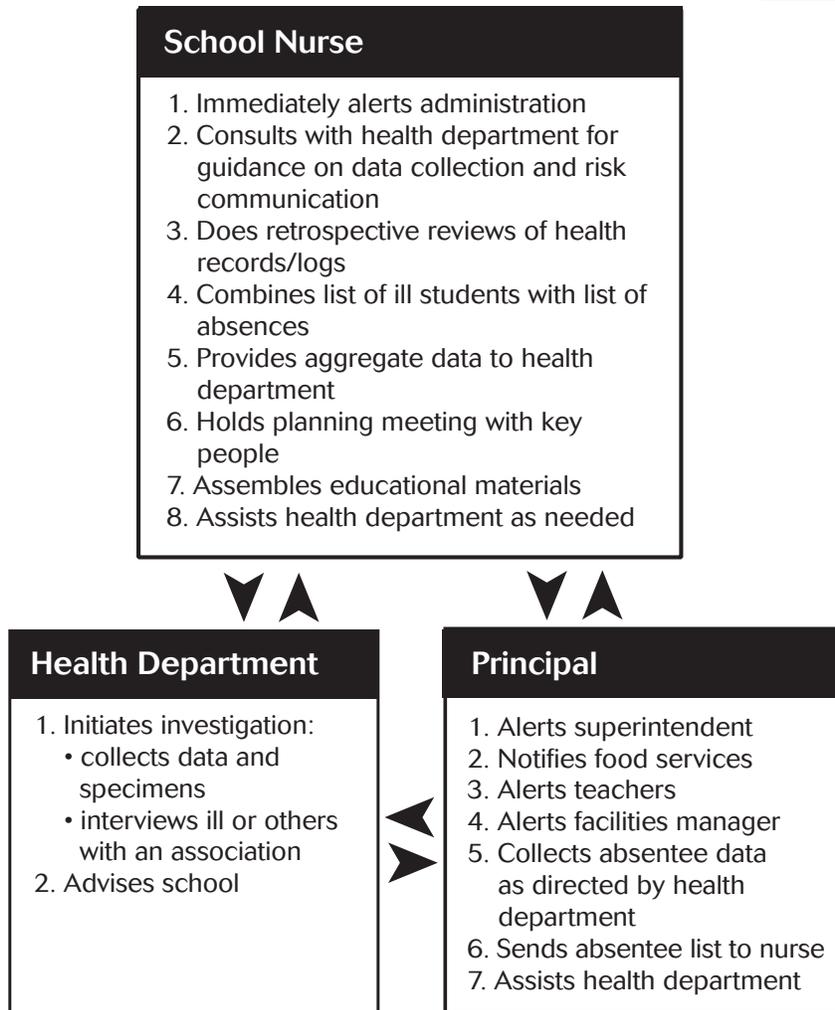
How should the school nurse respond?

- **Share this information with school administration immediately.** If the information comes to a school administrator first, then it should be immediately shared with the nurse.
- **Consult with the health department for guidance on data collection and communicating risk** to staff, students, and families.
- **Review health records of students seen in the clinic over the past month** for signs of gastroenteritis, specifically *E.coli* 0157:H7 infection (incubation:1-8 days: duration: 5-10 days; symptoms: watery diarrhea followed by bloody diarrhea, abdominal pain, vomiting with little or no fever).
- **Combine list of ill students with list of absentees** during the identified time period to assist health department investigation.
- **Have a planning meeting with key school and community people** to coordinate spokespersons for media and public announcements.
- **Assemble educational materials on *E. coli* infections:** prevention, transmission, and signs and symptoms, plus resources in the community for more information.
- **Assist health department during investigation** as needed.

Scenario 5 Response Chart

scenario 5

School is notified of a confirmed case of foodborne illness among students or staff



Section 2

Fundamentals for Nurses

CHAPTER 1:
Epidemiology of
Foodborne Illnesses

CHAPTER 2:
Pathophysiology of
Foodborne Diseases

CHAPTER 3:
Food Safety

Chapter 1

Epidemiology of Foodborne Illnesses

Epidemiology is the study of:

- how and why diseases are distributed in the population,
- why some people get sick and some do not, and
- the distribution and determinants of health-related states, injuries or events in human populations

Diarrhea, the most common symptom of a foodborne disease, accounts for approximately 5 million deaths of children annually worldwide. Diarrhea episodes can occur at the rate of 15 – 20 per person annually in developing countries. Refrigeration and sewage systems in developed countries drop the annual frequency to 1 – 3 episodes per person. The etiology of diarrhea contains a wide array of bacteria (some toxin producing), chemicals and metals, fish and shellfish toxins, fungi toxins, parasites, and viruses. The future will undoubtedly add to the list of known causes of foodborne illnesses. Details of the causes of common foodborne illnesses are in Appendix 1.

Epidemiological Picture

The epidemiological picture of foodborne diseases has changed rapidly in the past 10 years. Factors that contribute to foodborne disease outbreaks may also place students at risk:

- **Dietary changes.** Americans consumed 50% more fruits and vegetables in 1995 than in 1970 as they focused on improved health, (eating heart-healthy foods, reducing obesity). Fresh produce (fruits and vegetables) may be a source of

pathogens if they are contaminated where they are grown or during harvesting or distribution. Fresh produce accounted for 30% of foodborne disease in Minnesota from 1990 to 1996 (26).

- **Global distribution of foods.** Demand for year-round fresh produce led to cost-cutting imports from developing countries. Produce is not usually cooked, and contamination can occur in the field, during transport, when handled by an infected worker, or by cross-contamination from other raw foods such as meats. Mexico supplies up to 70% of certain produce items during its peak season, which may be the source of sporadic diarrhea in the United States.
- **New methods of large-scale production.** Fast foods and ready-to-eat meals are popular. Foods are often partially prepared in a central processing plant to reduce preparation time on site. The average food service worker stays in the industry for less than a year. Many are young and from low socioeconomic groups that have a high incidence of enteric disease; without sick leave many continue to work when they are ill.
- **Expansion of commercial food services.** Nationwide distribution of food products easily magnifies seemingly minor breaches in food safety practices. Contamination is possible from infected people who handle foods and ingredients; cross-contamination is possible from unsanitary conditions in the long production line. Tracing the source of the contamination of the food product (e.g., frozen hamburger patties) is complicated and often impossible without good distribution records. A national outbreak of *salmonellosis* was caused by transport of ice cream mix in a tanker trailer previously used for liquid unpasteurized eggs (26).
- **New foodborne pathogens are being recognized and others are re-emerging as a hazard.** *E.coli* 0157:H7, identified in 1982, is a leading cause of diarrhea and can have a serious sequela, hemolytic uremic syndrome (27) Millions of cases of sporadic illness and chronic complications have been caused by pathogens that have reservoirs in healthy food animals, (e.g., *Campylobacter*; *E. coli* 0157-H7, Salmonella, Yersinia). Pathogens that have reservoirs in healthy food animals can be spread to a variety of food products derived from the animal. *E.coli* 0157:H7 alone has caused the recall of millions of pounds of ground beef and other related products distributed throughout the nation. Other foods implicated in *E. coli* outbreaks include sprouts, lettuce, and unpasteurized apple juice.
- **Increasing numbers in the population are susceptible to infections and some organisms are antibiotic-resistant.** Both of these factors increase the risk of secondary transmission. An increase in incidence and broader distribution of foodborne illnesses in the U.S. population result in an increased risk for severe disease for vulnerable groups: the young, the elderly, and those who are immuno-compromised.

To better quantify the impact of foodborne diseases in the United States, CDC published a synopsis of information gathered from multiple surveillance systems along with other sources (3). These estimates of the actual numbers of foodborne illnesses in this country each year have become the foundation for numerous reports, writings, policies, etc:

- Foodborne diseases cause approximately 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths in the United States each year.
- Known pathogens account for 14 million illnesses, 60,000 hospitalizations, and 1,800 deaths.
- Three pathogens — *Salmonella*, *Listeria*, and *Toxoplasma* — are responsible for 1,500 deaths each year (more than 75% of the deaths caused by known pathogens); unknown agents account for the remaining 62 million illnesses, 265,000 hospitalizations, and 3,200 deaths.

Overall, foodborne diseases appear to cause more illnesses but fewer deaths than previously estimated. These estimates were validated by using multiple data sources, including the (1996) national surveillance system, FoodNet (28).

New foodborne pathogens have been identified, others have re-emerged and some have spread worldwide. Once a new foodborne disease is identified, scientific investigations seek answers to critical questions, such as:

- What is the nature of the pathogen and the disease?
- What are simple ways to identify the pathogen and diagnose the disease?
- How can the disease be treated?
- Which foods transmit the pathogen?
- How does the pathogen get into the food and how well does it persist?
- Is there an animal reservoir and how do the animals get infected?
- What strategies will work to prevent this disease?

Investigation of sporadic cases can identify sources of infection and guide the development of prevention strategies. Outbreak investigations have focused locally on identifying a suspected food and removing it from circulation. It is recommended that outbreak investigation and epidemiological study go beyond identifying and removing the suspected food. Defining the chain of events that allowed contamination with a sufficient number of organisms to cause illness is critical. Knowledge grows over time with data from sources such as case-control studies and investigations of large, dispersed outbreaks. For example, after 15 years of research, a great deal is known about infections with *E. coli* 015:H7, but we still do not know how best to treat the infection nor how the cattle (the principal source of infection for humans) become infected. The challenge is to learn what went wrong so that strategies can be devised to prevent similar outbreaks in the future (29).

Preventing these diseases depends on understanding how food becomes contaminated and involves working with many partners— international, federal, state, and local— to reduce or prevent illnesses. Many agencies share responsibility for surveillance of foodborne illnesses and investigating outbreaks. At the local level, county or city health departments are responsible for basic surveillance, investigation, and prevention. At the state level epidemiologists, public health laboratories, sanitarians, and educators conduct statewide surveillance and prevention activities and support local authorities. At the national level, CDC is the primary risk-assessment agency for public health hazards and conducts primary national surveillance and epidemic response in support of state agencies. Food and Drug Administration (FDA), USDA, and Environmental Protection Agency (EPA) are the primary regulatory agencies with specific responsibilities for the nation’s food and water supply.

Surveillance Systems

Surveillance has improved significantly with the development of new systems and expansion of existing systems. Improved surveillance and investigation are now detecting outbreaks that would have been missed in the past. Most foodborne infections occur as individual or sporadic cases and can be scattered over a large geographical area. It is important that health care professionals, including school nurses report all cases of potential foodborne disease to the public health agency. A local health department may need to investigate a few cases that are part of a larger outbreak that has little impact locally or a local case that may be the index case for a national or even international event (30).

CDC Reported Foodborne Disease Outbreaks

The Electronic Foodborne Outbreak Reporting System (EFORS) is an Internet reporting system implemented in 2002 for states to electronically report foodborne outbreaks to the CDC. Prior to implementation of EFORS, CDC collected paper outbreak reports from the states(31).

The CDC Foodborne and Diarrheal Diseases Branch collects data on reported outbreaks of foodborne diseases from state, local and territorial health departments. Annual statistics are presented as national summaries of reported outbreaks (32). The annual summary statistics for 2000 are shown in Table 5. Only 52 % of the reported outbreaks had a confirmed etiology (14,090 of the total 26,021 cases).

Table 5: 2000 Summary Statistics from CDC's Outbreak Response and Surveillance Unit

Etiology	Number of Outbreaks	Number of Cases
Bacterial	223	6506
Chemical	37	185
Parasitic	6	169
Viral	176	7,208
Multiple etiologies	3	22
Total confirmed etiology	445	14,090
Total unknown etiology	969	11,931
Total for 2000	1,414	26,021

Information available from 5 of 11 reported outbreaks that occurred in schools in 2000 is provided in Table 6 as examples of data found in the CDC Annual Summary Statistics of Foodborne Outbreaks, available online (time lag of 8 – 10 months). (32). Annual reports include data on etiology, location, date, and food vehicle of transmission with space for comments.

