

**Notification Timeline:**

**From Lab/Practitioner to Public Health:** Immediate.

**From Public Health to Saskatchewan Health:** Within 72 hours.

**Public Health Follow-up Timeline:** Initiate within 24-48 hours.

**Public Health Purpose for Notification of Hantavirus Infections** (adapted from Public Health Ontario, 2016)

- To track trends of the epidemiology of Hantavirus infections in Saskatchewan including risk factors and geographic distribution;
- To monitor disease burden and outcomes of hantavirus infections in Saskatchewan;
- To inform the public, occupational and health care provider communities about this disease and how to prevent it; and
- To identify locations where increased transmission of Hantavirus may be occurring in order to inform other interventions.

**Surveillance Case Definition<sup>1</sup> – Hantavirus Pulmonary Syndrome (HPS)**

<p><b>Confirmed Case</b> (Public Health Agency of Canada, 2008)</p>	<p>Clinical illness<sup>1</sup> with laboratory confirmation of infection:</p> <ul style="list-style-type: none"> <li>• detection of IgM antibodies to hantavirus</li> <li><b>OR</b></li> <li>• detection of a significant (e.g., fourfold or greater) increase in hantavirus-specific IgG</li> <li><b>OR</b></li> <li>• detection of hantavirus ribonucleic acid (RNA) in an appropriate clinical specimen</li> <li><b>OR</b></li> <li>• detection of hantavirus antigen by immunohistochemistry.</li> </ul>
<p><b>Probable Case</b> (Saskatchewan Ministry of Health, 2013)</p>	<p>Clinical illness<sup>1</sup> with a history of exposure compatible with hantavirus transmission and lab confirmation is pending.</p>

<sup>1</sup> Surveillance case definitions ensure uniform reporting to allow comparability of surveillance data and support public health investigation and management. The definition is not intended to be used for clinical or laboratory diagnosis or management of patients.

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<sup>1</sup> Clinical illness is typically characterized by:

- a febrile illness (temperature > 38.3°C (101°F) oral) requiring supplemental oxygen  
**AND**
- bilateral diffuse infiltrates (may resemble acute respiratory distress syndrome[ARDS])  
**AND**
- develops within 72 hours of hospitalization in a previously healthy person.

**OR**

An unexplained illness resulting in death with an autopsy examination demonstrating noncardiogenic pulmonary edema without an identifiable specific cause of death.

## Epidemiology and Occurrence

Under Development

## Additional Background Information

### Causative Agent

Any of several hantavirus strains.

Hantaviruses are RNA viruses of the *Bunyaviridae* family. The most common cause of hantavirus pulmonary syndrome (HPS) is the Sin Nombre species. There are multiple other strains of hantavirus that cause different clinical illnesses (American Academy of Pediatrics, 2015).

### Symptoms

The prodromal illness of HPS is 3-7 days. Signs and symptoms during this time period include fever; chills; headache; myalgia of the shoulders, lower back and thighs; nausea; vomiting; diarrhea; dizziness and sometimes coughing. Following the onset of cough and dyspnea is the onset of respiratory tract signs and symptoms caused by pulmonary edema and severe hypoxemia, after which the disease progresses over a period of a few hours (American Academy of Pediatrics, 2012).

### Complications

Rapid progression to severe respiratory failure and shock with fatality rates of approximately 35-50% (Heymann, 2015).

### **Reservoir/Source**

The main reservoir for the Sin Nombre strain of hantavirus in North America is the deer mouse, but can also be isolated in pack rats, chipmunks and other rodents. Rodent species of the subfamily *Sigmodontinae* are mainly associated with other hantavirus strains (Heymann, 2008).

### **Mode of Transmission**

Aerosol transmission from rodent excreta, especially inside closed, poorly ventilated homes, vehicles and out buildings is the most likely mode of transmission (Heymann, 2015). Other potential routes include ingestion, contact of infectious materials with mucous membranes, broken skin and animal bites. Person-to-person transmission is extremely rare but has occurred in Argentina (Public Health Agency of Canada, 2010).

### **Incubation Period**

Approximately 2 weeks, with a range of a few days to 6 weeks (Heymann, 2015).

