Slide 1

Fiebre del Valle de Rift

Slide 2

**Panorama general**

- Causa
- Antecedentes históricos
- Distribución
- Transmisión
- La enfermedad en los seres humanos
- La enfermedad en los animales
- Prevención y control

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In today's presentation we will cover information on what causes Rift Valley Fever. We will also talk about the history of the disease, where it is distributed, species that it affects (including humans), and signs of illness observed. Finally, we will address prevention and control measures for Rift Valley Fever virus. This will include control of mosquitoes and their breeding sites. (Pictures from USDA).

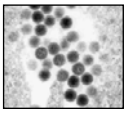
Slide 3

La causa

Slide 4

**Fiebre del Valle de Rift**

- Virus
- Se requiere de un mosquito para que se transmita de un animal a otro
- Enfermedad que ocasiona fiebre
  - Borregos, bovinos, cabras
  - Elevadas tasas de abortos
  - Muerte de animales jóvenes
- Capaz de afectar al ser humano
  - Síntomas similares a los de la influenza



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Rift Valley Fever (RVF) is caused by a virus. It requires a mosquito to transmit the disease from animal to animal. Rift Valley fever is a fever-causing viral disease that severely affects sheep, cattle and goats, especially young animals. There is a very high rate of abortion and death in newborn animals. RVF can also affect humans. Typically cases have mild, flu-like signs that are self-limiting, but severe disease can occur. The photo is an electron micrograph of the Rift Valley Fever virus (RVFV) from the CDC website. Rift Valley fever is associated with heavy rainfalls and is transmitted by an insect, usually mosquitoes. However, contact with contaminated tissue from infected animal, especially aborted fetuses, can transmit the virus to humans. This is a picture of the RVF virus taken using an electron microscope.

Slide 5

Antecedentes históricos

Slide 6

## Valle de Rift - Kenia, África

- Década de los 1900: detectada por primera vez en borregos
- 1930: se aísla el agente
- Brotes esporádicos en Kenia
  - 1950-51, brote mayor
    - 500,000 abortos de borregos
    - 100,000 borregos muertos

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Rift Valley Fever was first recognized as a disease in sheep in Rift Valley, Kenya, Africa around 1900. The virus was not actually isolated until 1930. Since then there have been sporadic outbreaks throughout Kenya. A major outbreak occurred in 1950-51 which resulted in 500,000 sheep abortions and 100,000 sheep deaths. This map depicts the area in Africa where this disease was first recognized- Kenya.

Slide 7

## Egipto: 1977-1978

- Seres humanos
  - 18,000 casos
  - 598 decesos
    - Inflamación del cerebro y trastorno hemorrágico
- Rumiantes
  - Abortos y decesos
    - Borregos, bovinos, cabras
    - Carabaos y camellos

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In 1977-78, a outbreak of RVF occurred along the Nile in Egypt. This was the first outbreak out of sub-Saharan Africa. This outbreak resulted in an estimated 18,000 human cases. There were 598 human deaths which was due to inflammation of the brain (encephalitis) and a bleeding disorder (hemorrhagic fever). Many abortions and deaths were reported in sheep, goats, cattle, water buffalo and camels. This map depicts the location of the 1977-1978 outbreak in Africa- Egypt.

Slide 8

## Otros brotes importantes

- 1987: Senegal, África
  - Resultó diferente a otros brotes.
    - No estuvo relacionado con precipitaciones pluviales intensas.
- 1997-98: Kenia, África
  - El brote más extenso jamás reportado.
  - 89,000 casos en humanos - 478 decesos
- 2000-01: Arabia Saudita y Yemen
  - Primer brote fuera de África

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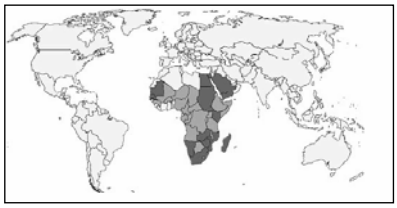
In 1987, an outbreak of RVF occurred in the Senegal river basin (West Africa). This outbreak in animals differed from prior outbreaks in that it was not associated with the typical heavy rainfall. Mosquito breeding occurred in large rivers and dams. The largest outbreak of RVF reported occurred in Kenya, Africa in 1997-1998. An estimated 89,000 humans were infected with 478 deaths. An outbreak of RVF occurred in Saudi Arabia from August 2000 to September 2001. This epidemic was the first confirmed outbreak of RVF outside of Africa. This outbreak illustrated the potential for the spread of this disease to other regions of the world.

Slide 9

Distribución

Slide 10

## Distribución de la Fiebre del Valle de Rift, 2002



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This map is from the CDC web site (Rift Valley Fever). The blue areas indicate African countries that have RVF disease and substantial outbreaks of RVF. The green areas are countries known to have some cases, periodic isolation or evidence from blood samples tested for RVF.