Table 6: Examples of Foodborne Outbreaks in Schools Caused by Bacteria

Etiology Bacterial	State	Month	Year	# No. Ill	Vehicle	Location
Clostridium perfringens	VA	11	2000	22	Pot Luck	School
E. Coli 0157:H7	WI	10	2000	29	Brownie	School
Salmonella enteritidis	VA	4	2000	106	Macaroni & Cheese	School
Salmonella Reading	AZ	9	2000	72	Unknown	School
Staphylococcus aureus	TN	11	2000	100	Turkey Stuffing	School

School nurses should remember that if there is an outbreak of foodborne illness in the school population, the primary source of the contaminant may not be at the school and often it may be impossible to pinpoint a pathogen or the food source during a health department investigation.

FoodNet

The Foodborne Diseases Active Surveillance Network, FoodNet, collects data on laboratory-diagnosed cases of seven bacterial and two parasitic foodborne diseases within a defined population in nine U.S. sites with approximately 37.8 million Americans. Active surveillance is conducted for laboratory-diagnosed cases of bacterial infections from *Campylobacter*, *E. coli 0157:H7*, *Listeria*, *Salmonella*, *Shigella*, *Vibrio*, and *Yersinia*; parasitic infections from *Cryptosporidium* and *Cyclospora*; and hemolytic uremic syndrome (HUS). The preliminary laboratory surveillance data for 2003 compared with data for 1996-2002 indicate substantial declines in the incidence of infections caused by *Campylobacter*, *E. coli 0157:H7*, *Salmonella*, and *Yersinia*. The changes in incidence occurred concurrently with implementation of control measures by government agencies and the food industry (33).

FoodNet telephone surveys are conducted to collect data on the frequency of diarrhea in the general population, the proportion of ill persons seeking care, and the frequency of stool culturing by physicians and laboratories for selected pathogens. Although FoodNet data provide the most detailed information available for these infections, limitations of the findings restrict generalization to the total U.S. population. Annual FoodNet reports are available online (34).

PulseNet

PulseNet plays a vital role in the surveillance and investigation of foodborne illness outbreaks that have been difficult to detect. In 1993 a scientist at CDC determined by DNA “fingerprinting” (pulsed-field gel electrophoresis-PFGE), that patients in a large outbreak of foodborne illness in the Western states were infected with the same strain of *E.coli 0157:H7* found in hamburger patties served at a chain of regional fast-food restaurants. Prompt recognition of the cause of this outbreak is estimated to have prevented 800 illnesses. In 1995 CDC with the assistance of the Association of Public Health Laboratories and selected state laboratories established the PulseNet network. In 2004, PulseNet participants included 50 state public health laboratories (7 are designated as area laboratories with assigned service and supporting zones), 5 city health laboratories, 7 FDA laboratories, and the USDA Food Safety and Inspection Services (FSIS) laboratory. PulseNet North consists of 6 provincial Canadian labs and the Canadian national laboratory. PulseNet has expanded its national surveillance of selected foodborne bacterial diseases (*E.coli 0157:H7*, nontyphoidal *Salmonella*, *Shigella*, *Listeria monocytogenes*, and *Campylobacter*).

DNA fingerprinting of foodborne bacteria is very important today. Twenty years ago, most foodborne outbreaks were local problems that resulted from improper food handling. Now, DNA matching can isolate specific strains or subspecies, indicate possible nationwide outbreaks, and lead to more rapid response and ultimately to future prevention (35). The following is an example of an early use of the PulseNet system (26).

In 1998 CDC was informed of an increase in *Salmonella* Agona infections in Illinois and Pennsylvania. Surveillance using PulseNet confirmed increases in cases of *Salmonella* Agona in 10 other states. A national outbreak was occurring with no obvious source. Ultimately, the source was traced to a toasted oat product from Minnesota. PulseNet had typed more than 1,000 isolates, identified 409 cases and identified one death in 23 states (including some states that initially were not known as sites for distribution of the product).

PulseNet has expanded to an early warning system for outbreaks of foodborne disease. The system uses an electronic network that identifies and labels the DNA “fingerprint” pattern of bacteria in the system that may be foodborne and permits rapid comparison of these patterns (through an electronic database at CDC) to identify related strains. All PulseNet laboratories can access the electronic network and quickly compare patterns, which is increasingly important for identifying potential agents of terrorism.

Syndromic Surveillance

National early warning systems are now in the forefront as an enhancement to traditional passive surveillance systems (paper forms and telephone reports with their inherent time delays). A variety of syndromic surveillance systems are being developed to monitor changes in nonspecific health indicator data for early detection of disease outbreaks. The goals are to address concerns of bioterrorism and for public health agencies to be able to detect a large-scale attack in its early stages. These systems will use advanced information technology to extract, transmit, process, and analyze an array of clinical detail for public health purposes. However, information is limited about the usefulness of these systems for outbreak detection and the best ways to support their function as enhancements to established surveillance systems. A working group from the CDC Division of Public Health Surveillance and Informatics, Epidemiology Office, published recommendations for evaluating these emerging systems.

The following are three relatively new syndromic surveillance systems listed here. Detailed information is available from the individual sites.

- The New York City Department of Health and Mental Hygiene monitors emergency room visits, 24 hours per day, 7 days a week, for chief complaints of respiratory problems, fever, diarrhea, and vomiting. Complaints are analyzed daily at 10am ‘Signals’ (significant aberrations) are investigated further (36).

- **EARS** an early aberration reporting system is a syndromic surveillance tool used by local, county, and state public health departments in the United States and abroad. Data are collected from emergency departments 911 calls, physician offices, school and business absentee lists, and over-the-counter drug sales. The tool was developed by Emergency Preparedness and Response and is available for download. (37).
- **RUsick2** is a Web site developed to collect information from individuals on symptoms, time of onset, 4-day pre-illness food history, food sources, and other pertinent information. (38). Individual information is entered on a form and is then compared with data in the system (39).

Chapter 2

Pathophysiology of Foodborne Diseases

Foodborne illnesses consist of a multitude of acute syndromes that result when susceptible people consume a food, contaminated with sufficient quantities of a poisonous substance or pathogenic microorganisms.

Some of the variables include:

- the number of pathogenic microorganisms or concentration of the poisonous substance,
- the nature of the causative agent,
- individual susceptibility or resistance to the contaminant, and
- unequal distribution of contaminant on or within the food product.

Most cases of foodborne illness are caused by the ingestion of pathogens in foods or beverages. Person-to-person transmission as well as transmission from inanimate objects are also possible and facilitate fecal-oral or hand-to-mouth spread of the contaminant.

The risk of infectious diarrhea cannot be eliminated even with close monitoring of foods and beverages. Contaminated foods may look, smell, and taste normal and the pathogen sometimes survives traditional preparation techniques. Certain precautions, such as: drinking only treated or filtered water, avoiding ice from unknown sources, avoiding unpasteurized milk or juice products, ensuring that meats are thoroughly cooked, and serving hot foods steaming, rather than lukewarm, can significantly reduce the risk.

Norovirus (previously called Norwalk-like virus) which is prevalent throughout the United States, causes acute gastroenteritis ('stomach flu'), the most common foodborne

illness. Food and drink can easily become contaminated because the virus particles are small; fewer than 100 can cause an infection, and they are transmitted by utensils, environmental surfaces, and hands.

In the United States, *Giardia*, is the organism most commonly associated with waterborne outbreaks. The surface water of lakes and streams frequently is contaminated with *Giardia* cysts from human or animal sources. Water also has been a vehicle for *Campylobacter*, *Cryptosporidium* and *Norovirus*. Ice has been a source of infections with *Escherichia coli*, *Norovirus* and *Vibrio cholerae*. A common mistake of travelers is to drink bottled water with ice made from contaminated water.

Poultry products have frequently been identified as the vehicle for infection with *Salmonella* and *Campylobacter*. The laying hens have a high rate of infection and the infection is transferred to their eggs. Infected eggs can be intact and have a Grade A rating and still transmit infection to humans. Eggs are clearly a risk when consumed raw in cake batter, salad dressings, and mousses or undercooked in soft-boiled eggs.

Milk was the vehicle of the largest outbreak of *Salmonella* in the United States. In 1985 an outbreak of anti-microbial resistant salmonellosis associated with pasteurized milk that became contaminated with unpasteurized milk late in the process was estimated to have resulted in approximately 20,000 illnesses (40). Unpasteurized cheese has been linked to infections with *Listeria*.

The consumption of shellfish and fish includes multiple risks (associated both with their habitat and the handling of the product during processing for market) of infection with *Vibrio* and *Norovirus*, and neurotoxic and paralytic fish poisoning. Thorough cooking may not totally eliminate the risk.

The large and rapid distribution system for fresh fruits and vegetables has led to a series of outbreaks traced to salads and salad bars; fruits such as grapes, melons, strawberries, and raspberries; herbs; and green onions and sprouts from sources in distant states or other countries. Untreated or contaminated water seems to be a likely source of contaminants at various stages. Water used for growing, spraying, washing, and maintaining the appearance of produce can be a source of harmful microscopic organisms on foods that are eaten raw.

Host Resistance

Diarrhea-causing organisms must successfully avoid a number of human defenses to reach the small bowel or colon. Preformed toxins create a more immediate reaction in the stomach and small intestine causing nausea and severe vomiting, often within an hour after ingestion. Other organisms must reach their site of action in the small bowel or colon.

The human defenses against enteric organisms are gastric acidity, small bowel motility, local antibody formation, and colonic microflora. (41).

Gastric acidity at the normal fasting pH (less than 4) is an effective barrier to infection, eradicating 99% of most bacteria within 30 minutes. Antacids that raise the pH and food that may buffer the acid lessen the barrier and increase host susceptibility to infection by some organisms.

Small bowel motility is a constant action that makes it difficult for organisms that function by attachment to invade and attach to the mucosa. Individuals may have decreased motility (from diabetes or medications) which allows increased contact time between the organism and the bowel mucosa, and thus facilitates attachment and infection.

Local antibody formation, specifically immunoglobulin A, seems to have a minor role in protection against diarrheal pathogens. There is growing evidence that some pathogens have developed mechanisms to elude or trick the immune system (26).

Colonic microflora (10^{11} anaerobic organisms per gram of feces) are normally a significant defense against diarrheal pathogens. These anaerobes compete with the invading pathogens for nutrients and attachment sites, and can produce chemicals that are toxic for some organisms. Antibiotics and other medications may reduce the normal protection by altering the normal bacterial flora.

Organism factors

The production of a toxin by an infectious organism is the most common factor for foodborne illness. Pathogens may produce enterotoxins, neurotoxins, and cytotoxins (41).

- **Enterotoxins** may be present on the food before ingestion and can work on the small bowel. They go through a series of chain reactions that lead to change in sodium and potassium absorption creating a movement of fluid into the gut. This secretory diarrhea can produce volumes of liquid loss. This is the main mechanism of *Vibrio cholera*, *enterotoxigenic Escherichia coli*, and *Clostridium perfringens*.
- **Neurotoxins** act on the autonomic nervous system causing hyperperistalsis and may act centrally as a stimulant to emesis. Two preformed enterotoxins from *Staphylococcus aureus* and *Bacillus cereus*, are formed on the food before ingestion and cause a sudden onset of symptoms 1-6 hours after ingestion.
- **Cytotoxins** are associated with gastrointestinal pathogens and are usually formed inside the body by organisms that act in the colon. Unlike the other two toxins, cytotoxins damage the mucosa directly.