### **Period of Communicability**

Person-to-person transmission has not been described in North America. Outside of a host, the virus is inactive within a week outdoors and after a few hours when exposed to direct sunlight (Canadian Centre for Occupational Health and Safety, 2008).

### **Specimen Collection and Transport**

Collect blood in serum separator vacutainer (SST). Centrifuge. If shipping will be delayed, ship 2 ml serum in a screw cap tube, with cold packs or on dry ice. Follow Roy Romanow Provincial Laboratory (RRPL) specimen collection guidelines available in the RRPL Compendium of Tests at <https://rrpl-testviewer.ehealthsask.ca/>.

### **Risk Groups**

- farmers;
- grain handlers;
- hikers;
- campers;
- people in occupations with unpredictable or incidental contact with rodents or their nesting materials are at risk (e.g., telephone installers, oil workers, plumbers, electricians, pest control officers and certain construction, maintenance and wildlife workers [Saskatchewan Ministry of Labour and Workplace Safety, 2011]).

### **Risk Activities**

Handling or trapping rodents, cleaning/entering rarely used and closed rodent-infested structures, cleaning animal shelter or food storage areas, living in a place with an increased density of mice in or around the home, or sleeping in a structure inhabited by rodents (American Academy of Pediatrics, 2015).

### **Public Health Investigation**

#### **I. Case**

##### **History**

Classify case in consultation with the attending physician and the case definitions. Refer to [Attachment – Hantavirus Data Collection Worksheet](#) to assist in the investigation.

- Clinical manifestation and onset dates can help identify exposure timelines.
- Exposure to mice, their saliva, and their excrement is key in the *acquisition* of hantavirus infections. In the past 6 weeks identify if the case has been involved in:
  - cleaning/entering rarely used and closed rodent-infested structures;
  - cleaning animal shelter or food storage areas;
  - handling or trapping rodents;
  - living in a place with an increased density of mice in or around the home;
  - sleeping in structure inhabited by rodents;
  - exposure through camping, hiking, etc.;
  - other.
- Identify the area where the exposure has occurred. Was there indoor exposure in closed, poorly ventilated:
  - barns;
  - outbuildings;
  - vehicles;
  - homes where visible rodent infestation is apparent?

If yes, identify geographic area where exposure occurred (e.g. city, town or RM).

##### **Outcome**

Did the patient require admission to an intensive care unit?

What was the outcome of the infection?

- recovered;
- fatal.

**Treatment/Supportive Therapy**

*The primary care provider is responsible for the treatment and clinical management of cases. The following serves as a reference for the public health investigator: Intensive respiratory support is often required. Suspected patients should be immediately transported to a tertiary care facility so supportive management can be initiated within the critical first 24-48 hours of illness (American Academy of Pediatrics, 2015).*

**Public Health Interventions****Assessment**

- Assess for [contacts](#) paying particular attention individuals that have had exposure to the same source.

**Communication**

- Letters can be used to inform contacts of the exposure, symptom monitoring and when to seek medical attention (see Sample letter).

**Education**

- All cases should be provided disease information as well as information on prevention and control measures.

**Environmental Health**

- When acquisition is linked to a public facility, inspection may be warranted.

**Referrals**

When a case of hantavirus is associated with an occupational exposure, Section 9 of *The Disease Control Regulations*<sup>2</sup> stipulates that the medical health officer (MHO) shall notify the director (as defined in *The Occupational Health and Safety Act, 1993*<sup>3</sup>). In order to fulfill this obligation, they must complete and send the form in [Appendix L – Notification of Occupational Health and Safety](#) within 14 days.

**II. Contact****Contact Definition**

Individuals who have been exposed to the same settings where the case likely acquired infection.

<sup>2</sup> <http://www.qp.gov.sk.ca/documents/english/Regulations/Regulations/p37-1r11.pdf>.

<sup>3</sup> <http://www.qp.gov.sk.ca/documents/English/Statutes/Statutes/P37-1.pdf>.

### **Public Health Interventions**

#### **Assessment**

- Assess for symptoms.

#### **Education**

- Hantavirus information sheet is a resource to guide content of education.
- Contacts should be informed that if they develop a fever or respiratory illness within 6 weeks of the last potential exposure they should immediately seek medical attention and inform the attending physician of the risk of having acquired hantavirus infection.

