McMaster University
Medical Monitoring Program Information Sheet

The purpose of this document is to provide information on an agent/virus in order for all McMaster University staff and students to make an informed decision about entering our medical monitoring program.

Please review this document, print your name, sign and date the Memorandum of Understanding and Agreement and then provide it to your supervisor.

Salmonella enterica SPP

The following summary is provided by the McMaster Biosafety Office.

For a complete copy of the excerpted text below please refer to: http://www.phac-aspc.gc.ca/lab-bio/res/psds-ftss/salmonella-ent-eng.php

Salmonella enterica spp. (formerly Salmonella choleraesuis). Salmonella enterica spp. is subdivided into 6 subspecies (enterica (I), salamae (II), arizonae (IIIa), diarizonae (IIIb), houtenae (IV) and indica (VI) ). The usual habitat for subspecies enterica (I) is warm-blooded animals. The usual habitat for subspecies II, IIIa, IIIb, IV and VI is cold-blooded animals and the environment.

HOST RANGE: All species of Salmonella can infect humans. The infectious dose varies with the serotype. For non-typhoidal salmonellosis, the infectious dose is approximately 103 bacilli. For enteric fever, the infectious dose is about 105 bacilli by ingestion.

SUSCEPTIBILITY TO DISINFECTANTS: Gram negative bacteria are susceptible to 2-5% phenol, 1% sodium hypochlorite, 4% formaldehyde, 2% glutaraldehyde, 70% ethanol, 70% propanol, 2% peracetic acid, 3-6% hydrogen peroxide, quaternary ammonium compounds and iodophors; however, Salmonella spp. is resistant to nitrites.

Susceptible to moist heat (121 ºC for at least 15 minutes) and dry heat (170 ºC for at least 1 hour). Salmonella spp. can also be disinfected with ozone. Serotype Choleraesuis can survive in wet swine feces for at least 3 months and in dry swine feces for at least 13 months. Serotype Dublin can survive in feces spread on concrete, rubber, and polyester for almost six years. Serotype Typhimurium can survive in cattle slurry for 19-60 days, cattle manure for 48 days, soil for 231 days, and water for up to 152 days. Flies have been shown to excrete certain serotypes for 8 days and bed bugs can excrete bacilli for up to 21 days. Certain serotypes have been shown to survive on fingertips for up to 80 minutes, depending on the inoculum size. 
LABORATORY-ACQUIRED INFECTIONS: Until 1974, 258 cases and 20 deaths due to laboratory-acquired typhoid fever were reported. 48 cases of salmonellosis were reported until 1976. 64 cases and 2 deaths due to Salmonella spp. infections were reported between 1979 and 2004, most of them associated with S. Typhi. All Salmonella enterica subspecies (with the exception of serotype Typhi) are found in blood, urine, feces, food and feed and environmental materials. Serotype Typhi is found in blood, urine, feces and bile.

PRIMARY HAZARDS: Primary hazards when working with Salmonella enterica are accidental parenteral inoculation and ingestion. The risk associated with aerosol exposure is not yet known. Infected animals are a risk (for all serotypes except Typhi and Paratyphi).

RISK GROUP CLASSIFICATION: Risk group 2. The risk group associated with Salmonella enterica ssp. reflects the species as a whole, but does not necessarily reflect the risk group classification of every subspecies. Containment level 2 practices, safety equipment and facilities are recommended for work involving infectious or potentially infectious materials, animals, or cultures. Containment level 3 practices and procedures are recommended for activities with serotype typhi that might generate aerosols or large quantities of organisms. These containment requirements apply to the species as a whole, and may not apply to each subspecies within the species. Lab coat. Gloves when direct skin contact with infected materials or animals is unavoidable. Eye protection must be used where there is a known or potential risk of exposure to splashes. All procedures that may produce aerosols, involve high concentrations or large volumes should be conducted in a biological safety cabinet (BSC). The use of needles, syringes and other sharp objects should be strictly limited. The use of needles, syringes, and other sharp objects should be strictly limited. Additional precautions should be considered with work involving animals or large scale activities.