The organisms that produce these toxins have similarities in their genetic codes that may allow transfer of genetic material among organisms. Virulence factors include motility, chemotaxis, invasiveness, and adherence and attachment to the mucosa.

These organisms have multiple properties and, sometimes, more than one type of toxin. Timing of symptoms may be staggered because some toxins are preformed and act on the small intestine whereas others are formed after ingestion and act on the colon. This explains why infections with a single pathogen, *E.coli*, may begin as watery diarrhea and progress to fever and an invasive syndrome.

Many foodborne pathogens have an animal reservoir and are spread to humans through manure or fecal contamination of meat, food products, or other vehicles. Pathogens are spread from ill individuals or asymptomatic infected individuals by direct contact or indirectly from contamination of food or other vehicles.

Chronic (secondary) complications may occur independent of a foodborne illness or accompany the acute-phase response (diarrhea, vomiting, other gastrointestinal complaints). Chronic sequelae are estimated to occur in 2-3% of foodborne disease cases. Chronic conditions linked to foodborne infections, include ankylosing spondylitis, rheumatoid disease, renal disease, autoimmune disease, Guillain-Barre's syndrome, cardiac and neurologic disorders, and other disorders such as chronic gastritis and incapacitating diarrhea (42).

Host susceptibility

Risk for travelers depends on their destination, and their eating habits. Canada, Australia, and Northern Europe are relatively low risk areas for U.S. travelers. Southern Europe and several of the Caribbean Islands have a higher risk. The highest risk areas are Latin America, parts of Asia, the Middle East and Africa: 50-60% of travelers in these areas get diarrhea but most cases are self-limited.

Several underlying illnesses such as sickle cell anemia and immune deficiencies greatly increase a person's risk for infectious diarrhea. People with AIDS have the highest incidence of diarrhea.

Hospital or institutionalized individuals are at increased risk. The incidence of diarrhea in these individuals may be similar to that of travelers. For example: an outbreak of Norovirus in a local hospital lasted 3 weeks, 50% of the residents and 39% of the staff were ill, creating a disaster for the hospital, staff, patients, families and the community (22).

Reports of outbreaks of acute gastroenteritis (AGE) on cruise ships, and institutional settings have increased. These outbreaks are consistent with Norovirus infection, which is common in crowded settings. Outbreaks of Norovirus disease affect all age groups and 30% of those infected may be asymptomatic. Recent reports highlight the potential of *Norovirus* transmission through non-foodborne modes of transmission (including airborne droplets from vomitus). Transmission is also supported by the absence of long-lasting

immunity, durability of the organism in the environment, multiple methods of transmission, and an infectious dose of as few as 10 viral particles (24).

Prevention of person-to-person transmission should be a primary concern for the school nurse for many of the viral and bacterial foodborne illnesses. Promoting frequent handwashing by staff and students and good personal hygiene is key to controlling many of the potential outbreaks in the school population. Maintaining infection control measures in the health office is critical to containing a suspected or real outbreak.

Chapter 3

Food Safety

FOOD safety has been defined as the absence or the reduction to an acceptable level of hazards that can be transmitted to people through consumption of food. Such hazards are caused by contamination that can occur at any stage of the process that brings the food from its source to consumption by an individual. Much has been learned about how, why, and when foods can be potentially hazardous. Some foods are potentially hazardous by their nature (fungi, poisonous fish, plant toxicants), but any food can become contaminated with harmful substances (chemicals, metals) or disease-causing microorganisms (bacteria, parasites, viruses) through poor practices in processing, transporting, preparing or serving.

Basics of Food Safety

Bacteria are always present, regardless of how clean something appears. Dangerous bacteria cause 90% of all reported foodborne illnesses and they cannot be seen, tasted, or smelled. Bacteria reproduce by division and the number of bacteria can grow to millions in a very short time. Bacteria that cause foodborne illnesses (unlike viruses which replicate inside human cells) incubate on foods, especially animal products, or protein-rich foods with low acidity, under the right conditions, which include: moisture (which facilitates reproduction), and more than 4 hours between 41° F and 140° F.

An FDA review of outbreaks caused by food workers (from 1975 to 1998), reported that 93% of the outbreaks involved food workers who were ill, either before or during the time

of the outbreak (13). For most of the remaining outbreaks (7%), an asymptomatic food worker was believed to be the source of the infections. Contamination of food by an infected food worker is the most common mode of transmission of hepatitis A, and usually involves foods that were not cooked or that were contaminated during preparation. Hands may be the most important means by which enteric viruses are transmitted. Handwashing, with soap and water is recommended by CDC and other health experts to remove soil and transient microorganisms from the hands. (11, 12, 13, 14).

The four basic steps in proper handling of foods **Clean, Separate, Cook, and Chill** are promoted by **Fight BAC!**[™] (Keep Food Safe From Bacteria), a consumer education program (43). These simple, easy-to-remember terms focus attention on major control points where there are opportunities to intervene in the transmission of foodborne pathogens.

- **Clean:** Wash hands and surfaces often (e.g., wash hands and cutting boards in hot, soapy water).
- **Separate:** Do not cross-contaminate (e.g., keep raw meats or poultry away from other foods).
- **Cook:** Cook to proper temperatures (e.g., use time/temperature cooking for risky foods to kill any bacteria).
- **Chill:** Refrigerate promptly (e.g., refrigerate less than 40°F.) perishables and leftovers within 2 hours).

Keeping hot foods at 140° F. or warmer and cold foods at 40° F or colder is essential to maximize the safety of perishable foods. Minimizing the time that perishable foods are at room temperature reduces the opportunity for the pathogens to multiply. Fewer pathogens reduce the risk of foodborne illness.

The 2 hour rule is an important principle of safe food handling from FSIS that is relevant to the safety of foods served in schools. The 2-hour rule states that harmful bacteria can grow rapidly in the “danger zone” (between 40° and 140° F) and perishable foods left at room temperature longer than 2 hours should be discarded. If room or outdoor temperature at a picnic or cookout is over 90°, perishable foods should be discarded after 1 hour. This rule should be followed when developing policies or prevention strategies for preparing or serving foods at school or transporting foods to a school activity.

Numerous factors contribute to the contamination, microbial survival, and microbial growth of our food supply. Listed below are the most common factors.

- Contamination factors
 - Raw foods contaminated at the source (e.g., meat, shellfish, rice, grains, and herbs)
 - Infected workers handling foods that were not subsequently cooked
 - Contaminants spread by workers’ hands, equipment, cleaning cloths

- Equipment not properly cleaned
- Foods obtained from contaminated sources
- Contaminated foods eaten raw
- Food contaminated during storage
- Food contaminated by sewage during growth or production
- Survival factors
 - Food cooked at inadequate temperature or for too short a time
 - Previously cooked foods reheated for too short a time or at insufficient temperature
 - Food inadequately acidified
 - Food inadequately thawed followed by insufficient cooking
- Microbial growth factors
 - Cooked food left at room temperature
 - Food improperly cooled
 - Hot food stored or held at a temperature that supported growth
 - Food prepared a half day ahead of serving and improperly stored
 - Food held in prolonged cold storage for several weeks
 - Food inadequately fermented or salt cured
 - Condensation formed on food
 - Environment provided other favorable conditions for pathogens.

These factors are applicable wherever foods are prepared, stored and served at a restaurant, school, home, or special event.

The great thing about foodborne illness
is that it can be PREVENTED!

HACCP System

Decreasing the conditions that allow dangerous bacteria to attach and multiply on a food can significantly reduce the risk of transmitting a foodborne disease. Altering the environment can destroy, minimize, or remove bacteria on or in a food product or prevent contamination.

Assessment procedures and preventive actions for food safety begin on the farm or at the point of food production and continue through the handling of food at harvest or during slaughtering of animals, during processing and packaging, in storage or transportation, at distribution centers, and during the final preparation and food service.

HACCP — hazard analysis of critical control points is essentially an adaptation of a system created in the early 1960s for the U. S. space program for protecting astronauts from microbial and other hazards in foods that could cause illness or injury. The HACCP principles are adaptable for all sites where foods are purchased, stored, prepared, cooked, served, or handled as leftovers (44). The purpose of the seven HACCP principles is to

- identify the unacceptable contamination, growth or survival of microorganisms and/or the unacceptable production or persistence in foods of products of microbial metabolism, (e.g., toxins and enzymes that may affect food safety);
- assess the magnitude or seriousness of the possible consequences; and
- estimate the probability of a hazard occurring.

FDA recommends implementation of HACCP in food establishments as the most effective and efficient prevention way to ensure that food products are safe. HACCP provides additional benefits over traditional inspections by identifying the food establishment as ultimately responsible for serving safe foods and allowing inspectors to determine the establishment's level of compliance.

The HACCP system is a self-assessment process that includes the following sequential steps (44):

1. **Conduct a hazard analysis** of the production, distribution and use of raw materials and food products to: identify potentially hazardous raw materials, identify the potential sources and specific points of contamination; determine the probability that microorganisms will survive or multiply during production, processing, distribution, storage and preparation for consumption; and assess the risks and severity of the identified hazard.
2. **Determine critical control points** at which control can be exercised to eliminate, prevent or minimize a hazard and specify criteria that indicate whether an operation is under control at a particular critical point.
3. **Establish critical limits for each critical control point** as a maximum or minimum value to which a hazard must be controlled to prevent, eliminate, or reduce to an acceptable level.
4. **Establish and implement critical control point monitoring requirements** to check that the hazard is under control at each critical control point.
5. **Establish corrective actions** that are intended to ensure that no product is injurious to health or otherwise adulterated as a result.
6. **Establish record keeping procedures** that maintain certain documents, including the results of the hazard analysis and a written HACCP plan, and

records documenting the monitoring of critical control points and limits, activities and the handling of processing deviations.

- 7. Establish procedures for verifying that the HACCP system is working as intended** by validating that the plans do what they were designed to do.

The basic principles of pathogen reduction (HACCP), and sanitation standard operating procedures are also being phased in at commercial food production plants for meats, poultry and egg products under the FSIS. With the growing evidence of *E.coli* 0157:H7 in hamburger meat, the FDA issued a *Federal Register* Notice on October 7, 2002, that advised establishments of their obligation to reassess their HACCP plans for raw beef products, and FSIS inspection personnel have new instructions for verification of *E. coli* 0157:H7 reassessments (45).

The 2001 Food Code contains revised national guidelines for handling foods to safeguard public health and provide foods to consumers that are safe, unadulterated, and honestly presented (46). Responsibilities for food safety cross many federal agencies i.e., USDA, FDA, FSIS and CDC.

The vulnerability of the U.S. food supply is a growing public concern. Unintentional foodborne disease outbreaks have occurred in the past and affected large, dispersed geographical areas. These conditions delay recognition of a foodborne outbreak and complicate identification of the contaminant and the food source. For example, in 1994 an estimated 224,000 people in the United States were infected with *Salmonella enteritidis* caused by contamination of pasteurized liquid ice cream that was transported and distributed nationally in tanker trucks containing the pathogen (47). Deliberate contamination of foods by terrorists could cause similar outbreaks. Biological agents such as *Salmonella*, *Shigella* and *E.coli* are available from clinical and research laboratories.

Detection of a terrorist act can result from a threat being made (overt attack) or from an epidemiological investigation of an outbreak (covert attack). Specific threats will be investigated by law enforcement and intelligence agencies. Detection of covert attacks depends on early recognition and investigation, — as with any foodborne outbreak — of the food and its distribution to prevent additional cases. Any suspicions that terrorists may be involved must be reported to authorities immediately to bring into play the full resources for a rapid response.

