APPENDIX A. FOOD BORNE ILLNESSES

A-1 GENERAL INFORMATION

a. Food is defined as a substance taken or absorbed in the body of an organism in order to sustain growth and repair, support vital processes and furnish energy for all activities of the organism. Though it is usually considered necessary for the preservation and maintenance of good health, there are several instances in which food may be harmful to an individual's health.

b. Food can affect health as a result of:

(1) Hypersensitivity or allergic conditions in which individuals will exhibit symptoms of an allergic reaction usually immediately upon ingestion of the food. The symptoms range from lip swelling, mild rash, angioedema to anaphylactic shock.

(2) Enzymes and other deficiency conditions in which the complete absence or abnormal function of an enzyme or substrate of a specific metabolic process will result in the abnormal processing of certain food. An example is lactase deficiency. In individuals who are deficient in this intestinal mucosal enzyme which catalyzes the breakdown of lactose, the ingestion of milk (which contains lactose) will result in abdominal cramping, bloating, flatulence, and diarrhea. This generally results in the abnormal accumulation of certain metabolites and deficiency of others.

(3) Contamination in which the food serves as a major vehicle for transmission of diseases in the population. Production and processing of food creates many opportunities for contamination before it reaches the consumer.

A-2 FOOD BORNE ILLNESSES

a. Food borne illnesses are syndromes acquired by the consumption of food contaminated by disease pathogens, microbial toxins, or poisonous chemical substances. These illnesses are frequently subclassified as infections or intoxications.

b. **Food Borne Infection:**

(1) A food borne infection is caused by the ingestion of food containing pathogenic microorganisms (i.e., bacteria, virus

or parasite) which must multiply within the gastrointestinal tract, producing widespread inflammation. The most commonly implicated microorganisms include species of *Salmonella, Shigella, E. coli 0157:H7*, etc. These infections have longer incubation periods than those experienced with food intoxications, usually commencing from 6-24 hours or longer after ingestion. Symptoms may include fever, headache, nausea, vomiting, diarrhea, abdominal pain or distress, and prostration. The causative organism may be identified by laboratory examination of the vomitus, feces, or blood and the suspected food, when available.

(2) Foods most commonly incriminated in outbreaks of food borne infections are meat and seafood mixtures such as hash, hamburger, creamed meat pies, crab, lobster, chicken, and turkey salads, turkey, turkey stuffing or dressing, and ham. These foods have common characteristics in they provide moisture, a good protein food supply and warmth. Given sufficient time, these factors promote an ideal environment for the growth and multiplication of microorganisms. It is important to remember these organisms do not necessarily cause any alteration in the normal appearance, odor, or taste of the food.

c. **Food Borne Intoxication:**

(1) Certain bacteria under favorable growth conditions produce chemicals (toxins) in food which when ingested will cause food intoxication. Enterotoxins produced by *Staphylococcus aureus* are heat stable (i.e., not destroyed by normal cooking temperatures) and are the cause of the most common food borne intoxication. The staphylococci multiply in the food where they produce their toxins before the food is consumed. It generally takes less than 8 hours for these organisms to elaborate enough toxins to cause symptoms. The disease is characterized by an abrupt onset (2 to 4 hours after ingestion) of symptoms of severe nausea, vomiting, diarrhea, and prostration with little or no fever.

(2) Staphylococcal food intoxication usually follows ingestion of starchy food, especially potato salad, custard and pies. When the offending food is meat, pork (including ham and salami) and poultry products are usually the source. Ham may become contaminated with staphylococci during the practice of boning, slicing and holding without adequate refrigeration for several hours before serving. In addition, highly salted ham permits staphylococcal growth but inhibits many other bacteria. Other foods commonly involved are canned or potted meat or fish, pressed tongue, beef, cheese, other milk products, cream or custard filled pastries, potato salad, and pasta salads. The usual source of the pathogens, which cause this form of food

intoxication, may be the nose, throat, boils, pimples, or infected cuts on the hands of food service personnel.