#### **Environmental Health**

- If investigation indicates potential for other persons to be exposed, environmental health assessments may be required.

#### **Referral**

- Symptomatic contacts should be referred to their primary care provider for assessment.

#### **Testing**

- Symptomatic contacts should be tested based on clinical assessment of the practitioner.

### **III. Environment**

Safety measures must be implemented when cleaning areas that have had rodent infestations. Refer to *Hantavirus Disease: Guidelines for Protecting Workers and the Public*<sup>4</sup> *A Hantavirus Exposure Control Program for Employers and Workers* (Worksafe BC, 2006)<sup>4</sup> for proper cleaning procedures and use of personal protective equipment.

In situations where the public may be experiencing ongoing exposures, additional measures may need to be taken in consultation with the MHO.

### **Epidemic Measures**

Public education regarding rodent avoidance and control.

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<sup>4</sup> <https://www.worksafebc.com/en/resources/health-safety/books-guides/a-hantavirus-exposure-control-program-for-employers-and-workers?lang=en&origin=s&returnurl=https%3A%2F%2Fwww.worksafebc.com%2Fen%2Fsearch%23q%3Dhantavirus%26sort%3Drelevancy%26f%3Alanguage-facet%3D%5BEnglish%5D&highlight=hantavirus>

## Prevention Measures

Refer to the [Vector Borne and Zoonotic Diseases – Introduction and General Considerations](#) section of the manual that highlights topics for client education that should be considered and provides further information on high-risk groups and activities.

Prevention measures are where most emphasis should be placed; risk reduction through environmental hygiene practices that discourage rodents from colonizing the home and work environment and that minimize aerosolization and contact with virus in saliva and excreta (America Academy of Pediatrics, 2015).

### Immunization

Currently, there is no vaccine available to prevent hantavirus infections.

### Education

Education should be provided regarding rodent avoidance and control in homes and outbuildings. People should be informed about personal protective measures that should be taken when handling rodents and rodent excreta.

In addition to general messaging, education should be targeted to [Risk Groups](#) on prevention measures as follows:

- control rodents;
- clean buildings and worksites;
- minimize exposure to sources of infection.

*Hantavirus Disease: Guidelines for Protecting Workers and the Public* A Hantavirus Exposure Control Program for Employers and Workers (Worksafe BC, 2006).

Additional information can also be found at <http://www.saskatchewan.ca/residents/health/diseases-and-conditions/hantavirus>.

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**Revisions**

<b>Date</b>	<b>Change</b>
August 2018	<ul style="list-style-type: none"><li>• Incorporated Public Health Purpose of Notification.</li><li>• Reorganized chapter and applied new format.</li><li>• Included a placeholder for <b>Epidemiology and Occurrence</b> section.</li><li>• Aligned with Panorama configuration.</li><li>• References reaffirmed or updated as necessary.</li><li>• Removed link to web content that was no longer available on a Saskatchewan website and replaced with a link to BC content.</li></ul>



## References

- American Academy of Pediatrics. (2015). *Red book: 2015 Report of the Committee on Infectious Diseases* (30<sup>th</sup> ed.). Elk Grove Village, IL: Author.
- Canadian Centre for Occupational Health and Safety. (2016). *Hantavirus*. Retrieved August, 2018 from <http://www.ccohs.ca/oshanswers/diseases/hantavir.html>.
- Heymann, D. L. (Ed.). (2015). *Control of communicable diseases manual* (20<sup>th</sup> ed.). Washington, DC: American Public Health Association.
- Public Health Agency of Canada. (2008). Case definitions for communicable diseases under national surveillance. *Canada Communicable Disease Report (CCDR), 35S2, November 2009*. Retrieved August, 2018 from <http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/09vol35/35s2/Hanta-eng.php>.
- Public Health Agency of Canada. (2015). *Hantavirus spp.: Pathogen safety data sheet – infectious substances*. Retrieved August, 2018 from <http://www.phac-aspc.gc.ca/lab-bio/res/psds-ftss/hantavirus-eng.php>.
- Workers Compensation Board of BC. (2006). A hantavirus exposure and control program for employers and workers. Retrieved August, 2018 from <https://www.worksafebc.com/en/resources/health-safety/books-guides/a-hantavirus-exposure-control-program-for-employers-and-workers?lang=en&origin=s&returnurl=https%3A%2F%2Fwww.worksafebc.com%2Fen%2Fsearch%23q%3Dhantavirus%26sort%3Drelevancy%26f%3Alanguage-facet%3D%5BEnglish%5D&highlight=hantavirus>

## Hantavirus infection Data Collection Worksheet

Please complete all sections.