Congress and federal agencies are enacting new regulations, rules, and guidelines to safeguard foods. States have adopted federal regulations and many have additional rules. Regulatory authority of food safety and investigation of outbreaks of foodborne illness may be shared among multiple state agencies. The state inspectors who monitor compliance with these rules are given various titles by the state agencies. School nurses should seek current information on food safety regulations and guidelines from local, state, and federal agencies or from their Web sites.

Section 3

Appendixes

APPENDIX 1:
AMA: Foodborne Illnesses Tables

APPENDIX 2:
Sample Forms

APPENDIX 3:
Internet Resources

APPENDIX 4:
References

Appendix 1

AMA: Foodborne Illnesses Tables

THE Foodborne Illnesses Tables are excerpted from *Diagnosis and Management of Foodborne Illnesses: A Primer for Physicians and Other Health Care Professionals* with permission from the American Medical Association (17).

The tables have been grouped by type of illness—bacterial, parasitic, viral, and noninfectious—and contain information on many of the foodborne illnesses known to occur in the United States. Information includes etiology, incubation period, signs and symptoms, duration of illness, associated foods, laboratory testing, and treatment.

These tables are provided as an easily accessible resource for school nurses and include over 50 different agents of foodborne illnesses. It is important to remember that new agents may be identified in the future, a causative agent is not always found for reported foodborne illness outbreaks, and frequently the specific food source is not identified.

Foodborne Illnesses Tables

Foodborne Illnesses (Bacterial)

Etiology	Incubation Period	Signs & Symptoms	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
<i>Bacillus anthracis</i>	2 days to weeks	Nausea, vomiting, malaise, bloody diarrhea, acute abdominal pain.	Weeks	Insufficiently cooked contaminated meat.	Blood.	Penicillin is first choice for naturally acquired gastrointestinal anthrax. Ciprofloxacin is second option.
<i>Bacillus cereus</i> (diarrheal toxin)	10–16 hours	Abdominal cramps, watery diarrhea, nausea.	24–48 hours	Meats, stews, gravies, vanilla sauce.	Testing not necessary, self-limiting (consider testing food and stool for toxin in outbreaks).	Supportive care.
<i>Bacillus cereus</i> (preformed enterotoxin)	1–6 hours	Sudden onset of severe nausea and vomiting. Diarrhea may be present.	24 hours	Improperly refrigerated cooked or fried rice, meats.	Normally a clinical diagnosis. Clinical laboratories do not routinely identify this organism. If indicated, send stool and food specimens to reference laboratory for culture and toxin identification.	Supportive care.
<i>Brucella abortus</i> , <i>B. melitensis</i> , and <i>B. suis</i>	7–21 days	Fever, chills, sweating, weakness, headache, muscle and joint pain, diarrhea, bloody stools during acute phase.	Weeks	Raw milk, goat cheese made from unpasteurized milk, contaminated meats.	Blood culture and positive serology.	Acute: Rifampin and doxycycline daily for ≥6 weeks. Infections with complications require combination therapy with rifampin, tetracycline, and an aminoglycoside.

<i>Campylobacter jejuni</i>	2–5 days	Diarrhea, cramps, fever, and vomiting; diarrhea may be bloody.	2–10 days	Raw and undercooked poultry, unpasteurized milk, contaminated water.	Routine stool culture; <i>Campylobacter</i> requires special media and incubation at 42° C to grow.	Supportive care. For severe cases, antibiotics such as erythromycin and quinolones may be indicated early in the diarrheal disease. Guillain-Barré syndrome can be a sequela.
<i>Clostridium botulinum</i> - children and adults (preformed toxin)	12–72 hours	Vomiting, diarrhea, blurred vision, diplopia, dysphagia, and descending muscle weakness.	Variable (from days to months). Can be complicated by respiratory failure and death.	Home-canned foods with a low acid content, improperly canned commercial foods, home-canned or fermented fish, herb-infused oils, baked potatoes in aluminium foil, cheese sauce, bottled garlic, foods held warm for extended periods of time (e.g., in a warm oven).	Stool, serum, and food can be tested for toxin. Stool and food can also be cultured for the organism. These tests can be performed at some state health department laboratories and CDC.	Supportive care. Botulinum antitoxin is helpful if given early in the course of the illness. Contact the state health department.
<i>Clostridium botulinum</i> - infants	3–30 days	In infants <12 months, lethargy, weakness, poor feeding, constipation, hypotonia, poor head control, poor gag and sucking reflex.	Variable	Honey, home-canned vegetables and fruits, corn syrup.	Stool, serum, and food can be tested for toxin. Stool and food can also be cultured for the organism. These tests can be performed at some state health department laboratories and CDC.	Supportive care. Botulinum immune globulin can be obtained from the Infant Botulism Prevention Program, Health & Human Services, California (510) 540-2646. Botulinum antitoxin is generally not recommended for infants.

Foodborne Illnesses (Bacterial)						
Etiology	Incubation Period	Signs & Symptoms	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
<i>Clostridium perfringens</i> toxin	8–16 hours	Watery diarrhea, nausea, abdominal cramps; fever is rare.	24–48 hours	Meats, poultry, gravy, dried or precooked foods, time- and/or temperature-abused food.	Stools can be tested for enterotoxin and cultured for organism. Because <i>Clostridium perfringens</i> can normally be found in stool, quantitative cultures must be done.	Supportive care. Antibiotics not indicated.
Enterohemorrhagic <i>E. coli</i> (EHEC) including <i>E. coli</i> O157:H7 and other Shiga toxin-producing <i>E. coli</i> (STEC)	1–8 days	Severe diarrhea that is often bloody, abdominal pain and vomiting. Usually, little or no fever is present. More common in children <4 years.	5–10 days	Undercooked beef especially hamburger, unpasteurized milk and juice, raw fruits and vegetables (e.g., sprouts), salami (rarely), and contaminated water.	Stool culture; <i>E. coli</i> O157:H7 requires special media to grow. If <i>E. coli</i> O157:H7 is suspected, specific testing must be requested. Shiga toxin testing may be done using commercial kits; positive isolates should be forwarded to public health laboratories for confirmation and serotyping.	Supportive care, monitor renal function, hemoglobin, and platelets closely. <i>E. coli</i> O157:H7 infection is also associated with hemolytic uremic syndrome (HUS), which can cause life-long complications. Studies indicate that antibiotics may promote the development of HUS.
Enterotoxigenic <i>E. coli</i> (ETEC)	1–3 days	Watery diarrhea, abdominal cramps, some vomiting.	3–>7 days	Water or food contaminated with human feces.	Stool culture. ETEC requires special laboratory techniques for identification. If suspected, must request specific testing.	Supportive care. Antibiotics are rarely needed except in severe cases. Recommended antibiotics include trimethoprim and sulfamethoxazole (TMP-SMX) and quinolones.

<p>Enterotoxigenic <i>E. coli</i> (ETEC)</p>	<p>1–3 days</p>	<p>Watery diarrhea, abdominal cramps, some vomiting.</p>	<p>3–>7 days</p>	<p>Water or food contaminated with human feces.</p>	<p>Stool culture. ETEC requires special laboratory techniques for identification. If suspected, must request specific testing.</p>	<p>Supportive care. Antibiotics are rarely needed except in severe cases. Recommended antibiotics include trimethoprim and sulfamethoxazole (TMP-SMX) and quinolones.</p>
<p><i>Listeria monocytogenes</i></p>	<p>9–48 hours for gastrointestinal symptoms, 2–6 weeks for invasive disease</p>	<p>Fever, muscle aches, and nausea or diarrhea. Pregnant women may have mild flu-like illness, and infection can lead to premature delivery or stillbirth. Elderly or immunocompromised patients may have bacteremia or meningitis.</p>	<p>Variable</p>	<p>Fresh soft cheeses, unpasteurized or inadequately pasteurized milk, ready-to-eat deli meats, hot dogs.</p>	<p>Blood or cerebrospinal fluid cultures. Asymptomatic fecal carriage occurs; therefore, stool culture usually not helpful. Antibody to listeriolysin O may be helpful to identify outbreak retrospectively.</p>	<p>Supportive care and antibiotics; Intravenous ampicillin, penicillin, or TMP-SMX are recommended for invasive disease.</p>
	<p>At birth and infancy</p>	<p>Infants infected from mother at risk for sepsis or meningitis.</p>				

Foodborne Illnesses (Bacterial)						
Etiology	Incubation Period	Signs & Symptoms	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
<i>Salmonella</i> spp.	1–3 days	Diarrhea, fever, abdominal cramps, vomiting. <i>S. typhi</i> and <i>S. paratyphi</i> produce typhoid with insidious onset characterized by fever, headache, constipation, malaise, chills, and myalgia; diarrhea is uncommon, and vomiting is not usually severe.	4–7 days	Contaminated eggs, poultry, unpasteurized milk or juice, cheese, contaminated raw fruits and vegetables (alfalfa sprouts, melons). <i>S. typhi</i> epidemics are often related to fecal contamination of water supplies or street-vended foods.	Routine stool cultures.	Supportive care. Other than for <i>S. typhi</i> and <i>S. paratyphi</i> , antibiotics are not indicated unless there is extraintestinal spread, or risk of extraintestinal spread, of infection. Consider ampicillin, gentamicin, TMP-SMX, or quinolones if indicated. Vaccine exists for <i>S. typhi</i> .
<i>Shigella</i> spp.	24–48 hours	Abdominal cramps, fever, and diarrhea. Stools may contain blood and mucus.	4–7 days.	Food or water contaminated with human fecal material. Usually person-to-person spread, fecal-oral transmission. Ready-to-eat foods touched by infected food workers, (e.g., raw vegetables, salads, sandwiches).	Routine stool cultures.	Supportive care. TMP-SMX recommended in the United States if organism is susceptible; nalidixic acid or other quinolones may be indicated if organism is resistant, especially in developing countries.
<i>Staphylococcus aureus</i> (preformed enterotoxin)	1–6 hours	Sudden onset of severe nausea and vomiting. Abdominal cramps. Diarrhea and fever may be present.	24–48 hours	Unrefrigerated or improperly refrigerated meats, potato and egg salads, cream pastries.	Normally a clinical diagnosis. Stool, vomitus, and food can be tested for toxin and cultured if indicated.	Supportive care.

<i>Vibrio cholerae</i> (toxin)	24–72 hours	Profuse watery diarrhea and vomiting, which can lead to severe dehydration and death within hours.	3–7 days.	Causes life-threatening dehydration. Contaminated water, fish, shellfish, street-vended food typically from Latin America or Asia.	Stool culture; <i>V. cholerae</i> requires special media to grow. If <i>V. cholerae</i> is suspected, must request specific testing	Supportive care with aggressive oral and intravenous rehydration. In cases of confirmed cholera, tetracycline or doxycycline is recommended for adults, and TMP-SMX for children (<8 years).
<i>Vibrio parahaemolyticus</i>	2–48 hours	Watery diarrhea, abdominal cramps, nausea, vomiting.	2–5 days	Undercooked or raw seafood, such as fish, shellfish.	Stool cultures. <i>V. parahaemolyticus</i> requires special media to grow. If <i>V. parahaemolyticus</i> is suspected, must request specific testing.	Supportive care. Antibiotics are recommended in severe cases: tetracycline, doxycycline, gentamicin, and cefotaxime.
<i>Vibrio vulnificus</i>	1–7 days	Vomiting, diarrhea, abdominal pain, bacteremia, and wound infections. More common in the immunocompromised, or in patients with chronic liver disease (presenting with bullous skin lesions). Can be fatal in patients with liver disease and the immunocompromised.	2–8 days	Undercooked or raw shellfish, especially oysters, other contaminated seafood, and open wounds exposed to sea water.	Stool, wound, or blood cultures. <i>Vibrio vulnificus</i> requires special media to grow. If <i>V. vulnificus</i> is suspected, must request specific testing.	Supportive care and antibiotics; tetracycline, doxycycline, and ceftazidime are recommended.
<i>Yersinia enterocolytica</i> and <i>Y. pseudotuberculosis</i>	24–48 hours	Appendicitis-like symptoms (diarrhea and vomiting, fever, and abdominal pain) occur primarily in older children and young adults. May have a scarlatiniform rash with <i>Y. pseudotuberculosis</i> .	1–3 weeks, usually self-limiting	Undercooked pork, unpasteurized milk, tofu, contaminated water. Infection has occurred in infants whose caregivers handled chitterlings.	Stool, vomitus, or blood culture. <i>Yersinia</i> requires special media to grow. If suspected, must request specific testing. Serology is available in research and reference laboratories.	Supportive care. If septicemia or other invasive disease occurs, antibiotic therapy with gentamicin or cefotaxime (doxycycline and ciprofloxacin also effective).