(3) Exotoxins produced by *Clostridium botulinum* cause a highly publicized but an increasingly rare disease called botulism. This disease, which causes death in about 18% of patients even with adequate treatment, is most frequently associated with home canned low acid foods (vegetables and fruits) which have been improperly processed. Ingestion of inadequately cooked toxin containing food leads to nerve toxicity manifested by symptoms of weakness, headache, and dizziness, and sometimes death due to respiratory or cardiac failure. Cases of botulism have also resulted from home canned meats and fish, smoked fish, and improperly prepared commercial products, such as vichyssoise soup and potpies.

(4) Toxins produced in food contaminated by *Bacillus cereus, Clostridium perfringens,* and *Vibrio parahaemolyticus* also cause food borne illness outbreaks.

(5) Natural poisons or intoxicants found in certain plants and animal. Some foods are poisonous at the time they are harvested. Many of the poisons in these foods tend to attack the nervous system resulting in such symptoms as weakness or paralysis, numbness, tingling of the ears, apprehension and even death. Some fish and shellfish concentrate poisons produced by toxic plankton. Certain fish (grouper, snapper, jack, and barracuda) concentrate ciguatoxin, while mollusks (clams, oysters, scallops, and mussels) concentrate the toxin associated with "red tide." Naturally poisonous plants and animals include certain mushroom species and certain tropical fish (puffer type fish and ocean sunfish).

(6) Poisons may be intentionally or incidentally introduced in foods as a result of production, processing, transportation or storing. Chemical poisonings may be caused by arsenic residue of spray on fruits or vegetables cadmium or zinc dissolved by acid foods, such as a lemonade gelatin, tomatoes etc., cadmium plated or galvanized pitchers or cans; or exposure of food and food service equipment to insecticides or other chemicals such as cleaning compounds. Chemical poisonings usually cause violent nausea, vomiting, and diarrhea very shortly after ingestion.

A-3 INVESTIGATING FOOD BORNE DISEASE OUTBREAKS

a. A food borne disease outbreak (FBDO) is defined as an incident in which two or more persons experience a similar illness resulting from the ingestion of a common food and epidemiological analysis implicates the food as the source of the

illness. Food borne disease outbreaks include a single case of illness such as one person ill from botulism or chemical poisoning.

b. In the event of a suspected food borne outbreak, prompt action must be taken to identify cases associated with the outbreak, identify implicated food or beverage items, determine the factor or combination of factors which permitted the outbreak to occur and initiate measures to control or contain the spread of infection. Early identification of the causative agent allows for specific treatment of patients. Additional cases can be prevented by halting service or sale of an implicated food item. Future outbreaks can be prevented by modifying or correcting procedures for acquiring, processing and handling the implicated food. Assistance with any investigation may be obtained from the nearest occupational health/preventive medicine department at a naval hospital or clinic or NAVENPVNTMEDU by telephone or message request. *Procedures to Investigate Food borne Illness,* a publication of the International Association of Milk, Food and Environmental Sanitarians, Inc., P.O. Box 702, Ames, Iowa 50010, provides excellent guidelines for conducting an investigation.

c. Outbreak Investigation Procedures. An outbreak investigation is composed of several parts, many of which must be performed promptly and simultaneously by the person or persons conducting the investigation. Ideally, procedures, materials, personnel and responsibilities for initiating and conducting an investigation would have been developed in advance.

(1) Verify there is an epidemic or outbreak. When suspected cases of food borne illness are reported, the first step involves verifying whether an outbreak actually exists.

(2) Complete case history questionnaires.

(a) A case history questionnaire must be completed for each ill person. Figure 1-9 provides an example.

(b) A questionnaire should also be completed for any person who has not been ill, but who may have been exposed to the suspect food item, meal, or facility. These "controls" can include family members, roommates, coworkers, shipmates, and any others at risk who remained well. Comparisons of ill and well persons (e.g., food specific attack rates) are used to analyze factors contributing to the outbreak.

(c) Valid case history questionnaires collect information about: the person (name, rate or grade, social security number, residential address or work/berthing as assignments, duty station, age, race, sex, and telephone number);

their illness, if any (specific symptoms and specific times at which symptoms developed), and food history (when, where and what was eaten, as precisely as possible). The time at which food was eaten and symptoms started must be recorded precisely, e.g.,"0100" or "1245." Responsible persons should interview and complete a questionnaire for each person.