Panorama QA complete:  Yes  No  
 Initials: \_\_\_\_\_

Panorama Client ID: \_\_\_\_\_  
 Panorama Investigation ID: \_\_\_\_\_

### A) CLIENT INFORMATION

LHN -> SUBJECT -> CLIENT DETAILS -> PERSONAL INFORMATION

Last Name:	First Name: and Middle Name:	Alternate Name (Goes by):
DOB: YYYY / MM / DD    Age: _____	Health Card Province: _____ Health Card Number (PHN): _____	Preferred Communication Method: (specify - i.e. home phone, text): Email Address: <input type="checkbox"/> Work <input type="checkbox"/> Personal
Phone #: <input type="checkbox"/> Primary Home: <input type="checkbox"/> Mobile contact: <input type="checkbox"/> Workplace:		
Place of Employment/School:	Gender: <input type="checkbox"/> Male <input type="checkbox"/> Female <input type="checkbox"/> Other <input type="checkbox"/> Unknown	
Alternate Contact: _____ Relationship: _____ Alt. Contact phone: _____	Address Type: <input type="checkbox"/> No fixed <input type="checkbox"/> Postal Address <input type="checkbox"/> Primary Home <input type="checkbox"/> Temporary <input type="checkbox"/> Legal Land Description Mailing (Postal address): Street Address or FN Community (Primary Home):  Address at time of infection if not the same:	

### B) INVESTIGATION INFORMATION

LHN-> SUBJECT SUMMARY-> ZONOTIC AND VECTORBORNE ENCOUNTER GROUP->CREATE INVESTIGATION

Disease Summary Classification: CASE:	Date	Classification: CASE:	Date	LAB TEST INFORMATION:																
<input type="checkbox"/> Confirmed	YYYY / MMM / DD	<input type="checkbox"/> Does Not Meet Case	YYYY / MMM / DD	Date specimen collected: YYYY / MMM / DD																
<input type="checkbox"/> Probable	YYYY / MMM / DD	<input type="checkbox"/> Person Under Investigation	YYYY / MMM / DD	<b>Specimen Type</b>																
<input type="checkbox"/> Suspect	YYYY / MMM / DD																			
<b>Disposition:</b> FOLLOW UP: <table style="width: 100%; border: none;"> <tr> <td><input type="checkbox"/> In progress</td> <td>YYYY / MMM / DD</td> <td><input type="checkbox"/> Complete</td> <td>YYYY / MMM / DD</td> </tr> <tr> <td><input type="checkbox"/> Incomplete - Declined</td> <td>YYYY / MMM / DD</td> <td><input type="checkbox"/> Not required</td> <td>YYYY / MMM / DD</td> </tr> <tr> <td><input type="checkbox"/> Incomplete – Lost contact</td> <td>YYYY / MMM / DD</td> <td><input type="checkbox"/> Referred – Out of province</td> <td>YYYY / MMM / DD</td> </tr> <tr> <td><input type="checkbox"/> Incomplete – Unable to locate</td> <td>YYYY / MMM / DD</td> <td>(Specify where)</td> <td>YYYY / MMM / DD</td> </tr> </table>					<input type="checkbox"/> In progress	YYYY / MMM / DD	<input type="checkbox"/> Complete	YYYY / MMM / DD	<input type="checkbox"/> Incomplete - Declined	YYYY / MMM / DD	<input type="checkbox"/> Not required	YYYY / MMM / DD	<input type="checkbox"/> Incomplete – Lost contact	YYYY / MMM / DD	<input type="checkbox"/> Referred – Out of province	YYYY / MMM / DD	<input type="checkbox"/> Incomplete – Unable to locate	YYYY / MMM / DD	(Specify where)	YYYY / MMM / DD
<input type="checkbox"/> In progress	YYYY / MMM / DD	<input type="checkbox"/> Complete	YYYY / MMM / DD																	
<input type="checkbox"/> Incomplete - Declined	YYYY / MMM / DD	<input type="checkbox"/> Not required	YYYY / MMM / DD																	
<input type="checkbox"/> Incomplete – Lost contact	YYYY / MMM / DD	<input type="checkbox"/> Referred – Out of province	YYYY / MMM / DD																	
<input type="checkbox"/> Incomplete – Unable to locate	YYYY / MMM / DD	(Specify where)	YYYY / MMM / DD																	
<b>REPORTING NOTIFICATION</b>		Location:																		
Name of Attending Physician or Nurse:																				
Provider's Phone number:		Date Received (Public Health): YYYY / MMM / DD																		
Type of Reporting Source: <input type="checkbox"/> Health Care Facility <input type="checkbox"/> Lab Report <input type="checkbox"/> Nurse Practitioner <input type="checkbox"/> Physician <input type="checkbox"/> Other _____																				