Foodborne Illnesses (Viral)						
Etiology	Incubation Period	Signs & Symptoms	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
Hepatitis A	28 days average (15–50 days)	Diarrhea, dark urine, jaundice, and flu-like symptoms (i.e., fever, headache, nausea, and abdominal pain).	Variable, 2 weeks - 3 months	Shellfish harvested from contaminated waters, raw produce, contaminated drinking water, uncooked foods and cooked foods that are not reheated after contact with infected food handler.	Increase in alanine transferase, bilirubin. Positive immunoglobulin M and antihepatitis A antibodies.	Supportive care. Prevention with immunization.
Noroviruses (and other caliciviruses)	12–48 hours	Nausea, vomiting, abdominal cramping, diarrhea, fever, myalgia, and some headache. Diarrhea is more prevalent in adults and vomiting is more prevalent in children.	12–60 hours	Shellfish, fecally contaminated foods, ready-to-eat foods touched by infected food workers (salads, sandwiches, ice, cookies, fruit).	Routine RT-polymerase chain reaction (PCR) and electromicroscopy on fresh unpreserved stool samples. Clinical diagnosis, negative bacterial cultures. Stool is negative for white blood cells.	Supportive care such as rehydration. Good hygiene.
Rotavirus	1–3 days	Vomiting, watery diarrhea, low-grade fever. Temporary lactose intolerance may occur. Infants and children, elderly, and immunocompromised are especially vulnerable.	4–8 days	Fecally contaminated foods. Ready-to-eat foods touched by infected food workers (salads, fruits).	Identification of virus in stool via immunoassay.	Supportive care. Severe diarrhea may require fluid and electrolyte replacement.

Other viral agents (astroviruses, adenoviruses, parvoviruses)	10–70 hours	Nausea, vomiting, diarrhea, malaise, abdominal pain, headache, fever.	2–9 days	Fecally contaminated foods. Ready-to-eat foods touched by infected food workers. Some shellfish.	Identification of the virus in early acute stool samples. Serology. Commercial ELISA kits are now available for adenoviruses and astroviruses.	Supportive care, usually mild, self-limiting. Good hygiene.
Foodborne Illnesses (Parasitic)						
Etiology	Incubation Period	Signs & Symptoms	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
<i>Angiostrongylus cantonensis</i>	1 week to >1 month	Severe headaches, nausea, vomiting, neck stiffness, paresthesias, hyperesthesias, seizures, and other neurologic abnormalities.	Several weeks to several months	Raw or undercooked intermediate hosts (e.g., snails or slugs), infected paratenic (transport) hosts (e.g., crabs, fresh water shrimp), fresh produce contaminated with intermediate or transport hosts.	Examination of cerebrospinal fluid for elevated pressure, protein, leukocytes, and eosinophils; serologic testing using ELISA to detect antibodies to <i>Angiostrongylus cantonensis</i> .	Supportive care. Repeat lumbar punctures and use of corticosteroid therapy may be used for more severely ill patients.
<i>Cryptosporidium</i>	2–10 days	Diarrhea (usually watery), stomach cramps, upset stomach, slight fever.	May be remitting and relapsing over weeks to months	Any uncooked food or food contaminated by an ill food handler after cooking, drinking water	Request specific examination of the stool for <i>Cryptosporidium</i> . May need to examine water or food.	Supportive care, self-limited. If severe consider paromomycin for 7 days. For children aged 1–11 years, consider nitazoxanide for 3 days.

Foodborne Illnesses (Parasitic)						
Etiology	Incubation Period	Signs & Symptoms	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
<i>Cyclospora cayentanensis</i>	1–14 days, usually at least 1 week	Diarrhea (usually watery), loss of appetite, substantial loss of weight, stomach cramps, nausea, vomiting, fatigue.	May be remitting and relapsing over weeks to months	Various types of fresh produce (imported berries, lettuce).	Request specific examination of the stool for <i>Cyclospora</i> . May need to examine water or food.	TMP-SMX for 7 days.
<i>Entamoeba histolytica</i>	2–3 days to 1–4 weeks	Diarrhea (often bloody) frequent bowel movements, lower abdominal pain.	May be protracted (several weeks to several months)	Any uncooked food or food contaminated by an ill food handler after cooking, drinking water.	Examination of stool for cysts and parasites—may need at least 3 samples. Serology for long-term infections.	Metronidazole and a luminal agent (iodoquinol or paromomycin).
<i>Giardia lamblia</i>	1–2 weeks	Diarrhea, stomach cramps, gas.	Days to weeks	Any uncooked food or food contaminated by an ill food handler after cooking, drinking water.	Examination of stool for ova and parasites—may need at least 3 samples.	Metronidazole.

<i>Toxoplasma gondii</i>	5–23 days	Generally asymptomatic, 20% may develop cervical lymphadenopathy and/or a flu-like illness. In immunocompromised patients: central nervous system (CNS) disease, myocarditis, or pneumonitis is often seen.	Months	Accidental ingestion of contaminated substances (e.g., soil contaminated with cat feces on fruits and vegetables), raw or partly cooked meat (especially pork, lamb, or venison).	Isolation of parasites from blood or other body fluids; observation of parasites in patient specimens via microscopy or histology. Detection of organisms is rare; serology (reference laboratory needed) can be a useful adjunct in diagnosing toxoplasmosis. However, IgM antibodies may persist for 6–18 months and thus may not necessarily indicate recent infection. PCR of bodily fluids. For congenital infection: isolation of <i>T. gondii</i> from placenta, umbilical cord, or infant blood. PCR of white blood cells, cerebrospinal fluid, or amniotic fluid or immunoglobulin M and A serology performed by a reference laboratory.	Asymptomatic healthy, but infected, persons do not require treatment. Spiramycin or pyrimethamine plus sulfadiazine may be used for pregnant women. Pyrimethamine plus sulfadiazine may be used for immunocompromised persons, in specific cases. Pyrimethamine plus sulfadiazine (with or without steroids) may be given for ocular disease when indicated. Folinic acid is given with pyrimethamine plus sulfadiazine to counteract bone marrow suppression.
<i>Toxoplasma gondii</i> (congenital infection)	In infants at birth	Treatment of the mother may reduce severity and/or incidence of congenital infection. Most infected infants have few symptoms at birth. Later they will generally develop signs of congenital toxoplasmosis (mental retardation, severely impaired eyesight, cerebral palsy, seizures) unless the infection is treated.	Passed from mother (who acquired acute infection during pregnancy) to child.			

Foodborne Illnesses (Parasitic)						
Etiology	Incubation Period	Signs & Symptoms	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
<i>Trichinella spiralis</i>	1–2 days for initial symptoms; others begin 2–8 weeks after infection	Acute: nausea, diarrhea, vomiting, fatigue, fever, abdominal discomfort followed by muscle soreness, weakness, and occasional cardiac and neurologic complications.	Months	Raw or undercooked contaminated meat, usually pork or wild game meat (e.g., bear or moose).	Positive serology or demonstration of larvae via muscle biopsy. Increase in eosinophils.	Supportive care plus mebendazole or albendazole.
Foodborne Illnesses (Noninfectious)						
Etiology	Incubation Period	Signs & Symptoms	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
Antimony	5 minutes–8 hours, usually <1 hour	Vomiting, metallic taste	Usually self-limited	Metallic container.	Identification of metal in beverage or food.	Supportive care.
Arsenic	Few hours	Vomiting, colic, diarrhea.	Several days	Contaminated food.	Urine. May cause eosinophilia.	Gastric lavage, BAL (dimercaprol).
Cadmium	5 minutes–8 hours, usually <1 hour	Nausea, vomiting, myalgia, increase in salivation stomach pain.	Usually self-limited	Seafood, oysters, clams, lobster, grains, peanuts.	Identification of metal in food.	Supportive care.

Ciguatera fish poisoning (ciguatera toxin).	2-6 hours	GI: abdominal pain, nausea, vomiting, diarrhea.	Days to weeks to months	A variety of large reef fish. Grouper, red snapper, amberjack, and barracuda (most common).	Radioassay for toxin in fish or a consistent history	Supportive care, intravenous mannitol. Children more vulnerable.
	3 hours	Neurologic: paresthesias, reversal of hot or cold, pain, weakness.				
	2-5 days	Cardiovascular: bradycardia, hypotension, increase in T wave abnormalities.				
Copper	5 minutes-8 hours. usually <1 hour	Nausea, vomiting, blue or green vomitus.	Usually self-limited	Metallic container.	Identification of metal in beverage or food.	Supportive care.
Mercury	1 week or longer	Numbness, weakness of legs, spastic paralysis, impaired vision, blindness, coma. Pregnant women and the developing fetus are especially vulnerable.	May be protracted	Fish exposed to organic mercury, grains treated with mercury fungicides.	Analysis of blood, hair.	Supportive care.
Mushroom toxins, short-acting (museinol, muscarine, psilocybin, coprius artemetaris, ibotenic acid)	< 2 hours	Vomiting, diarrhea, confusion, visual disturbance, salivation, diaphoresis, hallucinations, disulfiram-like reaction, confusion.	Self-limited	Wild mushrooms (cooking may not destroy these toxins).	Typical syndrome and mushroom identified or demonstration of the toxin.	Supportive care.

Foodborne Illnesses (Noninfectious)						
Etiology	Incubation Period	Signs & Symptoms	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
Mushroom toxin, long-acting (amanitin)	4–8 hours diarrhea; 24–48 hours liver failure	Diarrhea, abdominal cramps, leading to hepatic and renal failure.	Often fatal	Mushrooms.	Typical syndrome and mushroom identified and/or demonstration of the toxin.	Supportive care, life-threatening, may need life support.
Nitrite poisoning	1–2 hours	Nausea, vomiting, cyanosis, headache, dizziness, weakness, loss of consciousness, chocolate-brown colored blood.	Usually self-limited	Cured meats, any contaminated foods, spinach exposed to excessive nitrification.	Analysis of the food, blood.	Supportive care, methylene blue.
Pesticides (organo-phosphates or carbamates)	Few minutes to few hours	Nausea, vomiting, abdominal cramps, diarrhea, headache, nervousness, blurred vision, twitching, convulsions, salivation and meiosis.	Usually self-limited	Any contaminated food.	Analysis of the food, blood.	Atropine; 2-PAM (Pralidoxime) is used when atropine is not able to control symptoms and is rarely necessary in carbamate poisoning.
Puffer fish (tetrodotoxin)	<30 minutes	Parasthesias, vomiting, diarrhea, abdominal pain, ascending paralysis, respiratory failure.	Death usually in 4–6 hours	Puffer fish.	Detection of tetrodotoxin in fish.	Life-threatening, may need respiratory support.