(3) Establish a diagnosis etiologically if possible, otherwise define cases clinically or epidemiologically. Obtain clinical specimens from patients, for laboratory analysis to isolate or identify the etiologic agents. Ideally, specimens should be collected during the acute phase of the illness when the patient is first seen or when the initial interview is conducted. Convalescent specimens collected after the patient recovers may be useful for comparison. If the patient has diarrhea, obtain a stool specimen or rectal swab. If the person is vomiting, collect vomitus. Blood specimens are used to detect antibodies, or isolate pathogens. Blood and/or urine specimens may also be useful in confirming diagnosis of chemical food poisoning. Contact the laboratory officer at the nearest medical treatment facility or NAVENPVNTMEDU for guidance on collecting, storing, and shipping samples for analysis. If the demand for laboratory analyses exceeds the capability of the MTF laboratory, contact the nearest NAVENPVNTMEDU. The units maintain a public health laboratory capability to conduct analysis of clinical specimens from an outbreak investigation or can assist in arranging for appropriate laboratory analysis.

(4) Collect food samples and containers. If food items are leftover from a suspect meal, or if a commercial product is suspected, collect and preserve samples for laboratory analysis. Remaining stocks of suspect food should not be used until the investigation is complete. Use aseptic techniques and containers to collect samples; seal and label each container. Collect a sample of each item weighing ½ to 1 pound or measuring ½ to 1 pint, if less is available collect all of it. Samples of perishable foods should be chilled and held below 41°F (4°C) but should not be frozen. Commercial foods in containers (e.g., jars or cans) should be kept in those containers. Empty containers of suspect commercial products should also be collected and preserved. Contact the nearest NAVENPVNTMEDU for additional guidance on collecting, storing and shipping samples for analysis. NAVENPVNTMEDU laboratories can analyze food samples or can assist in arranging for appropriate laboratory analyses.

d. Develop a case definition. A case definition allows exposed persons to be classified as either cases or noncases. A case is usually defined by symptoms, e.g., a person who was at risk and developed diarrhea (3 or more watery stools within a 24-hour period), and a timeframe. Use the data collected during the

initial phase of the investigation to establish the definition. A case definition may be specific, e.g., diarrhea and fever (temperature greater than 100.5°F) or more general, (e.g., diarrhea, nausea or vomiting with or without fever). Cases can be categorized further as confirmed or suspected. A confirmed case meets the case definition and has laboratory evidence of infection (e.g., diarrhea and laboratory isolation of a pathogenic bacteria), while a suspected case meets the case definition but laboratory confirmation is lacking or incomplete (e.g., diarrhea only).

e. Make epidemiologic associations.

(1) Although the investigation is not complete, a preliminary assessment of available data helps to confirm an outbreak has or has not occurred. The investigator needs to decide if two or more persons experienced a similar illness and the cases are associated by time (e.g., onset within a few hours or days of each other), place (e.g., eating at the same establishment or event) and/or person (e.g., eating same foods).

(2) Develop a hypothesis about the type of illness, possible vehicles of transmission and means by which the vehicle was contaminated. Hypotheses are possible explanations for the outbreak; more investigation and/or more data may be necessary to prove or disprove their role in the outbreak. Table 1-10 provides information concerning incubation periods, clinical syndromes, and criteria for confirming the etiology once an FBDO has been identified. The information on incubation periods and clinical syndromes is provided as a guideline and should not be included in the confirmation criteria. These guidelines may not include all etiologic agents and diagnostic tests. Decisions on additional investigative efforts (case and control finding, laboratory analyses, etc.) and their priority should be guided by the resulting information's value in providing or disproving the current hypotheses.

f. Provide information. Keep everyone with a "need to know" informed of the progress and findings to the investigation. Who "needs to know" varies with the outbreak but may include: appropriate line commanders; the commanding officer, preventive medicine staff and/or laboratory officer of the supporting MTF; appropriate public affairs officers (PAO); and local health department representatives. If the situation requires informing the public, work with a PAO or local risk communication personnel to provide objective factual information about the outbreak and clear recommendations on actions that the public should take. File a Medical Event Report per BUMEDINST 6220.12 series.