### C) DISEASE EVENT HISTORY

LHN-> INVESTIGATION->DISEASE SUMMARY (UPDATE)->DISEASE EVENT HISTORY

Site / Presentation:	<input type="checkbox"/> Hantavirus pulmonary syndrome	<input type="checkbox"/> Hemorrhagic fever with renal syndrome	<input type="checkbox"/> Other
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## Hantavirus infection Data Collection Worksheet

Please complete all sections.

Panorama Client ID: \_\_\_\_\_  
Panorama Investigation ID: \_\_\_\_\_

### D) SIGNS & SYMPTOMS *(Bold text = part of case definition)*

LHN-> INVESTIGATION-> SIGNS & SYMPTOMS

Description	Yes – Date of onset	Description	Yes - Date of onset
<b>Acute respiratory distress syndrome (ARDS)</b>	YYYY / MMM / DD	Lab - platelet count low	YYYY / MMM / DD
Chills	YYYY / MMM / DD	Myalgia (muscle pain)	YYYY / MMM / DD
Cough	YYYY / MMM / DD	Nausea	YYYY / MMM / DD
Diarrhea	YYYY / MMM / DD	Oliguria or anuria (decreased urine output)	YYYY / MMM / DD
Dizziness	YYYY / MMM / DD	Pain - abdominal	YYYY / MMM / DD
Dyspnea (shortness of breath)	YYYY / MMM / DD	Pain - back	YYYY / MMM / DD
<b>Fever</b>	YYYY / MMM / DD	<b>Pulmonary edema - noncardiogenic</b>	YYYY / MMM / DD
Headache	YYYY / MMM / DD	<b>Pulmonary edema - unexplained noncardiogenic (autopsy)</b>	YYYY / MMM / DD
Hemorrhagic manifestations	YYYY / MMM / DD	<b>Pulmonary infiltrates - diffuse - bilateral</b>	YYYY / MMM / DD
Hypotension	YYYY / MMM / DD	Rash - petechial	YYYY / MMM / DD
Hypoxemia - severe	YYYY / MMM / DD	<b>Respiratory compromise - oxygen therapy required</b>	YYYY / MMM / DD
Lab - hematocrit - elevated		Respiratory failure – requiring mechanical ventilation	
Lab - hypoalbuminemia	YYYY / MMM / DD	Vomiting	YYYY / MMM / DD
Other S/S			

### E) INCUBATION

LHN-> INVESTIGATION->INCUBATION & COMMUNICABILITY

<b>Incubation for Case (period for acquisition):</b>	
<b>Earliest Possible Exposure Date:</b> YYYY / MMM / DD	<b>Latest Possible Exposure Date:</b> YYYY / MMM / DD
<i>Exposure Calculation details:</i>	