The following summary is provided by Employee Health Services.

For a complete copy of the excerpted text below please refer to:

Facts
Infections with Salmonella enterica occur worldwide; however, certain diseases are more prevalent in different regions. Non-typhoid salmonellosis is more common in industrialized countries whereas enteric fever is mostly found in developing countries (with the most cases in Asia) (4, 12). There are about 1.3 billion cases of non-typhoid salmonellosis worldwide each year and the WHO estimates that there are 17 million cases and over 500,000 deaths each year caused by typhoid fever (4, 10). There is a peak in disease in the summer and fall, and it is most common in children (2, 7, 9). In the developing world, salmonellosis contributes to childhood diarrhea morbidity and mortality as bacteria are responsible for about 20% of cases (4, 13). Epidemics of salmonellosis have been reported in institutions such as hospitals and nursing homes (7). Human infection usually occurs when consuming contaminated foods and water,
contact with infected feces, as well as contact with infective animals, animal feed, or humans. Foods that pose a higher risk include meat, poultry, milk products, and egg products. In hospitals, the bacteria have been spread by personnel in pediatric wards, either on their hands or on inadequately disinfected scopes. Flies can infect foods which can also be a risk for transmission to humans.

Symptoms

*Salmonella enterica* can cause four different clinical manifestations: gastroenteritis, bacteremia, enteric fever, and an asymptomatic carrier state. It is more common in children under the age of 5, adults 20-30 year olds, and patients 70 years or older.

Gastroenteritis: Gastroenteritis or “food poisoning” is usually characterized by sudden nausea, vomiting, abdominal cramps, diarrhea, headache chills and fever up to 39 °C. The symptoms can be mild to severe and may last between 5-7 days. The Typhimurium serotype is the most common cause of gastroenteritis and there are an estimated 1.3 billion cases and 3 million deaths annually (1.4 million cases and 600 deaths in the US alone) due to non-typhoidal *Salmonella*. In well resourced countries with low levels of invasive complications, the mortality rate due to non-typhoidal *Salmonella* is lower than 1%; however, in developing countries, the mortality rate can be as high as 24%.

Bacteremia: Bacteremia occurs in 3-10% of individuals infected with *Salmonella enterica* and certain serotypes (particularly serotype Choleraesuis) have higher mortality rates. Immunosuppressed individuals and patients with comorbid medical conditions (e.g. HIV-AIDS, diabetes, mellitus, malignancy, cirrhosis, chronic granulomatous disease, sickle cell disease, lymphoproliferative disease, or collagen vascular disease) have a higher risk of developing bacteremia due to a *Salmonella* infection. Bacteremia can cause septic shock; endocarditis, especially in patients older than 50 or with heart conditions; infection of the aorta, especially in patients with pre-existing atherosclerotic disease; liver, spleen, and biliary tract infections in patients with underlying structural abnormalities; mesenteric lymphadenitis; osteomyelitis in long bones and vertebrae; urinary tract infection; pneumonia; pulmonary abscess; brain abscess; subdural and epidural empyema; meningitis; CNS infections (rarely); and death.

Enteric fever: Also known as typhoid fever, this infection is caused by serotypes Typhi and Paratyphi. Enteric fever is characterized by fever (rising within 72 hours after the onset of illness) and headache, brachycardia, faint rose-colored rash on the abdomen and chest, anorexia, abdominal pain, myalgias, malaise, diarrhea (more common in children) or constipation (more common in adults), hepatosplenomegaly, segmental ileus, meningismus, and neuropsychiatric manifestations. Less common symptoms are sore throat, cough, and bloody diarrhea. Complications include myocarditis, encephalopathy, intravascular coagulation, infections of the biliary tree and intestinal tract, urinary tract infection, and metastatic lesions in bone, joints, liver, and meninges. The most severe complication (occurs in about 3% of
patients) is hemorrhage due to perforations of the terminal ileum of proximal colon walls \(^{4, 7}\). If untreated, the fever can last for weeks; however, with proper antimicrobial therapy, patients usually recover within 10-14 days \(^7\). The disease is milder in children and, if treated, has a mortality rate of less than 1%; untreated cases can have a mortality rate greater than 10 \(^2, 4\).