Scombroid (histamine)	1 minutes – 3 hours	Flushing, rash, burning sensation of skin, mouth and throat, dizziness, urticaria, paresthesias.	3–6 hours	Fish: bluefin, tuna, skipjack, mackerel, marlin, escolar, and mahi mahi.	Demonstration of histamine in food or clinical diagnosis.	Supportive care, antihistamines.
Shellfish toxins (diarrhetic, neurotoxic, amnesic)	Diarrhetic shellfish poisoning - 30 minutes to 2 hours	Nausea, vomiting, diarrhea, and abdominal pain accompanied by chills, headache, and fever.	Hours to 2–3 days	A variety of shellfish, primarily mussels, oysters, scallops, and shellfish from the Florida coast and the Gulf of Mexico.	Detection of the toxin in shellfish; high-pressure liquid chromatography.	Supportive care, generally self-limiting. Elderly are especially sensitive to amnesic shellfish poisoning.
	Neurotoxic shellfish poisoning - few minutes to hours	Tingling and numbness of lips, tongue, and throat, muscular aches, dizziness, reversal of the sensations of hot and cold, diarrhea, and vomiting.				
	Amnesic shellfish poisoning - 24–48 hours	Vomiting, diarrhea, abdominal pain and neurological problems such as confusion, memory loss, disorientation, seizure, coma.				
Shellfish toxins (paralytic shellfish poisoning)	30 minutes – 3 hours	Diarrhea, nausea, vomiting leading to paresthesias of mouth, lips, weakness, dysphasia, dysphonia, respiratory paralysis.	Days	Scallops, mussels, clams, cockles.	Detection of toxin in food or water where fish are located; high-pressure liquid chromatography.	Life-threatening, may need respiratory support.

Foodborne Illnesses (Noninfectious)						
Etiology	Incubation Period	Signs & Symptoms	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
Sodium fluoride	Few minutes to 2 hours	Salty or soapy taste, numbness of mouth, vomiting, diarrhea, dilated pupils, spasms, pallor, shock, collapse.	Usually self-limited	Dry foods (e.g., dry milk, flour, baking powder, cake mixes) contaminated with sodium fluoride-containing insecticides and rodenticides.	Testing of vomitus or gastric washings. Analysis of the food.	Supportive care.
Thallium	Few hours	Nausea, vomiting, diarrhea, painful paresthesias, motor polyneuropathy, hair loss.	Several days	Contaminated food.	Urine, hair.	Supportive care.
Tin	5 minutes – 8 hours. usually <1 hour	Nausea, vomiting, diarrhea.	Usually self-limited	Metallic container.	Analysis of the food.	Supportive care.
Vomitoxin	Few minutes to 3 hours	Nausea, headache, abdominal pain, vomiting.	Usually self-limited	Grains such as wheat, corn, barley.	Analysis of the food.	Supportive care.
Zinc	Few hours	Stomach cramps, nausea, vomiting, diarrhea, myalgias.	Usually self-limited	Metallic container.	Analysis of the food, blood and feces, saliva or urine.	Supportive care.

Appendix 2

Sample Forms

SAMPLE forms are provided as a resource:

- Key Elements of a Coordinated Food-Safe School Program
- Food-Safe School Team-Key People
- Suspicion of foodborne illness documentation forms
 - School Nurse Documentation and Referral Form Sample #1
- Guidance for use of Sample #1
 - School Nurse Documentation and Referral Form Sample #2
 - School Record of Suspected Outbreak Sample Tracking Form
 - Sample General Notification Form

Key Elements to Promote a Coordinated Food-Safe School Program

Many elements of school policy, procedures, and facilities can support a food-safe school. The following is a list of key elements suggested by health and education experts to be addressed in planning for a coordinated food-safe school. It is not an exhaustive list. An assessment should take into consideration the individual differences of schools and the blank spaces can be used to add unique elements.

Use the scorecard to measure whether each element is included in your school districts' policies and procedures. An effective way to complete this assessment is to:

- Assemble a team including the school food service manager, local public health representative, teachers, pupil services, staff, parents and other community members. Provide a copy of the key elements to each team member.
- Gather relevant school district policies, established procedures, and other applicable documents such as curriculum guides and staff handbooks.
- As a group compare the key elements in the following chart to school district policies and procedures. Identify strengths and weaknesses in the school district's policies and procedures in relation to these elements.

Key Elements of a Coordinated School Food Safety Program	Yes	Somewhat	No	Comments & References Address these questions as appropriate for each element/question: 1) Who is responsible for the element? (the "go to" person) 2) Are there established guidelines/limitations? 3) Who approves or provides oversight?
1. Written Policies				
A. Do policies include all food events or are they limited to school food services?	2	1	0	
B. Is the topic of food safety part of an over-all school safety plan?	2	1	0	
C. Do policies require curriculum content on food safety for students?	2	1	0	
D. Does the school board review the emergency nursing services plan annually?	2	1	0	
E. Is the cafeteria inspected regularly by the health department?	2	1	0	
F. Does a policy exist regarding exclusion of ill food handlers?	2	1	0	
2. Outbreak Management Plan				
A. Has your school ever had a foodborne illness outbreak (FIO)?	2	1	0	
B. Does a procedure exist to provide direction/protocols in the event of a FIO?	2	1	0	

C. Is the SN able to respond (from a time perspective) to a suspected FIO? Is the SN in the school district full-time?	2	1	0	
D. Are students expected (and know) to report N/V/D symptoms?	2	1	0	
E. Are staff told to report symptoms of N/V/D?	2	1	0	
F. Is there a mechanism for RN review/ follow-up on absence?	2	1	0	
G. Does FIO management plan include health department contact?	2	1	0	
H. Does a communication "tree" exist in the event of a FIO?	2	1	0	
3. Delineation of roles/responsibilities				
A. Are staff assigned roles in prevention and management of food safety?	2	1	0	
B. Are staff given a copy of their roles/ responsibilities?	2	1	0	
C. Do you have a contact person at the health department for questions about foodborne illness?	2	1	0	
4. Qualified/Informed Staff				
4a. Food Service Manager				
A. Does the cafeteria manager have a degree/ certification in food service?	2	1	0	

B. Does the manager exclude ill staff from food handling?	2	1	0	
C. What is the ratio of manager to general staff?	2	1	0	
D. How does the manager monitor for hazards? What protocols are followed?	2	1	0	
E. Whom does the manager report to?	2	1	0	
F. Does the manager complete a report on inspection of cafeteria facilities for hazards?	2	1	0	
G. Is there a disciplinary policy for unsanitary practices?	2	1	0	
4b. Foodservice Staff				
A. Do foodservice staff receive training in sanitation?	2	1	0	
B. Do food service staff receive training in HACCP?	2	1	0	
C. Do food service staff follow personal hygiene and safe food handling protocols?	2	1	0	
4c. Health services staff				
A. Does health aide/secretary report N/V/D or symptoms from student or staff absence roster?	2	1	0	
B. Does the health aide/secretary suspect FIO when students present with N/V/D?	2	1	0	

C. Does the health aide/secretary consider student health as part of his/her responsibilities?	2		0	
5. Education in food safety				
5a. Staff				
A. Are the teachers who prepare foods in the classroom trained in food safety practices?	2	1	0	
B. Do all staff attend annual session of Blood-borne Pathogens review?	2	1	0	
C. Do staff teach hand washing to students?	2	1	0	
D. Which teachers prepare foods?	2	1	0	Names:
E. How often and under what circumstances do teachers serve foods?	2	1	0	
F. Is student hand washing a priority to staff?	2	1	0	
G. Is there an expectation/opportunity for on-going staff development in food safety?	2	1	0	
5b. Students				
A. Is hand washing taught to students?	2	1	0	
B. Are students able to wash their hands before eating?	2	1	0	
C. Is hand washing monitored by an adult?	2	1	0	

5c. Families				
A. Are families informed of food safety issues/ rules BEFORE they are allowed to bring in food?	2	1	0	
B. How are families informed? Materials sent home? Public announcements?	2	1	0	
6. Facilities				
6a. Foodservice facilities				
A. Is there adequate space for safe food preparation?	2	1	0	
B. Is equipment in good working order?	2	1	0	
C. Are inspections done regularly? Is report available?	2	1	0	
6b. Hand washing Facilities				
A. Are there sinks in close proximity to food handling/eating areas?	2	1	0	
B. Do sinks have warm water?	2	1	0	
C. Do sinks have soap?	2	1	0	
D. Do sinks have paper (clean) towels?	2	1	0	
E. Is the ratio of sink to student/staff adequate?	2	1	0	

6c. Health Clinic Facilities				
A. Does the school have a designated health office?	2	1	0	
B. Is space in health office adequate to treat more than one student at a time?	2	1	0	
C. What is staffing level in health office?	2	1	0	
D. Does the health room have supplies to manage >8 students with acute GI symptoms?	2	1	0	
E. What alternate treatment site is available?	2	1	0	

Developed by the Wisconsin Department of Public Instruction and Student Services, Madison, WI. Permission granted for reprinting this document (48).

Food-Safe School Team-Key People

Team Members	Your District/School
Principal/Administrator	
Team coordinator	
School nurse/school medical advisor	
Food service manager	
Health department	
Facilities manager	
Teacher representative	
Food services rep.	
Parent rep.	
Student rep.	
Cooperative extension	
Risk manager	
Others	

Suspicion of Foodborne Illness
 School Nurse Documentation and Referral Form
 Sample #1

1. Date _____ Time _____

2. Student name _____ Date of Birth _____

Class/HR _____ School _____

3. Parent/Guardian/Care provider _____ Tel.# _____

Address _____

4. Allergies: No Yes (list) _____ Chronic disease: No Yes

Medications: No Yes (list) _____

5. CHECK all that apply

SYMPTOMS	FREQUENCY/ DURATION	OBSERVATIONS/SIGNS
<input type="checkbox"/> Dec. intake of food/fluids <input type="checkbox"/> Nausea <input type="checkbox"/> Vomiting <input type="checkbox"/> Diarrhea <input type="checkbox"/> Weight loss <input type="checkbox"/> Dehydration <input type="checkbox"/> Fever <input type="checkbox"/> Abdominal pain <input type="checkbox"/> Headache <input type="checkbox"/> General malaise <input type="checkbox"/> Muscle and joint pains <input type="checkbox"/> Neurological <input type="checkbox"/> Urinary output <input type="checkbox"/> Other _____		<input type="checkbox"/> No appetite <input type="checkbox"/> Metallic taste <input type="checkbox"/> Soapy/salty taste <input type="checkbox"/> Sudden onset <input type="checkbox"/> Projectile <input type="checkbox"/> Watery <input type="checkbox"/> Lg. volume <input type="checkbox"/> Bloody <input type="checkbox"/> Pallor <input type="checkbox"/> Weakness <input type="checkbox"/> Reduced skin turgor <input type="checkbox"/> Dry mucous membranes <input type="checkbox"/> Hypotension <input type="checkbox"/> Inc. pulse <input type="checkbox"/> Hyperpnea <input type="checkbox"/> C°/F° <input type="checkbox"/> Chills <input type="checkbox"/> Sweating <input type="checkbox"/> Acute/severe <input type="checkbox"/> Mild cramps <input type="checkbox"/> Severe <input type="checkbox"/> Dizziness <input type="checkbox"/> Discomfort <input type="checkbox"/> Listless <input type="checkbox"/> Tired <input type="checkbox"/> Generalized <input type="checkbox"/> Localized <input type="checkbox"/> Dbl.vision <input type="checkbox"/> Dysphasia <input type="checkbox"/> Resp. Distress <input type="checkbox"/> Dark colored <input type="checkbox"/> Bloody <input type="checkbox"/> Other <input type="checkbox"/> Other _____

6. Recent activities: check all that apply

Camping Visited/lives on a farm

Pets Travel

Contact with ill family/friends

Other _____

continued on next page

7. Food history (past 72 hours)

Meals	Location/Source	Foods and drinks consumed
Today		
Breakfast		
Lunch		
Snacks		
Yesterday		
Breakfast		
Snacks		
Lunch		
Dinner		
Day before		
Breakfast		
Snacks		
Lunch		
Dinner		

8. Check ALL that apply

Disposition: Stay at school Send home
 Refer for Diagnosis/Treatment Send to Clinic/ER
 Other _____

Transported by: School Parent/guardian EMS
 Other (specify) _____

Notification: Administration Health Department
 SFS manager Parent/guardian
 Other _____

9. Nursing Diagnosis/Follow-up:

School Nurse _____ (Signature) _____ (Print name)

Telephone _____

Suspicion of Foodborne Illness School Nurse Documentation and Referral Form

Guidance for use of Sample #1

1. Date and time: Establishes a time frame for symptoms and signs recorded on individual students and validates information provided to (with parent/guardian permission) public health departments for investigation of outbreaks or clusters.