### F) RISK FACTORS *(in the 8 weeks prior to onset of illness)*

LHN-> SUBJECT->RISK FACTORS

DESCRIPTION	YES	N – No NA – not asked U - Unknown	DESCRIPTION	YES	N – No NA – not asked U - Unknown
<b>Animal Exposure</b> Rodents/rodent excreta	YYYY /MM/DD		<b>Occupation - Other (specify)</b>		
<b>Behaviour –</b> Camping/hiking	YYYY /MM/DD		<b>Travel – Outside of Canada (specify)</b>	YYYY /MM/DD	
<b>Behaviour –</b> Lack of personal protective measures			<b>Travel – Outside of Saskatchewan, but within Canada (specify)</b>	YYYY /MM/DD	
<b>Environmental Exposure –</b> contaminated building	AE		<b>Travel – Within Saskatchewan (Specify)</b>	YYYY /MM/DD	
<b>Occupation –</b> Farmer					

### G) COMPLICATIONS

LHN-> INVESTIGATION->COMPLICATIONS

Description	Yes Date of onset	Description	Yes Date of onset
Hemorrhage - severe	YYYY / MMM / DD	Shock	YYYY / MMM / DD
Other complications			

# Hantavirus infection Data Collection Worksheet

Please complete all sections.

Panorama Client ID: \_\_\_\_\_  
Panorama Investigation ID: \_\_\_\_\_

## H) TREATMENT

INVESTIGATION-> MEDICATIONS->MEDICATIONS SUMMARY

Medication ( <i>Panorama = Other Meds</i> ): _____
Prescribed by: _____ Started on: YYYY / MMM / DD

## I) INTERVENTIONS

INVESTIGATION->TREATMENT & INTERVENTIONS->INTERVENTION SUMMARY

<b>Intervention Type and Sub Type:</b>				
<b>Assessment:</b> <input type="checkbox"/> Assessed for contacts Investigator name	YYYY / MM / DD	<b>Environmental health:</b> <input type="checkbox"/> Inspection Investigator name	YYYY / MM / DD	
<b>Communication:</b> <input type="checkbox"/> Other communication (see Investigator Notes) Investigator name	YYYY / MM / DD	<input type="checkbox"/> Letter (See Document Management) Investigator name	<b>Referral:</b> <input type="checkbox"/> Saskatchewan Occupational Health and Safety Investigator name	
<input type="checkbox"/> Disease-Info/Prev-Control Investigator name	YYYY / MM / DD	<input type="checkbox"/> Disease-Info/Prev-Cont/Assess'd for Contacts Investigator name	<b>Other Investigation Findings:</b> <input type="checkbox"/> Investigator Notes <input type="checkbox"/> See Document Management	
<input type="checkbox"/> Prevention/Control measures Investigator name	YYYY / MM / DD	<input type="checkbox"/> Disease information provided Investigator name	YYYY / MM / DD	
<b>Date</b>	<b>Intervention subtype</b>	<b>Comments</b>	<b>Next follow-up Date</b>	<b>Initials</b>
YYYY / MM / DD			YYYY / MM / DD	
YYYY / MM / DD			YYYY / MM / DD	
YYYY / MM / DD			YYYY / MM / DD	
YYYY / MM / DD			YYYY / MM / DD	
YYYY / MM / DD			YYYY / MM / DD	

## J) OUTCOMES (optional except for severe influenza)

LHN-> INVESTIGATION->OUTCOMES

<input type="checkbox"/> Not yet recovered/recovering	YYYY / MM / DD	<input type="checkbox"/> ICU/intensive medical care	YYYY / MM / DD	<input type="checkbox"/> Hospitalization	YYYY / MM / DD
<input type="checkbox"/> Recovered	YYYY / MM / DD	<input type="checkbox"/> Intubation /ventilation	YYYY / MM / DD	<input type="checkbox"/> Unknown	YYYY / MM / DD
<input type="checkbox"/> Fatal	YYYY / MM / DD	<input type="checkbox"/> Other _____	YYYY / MM / DD		
Cause of Death: (if Fatal was selected) _____					

## K) EXPOSURES

### Acquisition Event

LHN-> INVESTIGATION-> EXPOSURE SUMMARY-> ACQUISITION QUICK ENTRY

Acquisition Event ID: \_\_\_\_\_

Exposure Name: _____
Acquisition Start YYYY / MM / DD to Acquisition End: YYYY / MM / DD
Location Name: _____
<b>Setting Type</b>
<input type="checkbox"/> Travel <span style="float: right;"><input type="checkbox"/> Most likely source</span>

Initial Report completed by: _____	Date initial report completed: YYYY / MMM / DD
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