**Diagnosis**

Confirm diagnosis by isolation from stool or blood and by serotyping to identify the serotype \(^7, 8\).

**Treatment**

Treatment depends on the clinical symptoms presented by the patient.

Gastroenteritis: Fluid and electrolyte replacement as well as control of the nausea and vomiting are the usual treatments for these symptoms \(^7, 8\). Antibiotic treatment is not usually used; however, it may be necessary for neonates, children, the elderly, and the immunosuppressed, in which case ciprofloxin, co-trimoxazole, ampicillin, and cephalosporins may be used \(^4, 7, 8\).

Bacteremia: Antibiotic treatment is used to treat bacteremia (e.g. ciprofloxin, co-trimoxazole, ampicillin, or cephalosporins), especially for neonates, children, the elderly, and the immunosuppressed \(^7, 8\).

Enteric fever: Chloramphenicol is the most common antibiotic used for enteric fever although ampicillin, trimethoprim-sulfonamid, cephalosporins, ciprofloxin, and norfloxacin are also being used to treat the disease \(^4, 7\).

Asymptomatic carrier state: Carriers can be treated with ciprofloxin in order to reduce the spread of the infectious agent \(^8\).

There is no vaccine to prevent non-typhoidal salmonellosis currently available \(^14\). Three vaccines (2 parenteral and 1 oral) are licensed for use in the US and should be considered for those working with serotype Typhi in a laboratory setting and for travelers who are going to spend extended periods of time in endemic areas \(^4, 7, 14\). The vaccines available offer moderate protection against typhoid fever; however, they do not protect against the Paratyphi serotype of the bacterium \(^12\). It has been shown that a live oral vaccine protects 70% of children inoculated in endemic areas \(^7\). Vaccination is not recommended for pregnant women and patients with HIV-AIDS \(^29\). Antibiotics can be used as prophylaxis in at-risk individuals (for example neonates and the immunocompromised) \(^7\). Clean water supplies, sanitation, and treatment of carriers are the best prophylactic measures to prevent the spread of enteric fever in endemic areas \(^7\).
Memorandum of Understanding and Agreement ("MUA")
for BSL2 Medical Monitoring Program

Note: This MUA is to be signed by the employee/student and supervisor, filed and kept by the supervisor. It will be reviewed during the annual biosafety audit by the McMaster Biosafety office.

The employee/student named below acknowledges and agrees as follows:

- I have read and understand all of the information in this Medical Monitoring Information Sheet provided jointly by the McMaster Biosafety Office and Employee Health Services and reviewed the biologically hazardous agent to which I have potential exposure. Initial here____

- I will report a pregnancy or a compromised immune system (due to medication {steroid or other immunosuppressive therapy}, organ transplant, chemotherapy or radiation therapy, HIV infection etc.) to my supervisor and X (graduate students) or Employee Health Services Occupational Health Nurse at ext. 20310 (faculty and staff) Initial here____

- I will report an exposure to a biological agent to my supervisor immediately and complete a McMaster incident/accident report. Initial here____

- I will report any illness that resembles the symptoms listed in this Medical Monitoring Information Sheet to my supervisor. Initial here____

- I recognize my responsibility to observe all safety practices and precautions while present in the BSL2 laboratory. Initial here____

- I am aware of, and wish to participate in, the medical monitoring program (RMM #605) for this biological level 2 agent. Please circle: [yes] [no] Initial here _____

Employee/Student print name: ____________________________  Supervisor print name: ____________________________

Signature: ___________________________________________  Signature: ___________________________________________

Date: _______________________________________________  Date: _______________________________________________