g. Expand the investigation. Often the initial investigation will identify a pathogen. The investigator may have a plausible hypothesis for the vehicle and its method of contamination. The food service manager may have implemented the recommendations to prevent further illness. It is often tempting to conclude the investigation at this point. Such superficial investigations may underestimate the true number of cases, miss the true method of contamination, and fail to alter potentially hazardous food handling procedures. At this point it is important to find and interview additional persons (both ill and well) at risk. Complete food history questionnaires on both ill and well and obtain clinical specimens from ill persons. It may be appropriate to seek assistance, either consultative support or on-site support, from the nearest NAVENPVNTMEDU.

h. Investigate food handling procedures. The investigation must inquire into the source and method of preparation of each item of food or drink served at a suspected meal. Although a standard inspection may be conducted, an investigation focusing on high risk foods and their handling may be more productive. A flowchart documenting the individual steps from delivery, through preparation, to service of highly suspect items may be helpful. Talk with the person in charge, shift supervisors and the watch captains. Collect menus, recipes, and lists of personnel with their assignments. Separately interview food service personnel involved in handling the suspect item(s). Food service personnel should have a physical examination and specimens should be collected (e.g., stool sample or rectal swab), if appropriate.

i. Analyze the data. The organization and summary of data collected from ill and well persons who ate or drank the suspect item or meal help to classify the illness, identify involved groups, and identify a possible vehicle for transmission.

(1) Plot an epidemic curve. Prepare a graph of the distribution of cases (ill persons) by the time of onset of their symptoms (Figure 1-11.) The period of time covered by the outbreak determines the unit of time used on the graph. For staphylococcal food poisoning, use a scale of hours; for a possible salmonella outbreak, use 6 or 12-hour periods; and for hepatitis A, use days. A common source outbreak graph will show a sharp peak when many cases developed their symptoms followed by a gradual tapering off of cases. Figure 1-1 displays data for a common source outbreak of staphylococcal food poisoning. An outbreak with person to person spread (e.g., shigellosis) will show a slower rise to a less distinct peak or may have no dominant peak.

(2) Identify the common symptoms and signs. Symptoms are felt by a person, while signs are noted by an observer. Use data

from ill persons to prepare a chart showing the percentage of cases with specific symptoms (e.g., nausea or headache) and signs (e.g., fever). The predominate signs and symptoms, whether enteric, neurologic or generalized, help limit the list of possible agents that caused the outbreak.

(3) Calculate incubation periods and determine a median incubation period.

(a) The interval between ingestion of the suspect food and the appearance of an initial symptom or sign of illness is the incubation period. Knowledge of the median incubation period further limits the list of possible causative agents for the outbreak. The median is used because it is not affected by exceptionally long or short incubation periods, as is the mean (average) value.

(b) Calculate the interval for each case, and determine the range of incubation periods by identifying the shortest and longest incubation period. Calculate the median incubation period. (Make a list of the individual incubation periods from shortest to longest. The middle value on the list, or the average of the two middle values if there is an even number of cases, is the median incubation period.)

(c) Table 1-12 displays data on symptom onset and incubation period for a common source outbreak of staphylococcal food poisoning. Table 1-12 shows the incubation periods grouped by 2-hour intervals. Both the median incubation period (3.5 hours) and the large number of cases with illness onset between 2 and 4 hours after eating the suspect food are consistent with staphylococcal food poisoning.

(4) Calculate attack rates.

(a) Attack rates, the percentage of ill persons, may be food or meal specific. For either type of attack rate to be meaningful, the investigator must have food and/or meal histories on both ill and well persons who were at risk of eating the suspect food or meal.

(b) Food specific attack rates help pinpoint a suspect food within a meal, and can support observations and conclusions on food handling that contributed to the outbreak. Meal specific attack rates are appropriate when an investigation has not pinpointed a particular meal; the results may help focus further investigative efforts.