2. Student identification: Name, birth date, class, and school information documents potential place or person association to identify students with similar symptoms in a potential foodborne illness outbreak or cluster.

3. Parent/guardian: Name and address with telephone number facilitates follow-up or investigation of a foodborne illness.

4. Allergies, chronic disease, and medications: This information may be related to susceptibility or increased risk depending on the severity and duration of illness.

5. Checklist of symptoms: The checklist enables the school nurse to maintain a detailed record and have information available for primary care providers or public health authorities; it facilitate determining whether the illness has a foodborne etiology. For Frequency/duration ask: When did it start? Did it start suddenly or gradually? Did it stop and then reoccur? Some typical signs have been listed under Observations/Signs to facilitate the process. A final box in each line is provided for the entry of additional observations.

- **Decreased intake/appetite:** Nausea, vomiting, and diarrhea are common with foodborne illnesses and if prolonged or recurrent the student may be at risk for dehydration.
- **Nausea:** May be the only symptom. May be accompanied by unusual tastes or burning sensations of mouth area, indicating possible ingestion of foods or drinks contaminated with chemicals.
- **Vomiting:** Often the first symptom of a foodborne illness. Chemical poisoning can cause coloration of vomitus (e.g., milky from lead, blue or green from copper).
- **Diarrhea:** Extremely common symptom. It is important to ask about blood in the stool, fever, and previous occurrences of similar symptoms.
- **Weight loss:** Usually related to fluid loss and lack of appetite. Prolonged symptoms of chronic diarrhea, fatigue, and weight loss may be related to an untreated parasitic infection.
- **Dehydration:** This is a major concern with fluid loss from vomiting and watery diarrhea. Check for signs of dehydration: skin turgor, mucous membranes, as well as dizziness when standing, feeling of weakness or rapid heart rate. Signs of even mild dehydration require medical evaluation and intervention.

- **Fever:** Elevated temperature may indicate that the organism has invasive properties and has created a local or systemic infection.
 - **Abdominal pain:** Abdominal cramps and pain are common symptoms related to the increased activity and irritation in the bowel. Hypoactive bowel sounds with severe abdominal pain is an ominous sign requiring immediate transport for medical diagnosis and intervention.
 - **Headache:** Usually associated with foodborne illnesses that include symptoms of fever or chills.
 - **General malaise:** A common nonspecific complaint. Severity of the pathogen and duration of profuse watery diarrhea could progress to weakness, fatigue, drowsiness or prostration.
 - **Muscle and joint pain:** Muscular and joint pain, muscular weakness, or myalgia are not common symptoms of foodborne illnesses but may be significant for determining diagnosis.
 - **Neurological abnormalities:** Neurological symptoms may be present, such as paresthesia, motor weaknesses, double vision, tingling and numbness around lips or fingertips, or difficulty swallowing. These constitute an emergency situation in a school setting. The student requires monitoring of vital signs, emergency medical system transport, and immediate medical diagnosis and management of care. If these symptoms were preceded by or accompany gastrointestinal symptoms, food poisoning by ingestion of contaminated seafood or other foods containing certain lethal toxins, or chemical poisoning is possible. Such symptoms can be life threatening, requiring aggressive treatment and, possibly, life-support systems.
 - **Urinary output:** A decrease and concentration in urinary output may be secondary to loss of fluids from vomiting and diarrhea. Dark urine is associated with hepatitis A infection. Blood in the urine is significant (requires referral for medical diagnosis and follow-up) and may indicate hemolytic uremic syndrome.
- 6. Recent activities checklist:** The list includes some of the commonly suspected sources of contact with infectious organisms. Ask about eating risky foods (undercooked eggs, meat, or fish; home-canned goods; fresh produce; or unpasteurized milk or cheeses).
- **Camping** may relate to consuming untreated water, unsanitary toilet facilities, or close contact with ill individuals.
 - **Visiting or living on a farm** provides opportunities for contact with infected animals or objects contaminated with animal feces.
 - **Pets** may be carriers of infectious organisms and contact with animal feces or saliva may transmit organisms.

- **Travel** either to coastal areas where the consuming of raw or undercooked fish could be a factor or foreign travel where food preparation is not controlled as in this country or where foodborne illnesses are not uncommon.
- **Contact with ill family or friend** may transmit many of the causative organisms from one person to the other either by direct contact, on food or inanimate objects, or by the fecal-oral route.
- **Other** activities or special events where they may have consumed contaminated foods.

7. Food history (past 72 hours): Any information that can be collected on food and drink consumption may be important. The list need not be exhaustive, only what the student can recall during the initial assessment. Further information may be required if an investigation is initiated.

8. Disposition, transported by, and notification: The information documents the nurse's plan for the student.

9. Nursing diagnosis: This information documents the nurse's assessment and plan.

10. Signature: The signature provides legal attestation of information contained in the form.

11. Printed name of nurse and contact telephone number: This information is provided to encourage continued involvement of school nurse in any investigation or collaboration concerned with resolving the issues of infection control at the school.

Suspicion of Foodborne Illness
 School Nurse Documentation and Referral Form
 Sample #2

1. Date _____ Time _____
2. Student name _____ Date of Birth _____
 Class/HR _____ School _____
3. Parent/Guardian/Care provider _____ Tel.# _____
 Address _____
4. Allergies: No Yes (list) _____ Chronic disease: No Yes
 Medications: No Yes (list) _____

5. CHECK all that apply: Provide additional information, if known, for each complaint checked.

Complaints Symptoms	Onset	Duration	Recurring	
			Yes	No
<input type="checkbox"/> Abdominal pain/cramps				
<input type="checkbox"/> Diarrhea				
<input type="checkbox"/> Fever				
<input type="checkbox"/> General malaise				
<input type="checkbox"/> Headache				
<input type="checkbox"/> Nausea				
<input type="checkbox"/> Vomiting				
<input type="checkbox"/> Other				

6. Recent activities: check all that apply

- Camping Visited a farm or zoo Pets Travel Contact with ill family/friends
 Other _____

7. Special Food Events:

Cafeteria	Picnic	Classroom
Restaurant	Fair/Festival	Special catered celebration
Family/friend's party	Field trip	Other

continued on next page

8. Check ALL that apply

Disposition: Stay at school Send home
 Refer for Diagnosis/Treatment Send to Clinic/ER
 Other _____

Transported by: School Parent/guardian EMS
 Other (specify) _____

Notification: Administration Health Department
 SFS manager Parent/guardian

9. Follow-up:

School Nurse _____ (Signature) _____ (Print name)

Telephone _____

Suspicion of Foodborne Illness
 School Nurse/School Record of Suspected Outbreak
 Sample Tracking Form

Date: _____

Collected by: _____
 Print Name Title School

Symptoms/Signs (Check all that apply)***

No.	S/F	Class/ Grade	EE**	Onset date	Onset time	Symptoms/Signs								
						N	V	D	AC	BA	F	HA	CH	NS
1.														
2.														
3.														
4.														
5.														
6.														
7.														
8.														
9.														
10.														
11.														
12.														
Total														

*S = student, F= faculty.
 **EE = eating event, C=cafeteria, FT = field trip, CR = classroom, SE = special event, O=other.
 ***Symptoms and signs: N=nausea, V=vomiting, D=Diarrhea, AC=abdominal cramps,
 BA=body aches, F=fever, HA=headache, CH=chills, NS=neurological signs.

Adapted for schools from the Line list table in Foodborne and Waterborne Disease
 Outbreak Investigation Manual (49).

Suspicion of Foodborne Illness Sample General Notification Form

Information sent to health department _____
Date/time

Reported by _____
Name School

Number of ill with similar complaints:

Students _____
Faculty _____
Food service workers _____
Others (identify) _____

Predominant symptoms:

Nausea Vomiting Diarrhea Cramps Fever
 Headache Chills Body aches Muscle Weakness

Other _____

_____ to _____
Onset date/time date(s)/ time(s)

Common food event/s or foods eaten (if known):

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____

Appendix

Internet Resources

Partners in Food Safety

Centers for Disease Control and Prevention (CDC):
<http://www.cdc.gov/>

- **National Coalition for Food Safe Schools (NCFSS): www.foodsafeschools.org**

This site is a product of the collaboration between public and private organizations working together to improve school food safety, NCFSS developed this site as a one-stop gateway to a wealth of Internet-based school food safety information and resources. Information is provided for children, parents, educators, school nurses, administrators, local health departments, and school food service staff.

- **Healthy Schools, Healthy People: <http://itsasnap.org/index.asp>**

This initiative is designed to help keep students in school and learning by improving overall health through promoting clean hands education. Schools can use the SNAP program to increase student and staff hand cleaning and help them stay healthy. SNAP offers a FREE educational poster-toolkit to improve clean-hands education into middle school curricula, foster teamwork and provide new ideas that support the national education standards.

Food and Drug Administration (FDA):

<http://www.fda.gov/>

- **National Food Safety programs:**
<http://www.foodsafety.gov/~dms/fs-toc.html>

This site provides information for kids, teens and educators on food-safety. It has links to many news and safety alerts.

- **FDA/Center for Food Safety and Applied Nutrition/Foodborne Pathogenic Microorganisms and Natural Toxins Handbook:**
<http://vm.cfsan.fda.gov/~mow/intro.html>

This site has information on the Bad Bug Book, a handbook that provides basic facts regarding foodborne pathogenic microorganisms and natural toxins, and information from the FDA, CDC, USDA Food Safety Inspection Service, and National Institutes of Health.

National Association of City and County Health

Officials (NACCHO):

<http://naccho.org/project39.cfm>

NACCHO has developed a food safety peer assistance network (PAN) to provide the food safety demonstration sites and other food safety programs with technical assistance and resources from experts at a variety of levels. A list of peer advisors according to their specialty can be found here.

National Environmental Health Association (NEHA):

<http://www.foodsafetyweb.info/reviews.asp>

The Food-Safety Literature review is now available. Environmental health professionals provide critiques of food safety resource materials.

School Nutrition Association:

<http://www.schoolnutrition.org/foodsafety/>

This site contains information for school food service professionals to develop and adhere to strict food safety policies and procedures. It offers tools for prevention of foodborne illness, public education, research, response to foodborne illnesses, and food product recalls. Food Safety training and certification programs are also available.

United States Department of Agriculture (USDA):

<http://www.usda.gov/>

- **USDA/Food Safety and Inspection Service** <http://www.fsis.usda.gov/>

Various resources for food-safety are available. Activities, news updates, publications and consumer information are listed.

- **USDA/Agriculture Research Service/Food and Nutrition Center**

<http://www.nal.usda.gov/fnic/>

This site has access to the US National Agricultural Library's databases on nutrition and school meals.

- **National Agriculture Library: <http://www.nal.usda.gov/>**

This site offers search facilities and gateways to agricultural information and databases.

- **USDA/FDA Foodborne Illness Education Information Center:**

<http://www.nal.usda.gov/fnic/foodborne/foodborn.htm>

This site contains information on and discusses the issues related to food safety. It includes stories, solutions, and strategies.

Infectious Diseases Information

National Center for Infectious Diseases, Centers for Disease Control and Prevention:

<http://www.cdc.gov/ncidod/diseases>

This page contains links to disease information from A – Z (excellent resource for current information, answers to frequently asked questions and printable fact sheets on major infectious diseases); infectious disease information related to foods, including teacher tools, student resources as well as consumer education; and information and resources on investigations, summaries of investigations of U.S. foodborne outbreaks.

Other Food Safety Related websites

American Meat Institute

<http://www.meatami.org/>

This member-driven institute represents the interests of the U.S. meat and poultry industry to the federal government, Congress, media, and the customer.

Gateway to Government Food Safety Information:

www.foodsafety.gov

This site contains news and safety alerts, consumer advice, resources for kids, teens and educators, industry assistance, sites for reporting illness and product complaints, list of foodborne pathogen resources, national food safety programs and a list of federal and state government agencies.

Partnership for Food Safety Education: Fight Bac! Fighting the Problem of Foodborne Illness:

<http://www.fightbac.org/>

Information is presented about cross-contamination and how bacteria spread. Fight Bac describes the four basic steps in keeping foods safe.

U.S. Environmental Protection Agency (EPA)

pesticides and water:

<http://www.epa.gov/OW/new.html>

This link provides information on laws and regulation, funding opportunities, and educational resources on water safety.

Appendix

4

References

1. Centers for Disease Control and Prevention, National Center for Infectious Diseases. (1998). Preventing Emerging Infectious Diseases: *Addressing the Problem of Foodborne and Waterborne Diseases, A Strategy for the 21st Century*. Online at <http://www.cdc.gov/ncicoc/emerplan/foodborne.htm>.
2. Daniels NA, Mackinnon L, Rowe SM, Bean NH, Griffin PM, Mead PS. Foodborne disease outbreaks in United States schools. *Pediatric Infectious Disease Journal* 2002; 21:623-8.
3. Tucker NA, Sulka AC, Painter J, Fry AM, Mead PS. School-related foodborne disease outbreaks in the United States. International Association for Food Protection, 90th Annual Meeting, Aug 10-13, 2003, New Orleans, Louisiana, Abstract P040.
4. Rotz R, Khan AS, Lillibridge SR, Ostroff SM, Hughes JM. (2002). Public Health Assessment of Potential Biological Terrorism Agents, Report Summary. *Emerging Infectious Diseases* 2002, vol.8 no2.
5. Dworkin MS, Ma X, Golash RG. Fear of bioterrorism and implications for public health preparedness. *Emerging Infectious Diseases* 2003; 19(4):1-7.
6. U.S. Department of Agriculture, Food and Nutrition Services. *A Biosecurity Checklist for School Foodservice Programs: Developing a Biosecurity Management Plan*. March 2004. Available at <http://schoolmeals.nal.usda.gov/Safety/biosecurity.pdf>.

7. U.S. General Accounting Office. *Food Safety. Continued vigilance needed to ensure safety of school meals.* May 2002. Available at <http://www.gao.gov/new.items/d2669t.pdf>
8. National Coalition for Food Safe Schools. Available at www.FoodSafeSchools.org.
9. DeLozier, D. *Partnering for Food-Safe Schools: The Action Guide.* Presentation. Orlando, FL 2002. Online at <http://www.fsis.usda.gov/orlando2002/presentations/ddeLozier>
10. Centers for Disease Control and Prevention. *Needs Assessment and Planning Tool.* Food-Safe Schools: Action Guide. Available at www.FoodSafeSchools.org/needsassessment.
11. Centers for Disease Control and Prevention. (2002). *Guidelines for Hand Hygiene in Health-Care Settings.* *MMWR* 2002; 51(RR-16): 1–45
12. School Network for Absenteeism Prevention. *It's A SNAP: The SNAP Toolkit.* Available at <http://www.itsasnap.org/index.asp>.
13. Guzewich J, Ross MP. (1999). *A Literature Review Pertaining to Foodborne Disease: Outbreaks Caused by Food Workers, 1975-1998. Evaluation of Risks Related to Microbiological Contamination of Ready-to-eat Food by Food Preparation Workers and the Effectiveness of Interventions to Minimize Those Risks.* College Park, MD: Center for Food Safety and Applied Nutrition, FDA, September 1999. Available at <http://cfsan.fda.gov/~ear/rterisk.html>.
14. Larson E. Hand washing: It's essential—even when you use gloves. *American Journal of Nursing* 1989; 89:934–939.
15. U.S. Department of Agriculture, Food Safety and Inspection Service. Protecting public health through food safety. Available at <http://www.fsis.usda.gov/>.
16. Mead PS, Slutsker L, Deitz V, McCraig LF, Bresee JS, Shapiro C, Griffin PM, Tauxe R (1999). *Food-related Illness and Death in the United States.* *Emerging Infectious Diseases* Vol.(5) 607-625.
17. American Medical Association (2004). *Diagnosis and Management of Foodborne Illness: A Primer for Physicians and Other Health Care Professionals.* Online at: <http://www.ama-assn.org/ama/pub/category/3629.html>.
18. Wong CS et al (2000). *The Risk of Hemolytic-uremic Syndrome after Antibiotic Treatment of Escherichia coli 0157:H7 Infections.* *The New England Journal of Medicine*, June 29, 2000: 342:1930-6.
19. Schwab N, Gelfman, MHB. *Legal Issues In School Health Services.* North Branch, MN: Sunrise River Press, 2001.

20. American Nurses Association. Nursing: SCOPE and STANDARDS of Clinical Practice.2003. Online at: <http://www.nursingworld.org>
21. National Association of School Nurses and American Nurses Association. SCOPE and STANDARDS of Professional School Nursing Practice, 2001.
22. Moralejo DG, Russell ML, Porat BL. Outbreaks can be disasters; a guide to developing your plan. *Journal of Nursing Administrators* 1997; 27(7/8): 56–60.
23. Council of State and Territorial Epidemiologists. *Current State and Territorial Epidemiologists*. <http://www.cste.org/NNDSSHOME.htm>
24. Centers for Disease Control and Prevention. Norovirus activity—United States, 2002. *MMWR* 2003; 52(3): 41–45.
25. Centers for Disease Control and Prevention. Norwalk-like virus-associated gastroenteritis in a large, high-density encampment—Virginia, July 2001. *MMWR* 2002; 51(30):661–662.
26. Bender JB, Smith KE, Hedberg C, Osterholm MT. Foodborne disease in the 21st century: what challenges await us? *Postgraduate Medicine* 1999; 106(2):1–8.
27. Schmelzer M, Stam MA. A hidden menace: hemolytic uremic syndrome. *American Journal of Nursing* 2000; 100(11): 26–33.
28. Imhoff B, Hadler J, Morse D, Shiferaw B, Vugia D, Medus C, et al. (2000). *The Substantial Burden of Acute Diarrheal Illness in the United States: A Running Total, FoodNet, 1998-1999*. 2nd International Conference on Emerging Infectious Diseases. Abstract. Atlanta, GA, July 2000. Available at http://www.cdc.gov/foodnet/pub/iceid/2000/b_imho.htm.
29. Tauxe, RV (1997). Special Issue – *Emerging Foodborne Diseases: An Evolving Public Health Challenge*. *Emerging Infectious Diseases*, CDC. Vol.3 No.4,1-21.
30. Sobel J, Khan AS, Swerdlow DL. Threat of a biological terrorist attack on the US food supply: the CDC perspective. *The Lancet* 2002; 359(9): 874–880
31. Centers for Disease Control and Prevention, Foodborne Outbreak Response and Surveillance Unit. *U.S. Foodborne Disease Outbreaks*. Available at http://www.cdc.gov/foodborneoutbreaks/us_outb.htm
32. Centers for Disease Control and Prevention, Foodborne Outbreak Response and Surveillance Unit *2000 Summary Statistics*. Available at http://www.cdc.gov/foodborneoutbreaks/us_outb/fbo2000/summary00.htm.

33. Centers for Disease Control and Prevention. *FoodNet; Foodborne Diseases Active Surveillance Network: CDC's Emerging Infections Program*. Available online at <http://www.cdc.gov/foodnet>.
34. Centers for Disease Control and Prevention (2004). Preliminary Foodnet data on the incidence of infection with pathogens transmitted commonly through food—selected sites, United States 2003. *MMWR* 2004; 53(16):338–343. Available at <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5316a2.htm>
35. Centers for Disease Control and Prevention. *PulseNet: The National Molecular Subtyping Network for Foodborne Disease Surveillance*. Available at <http://www.cdc.gov/pulsenet>.
36. Heffernan R, Mostashari F, Das D, Karpati A, Kulldorff M, Weiss D. Syndromic surveillance in public health practice, New York City. *Emerging Infectious Diseases* (serial online) 2004; 10(5). Available at <http://www.cdc.gov/ncidod/EID/vol10no5/03-0646.htm>.
37. Centers for Disease Control and Prevention. *Emergency Preparedness and Response*. Available at <http://www.bt.cdc.gov/surveillance/ears/index.asp>
38. Michigan State University. *Got Food Poisoning? You've come to the right place*. Available at <http://www.Rusick2.msu.edu>.
39. Wethington H, Bartlett P. The RUSick2 foodborne disease forum for syndromic surveillance. *Emerging Infectious Diseases* 2004; 10(3): –13. Available at <http://www.cdc.gov/ncidod/EID/vol10no3/03-0358-G1.htm>
40. Ryan CA, Nickels MK, Hargrett-Bean NT, Potter ME, Endo T, Mayer L, et al. Massive outbreak of antimicrobial-resistant *Salmonellosis* traced to pasteurized milk. *JAMA*. 1987; 258(22); 3269-74.
41. Goodman L, Segretti J. *Infectious diarrhea*. Disease-a-Month 1999: Jul; 45(7): 268–299.
42. Lindsay, JA (1997). Special Issue: Chronic sequelae of foodborne disease. *Emerging Infectious Diseases* (serial online) 1997; 3(4). Available at <http://www/cdc.gov/ncidod/eid/vol3no4/lindsay.htm>.
43. Partnership for Food Safety Education. *Fight BAC!™ Keep Food Safe From Bacteria*. Available at <http://www.fightbac.org>.
44. U.S. Department of Agriculture, Food Safety and Inspection Service (1998). *Key Facts: The Seven HACCP Principles*. Available at <http://www.fsis.usda.gov/oa/background/keyhaccp.htm>
45. U.S. Department of Agriculture, Food Safety and Inspection Service. *E.coli 0157:H7 Contamination of Beef Products*. Federal Register Vol.67 No.194. Available at <http://www.gpoaccess.gov/fr07oc02-6>

46. U.S. Food and Drug Administration, Center for Food Safety & Applied Nutrition. *2001 Food Code*. Available at <http://www.cfsan.fda.gov/~dms/fc01-toc.html>.
47. Meng J, Doyle JP. Emerging issues in microbiological food safety. *Annual Review of Nutrition* 1997; 17:255–275.
48. Caldart-Olson, L. *Key Elements of a Coordinated School Food Safety Program*. The Critical Role of School Nurses in a Food-Safe School – A pilot workshop 2002. Madison, WI.
49. Wisconsin Division of Health, Department of Health and Family Services, Bureau of Public Health. Foodborne and Waterborne Disease Outbreak Investigation Manual. Available at <http://dhfs.wisconsin.gov/communicable/Communicable/pdffiles/FDWTRBorneMAN.pdf>