(c) To calculate the rates, divide the number of persons who become ill after they ate a particular food or meal by the total number of persons (both cases and controls) who ate that food or meal, and multiply the results by 100. Do the same for the persons who did not eat that particular food or meal. A highly suspect food or meal will have the highest attack rate for those who ate that food or meal, and the lowest attack rate for those who did not eat that food or meal. The difference between the two rates provides an easy method of comparing different meals or different foods.

(d) When investigating a disease with a long incubation period (e.g., hepatitis A), attack rates based on food preference rather than actual consumption may be necessary. A person's food preferences may be determined by asking if, when given a choice, they always or usually eat certain foods (e.g., raw oysters), purchase particular brand items, or dine at a particular restaurant.

(e) Table 1-14 is an example of a food specific attack rate analysis. Persons who reported they ate potato salad have a high rate of illness. The difference in attack rates is greatest for potato salad, which implicates this food item as the vehicle in the outbreak. Note that not all people who reported eating potato salad became ill. Variations in illness may be explained by one or more of the following conditions: recall bias (some people may not accurately remember events as they occurred), dose or inoculum (the number of organisms or amount of toxin ingested), and susceptibility. Some people may not accurately remember what they ate or did not eat.

j. Use investigative data for prevention. Preventing further illnesses is the primary purpose of a food borne illness investigation. During or immediately after completing the investigation, recommend and/or implement measures to prevent further illness.

k. Submit a Medical Event Report. Any food borne disease outbreak must be reported following the guidelines of BUMEDINST 6220.12 series on Medical Event Reports.

Figure 1-9. Case History Questionnaire

Name:		Grade/ Rate:		SSN:	Duty Station:
Work Telephone:	Home Telephone:	Age:	Sex:	Home Address:	

Other Information:

Signs and Symptoms (check appropriate items)

☐ Burning Sensations (mouth) ☐ Metallic Taste ☐ Excessive Salivation ☐ Nausea ☐ Vomiting ☐ Flushing ☐ Itching ☐ Prostration ☐ Cyanosis	☐ Abdominal Cramps ☐ Diarrhea ☐ Bloody Diarrhea ☐ Mucus Diarrhea ☐ Watery Diarrhea _____ # of Bowel Movements Per Day ☐ Fever _____Temp ☐F ☐ Duration of Fever	☐ Headache ☐ Chills ☐ Myalgia ☐ Edema ☐ Jaundice ☐ Anorexia ☐ Rash ☐ Weakness ☐ Dehydration

☐ Numbness
☐ Dizziness
☐ Double Vision
☐ Blurred Vision
☐ Dysphagia
☐ Dysphoria
☐ Delirium
☐ Paralysis
☐ Coma

Other Symptoms:

Time and Date of Onset:	Duration:	Severity: mild - severe 1 2 3 4	Treatment:

Physician Consulted: Telephone:	Address:
Hospital: Telephone:	Address:

Specimens Obtained:	Time/Date of Collection:	Laboratory Results:

Remarks and Diagnosis:

☐ Ill ☐ Well

Figure 1-9. Case History Questionnaire (cont.)

Food History for Previous 72 Hours or Other Specified Time					
Day of Illness					
Breakfast		Lunch		Supper	
Hour:	Place:	Hour:	Place:	Hour:	Place:
Food Items:		Food Items:		Food Items:	
Day Before Illness					
Breakfast		Lunch		Supper	
Hour:	Place:	Hour:	Place:	Hour:	Place:
Food Items:		Food Items:		Food Items:	
Two Days Before Illness					
Breakfast		Lunch		Supper	
Hour:	Place:	Hour:	Place:	Hour:	Place:
Food Items:		Food Items:		Food Items:	
Snacks (items, time and place)					
History of Eating Suspect Food					
Food:		Source:		Address:	
Common Event and Names and Addresses of others at event:					
Recent Travel (locations):					
Contacts With Known Cases Before Illness:					
Contact After Illness:					
Other Conditions (Housing Condition, Crowding, Water/Milk Supply, Excreta Disposal, Shellfish):					
Additional Remarks:					
Investigator:				Date:	