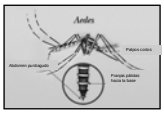
S_Rift Valley Fever

| | | |
|---|---|---|
| Slide 11 | **Distribución**<br>• Brote en Arabia Saudita y Yemen en 2000-2001<br>• Primer brote fuera de África<br>• 683 personas hospitalizadas<br>• 95 decesos<br>– Tasa de mortalidad de 13.9%<br>• 82.7% fueron hombres<br>• 76% había tenido contacto estrecho con animales<br>  <br>Center for Food Security and Public Health Iowa State University 2006 | The of RVF in Saudi Arabia and Yemen in 2000-2001 was the first time this disease was discovered outside of Africa. 683 humans were hospitalized with severe disease. Of those cases, 95 died (13.9% death rate). Males were attributed to 82.7 percent of cases. The average duration from disease onset to hospitalization was 3.3 days. The average time from disease onset to death was 6.3 days. Seventy-six percent of the patients reported having close contact with sheep and goats. This is a map of Saudi Arabia and Yemen. These countries are separated from Africa by the Red Sea. |
| Slide 12 | **Distribución**<br>• Común en el África tropical<br>– Brotes entre cada 5 y 20 años<br>▪ Vulnerabilidad de las poblaciones de animales<br>– Precipitaciones pluviales anormalmente intensas<br>– Niveles máximos a finales del verano<br>  <br>Center for Food Security and Public Health Iowa State University 2006 | RVF is common throughout most of tropical Africa. Outbreaks tend to occur in a cyclic pattern every 5-20 years and is usually associated with abnormally heavy rainfalls. The long intervals between outbreaks allows for development of a vulnerable animal population that is severely affected by the following outbreak. Photo of Egyptian delta farm from http://www.4egypt.info/images/delta_farm.gif |
| Slide 13 | **Distribución: vector**<br>• Mosquitos – especie *Aedes*<br>– La hembra del mosquito deposita los huevecillos en zonas propensas a inundarse<br>– El virus de la RVF se transmite de la hembra del mosquito a sus huevecillos<br>– Los huevecillos permanecen en estado inactivo en el suelo durante largos períodos<br>– Durante las precipitaciones pluviales intensas los huevecillos hacen eclosión<br>– Obtienen su alimento en animales y personas<br>  <br>Center for Food Security and Public Health Iowa State University 2006 | The vector for RVF is mosquitoes, particularly *Aedes* species. A vector is an insect that is able to transmit the disease from animal to animal. This mosquito will lay eggs in flood-prone areas and containers that may hold water including old tires and birdbaths. Then the eggs become infected with RVF inside the female mosquito after she ingests blood from an infected animal. These eggs lay dormant for many years in the dry soil of grassland areas. Following heavy rainfalls, the pooling water gives the eggs a proper environment to hatch. These newly hatched infected mosquitoes then seek a feeding source (human or animal). This photo depicts an *Aedes* mosquito feeding on a human. |
| Slide 14 | **Los animales ayudan a propagar la RVF**<br>• Bovinos, borregos, cabras<br>• Niveles elevados del virus en la sangre<br>• Amplifican (intensifican) el virus<br>– Infectan a otros mosquitos<br>– Establecen la enfermedad en el medio ambiente<br>– Pueden conducir a brotes extensos<br>• Humanos<br>– Posible fuente de virus para los mosquitos<br>Center for Food Security and Public Health Iowa State University 2006 | Infected cattle, sheep and goats may have high levels of virus in their blood which is enough to infect mosquitoes. These animals may serve as a source of infection by boosting the amount of virus (amplify) for many other mosquitoes that may then rapidly spread the disease. These animals may help the disease become established in the environment and may lead to large outbreaks. Humans also develop a high level of virus and may be a source of infection for mosquitoes. |
| Slide 15 | Transmisión<br>*Propagación del virus* | |

Slide 16

## Transmisión a los animales

- Vector
  - Transmitido por mosquitos.
  - Los mosquitos en EE.UU. podrían propagar la RVF si la enfermedad llegara a ingresar al país.

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In animals, transmission of RVF is through a vector (mosquito). RVF virus has been found in several species of mosquitoes. Several of these species of mosquitoes are found in the United States and could potentially contribute to the spread of RVF in this country.

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## Transmisión al ser humano

- Por vector
  - Picadura de mosquito infectado con RVF
- Por contacto directo
  - Tejidos o fluidos corporales de animales infectados
    - Al manejar tejidos durante la parición, carne
- Por aerosol
  - Al respirar el virus durante el sacrificio de animales infectados o en el transcurso del proceso de parición

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Iowa State University 2006

Rift Valley Fever may be transmitted to people from animals through several ways. A person may be bitten by a mosquito infected with RVF. The RVF virus may be transmitted by direct contact of infected animal tissues, meat, or body fluids with a person's skin. The RVF virus may be breathed in during slaughter of infected animals or during the birthing process.

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## Transmisión al ser humano

- Por vía oral
  - Al beber leche no pasteurizada proveniente de un animal infectado.
  - No muy común
- No se propaga de una persona a otra

Center for Food Security and Public Health
Iowa State University 2006

Finally, RVF may be transmitted by drinking unpasteurized milk from an infected animal. This method of transmission is not thought to be as common as the others. To date, no person-to-person transmission has been documented.

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## Fiebre del Valle de Rift en el ser humano

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## La enfermedad en los seres humanos

- Lapso de tiempo desde la exposición hasta la aparición de signos de la enfermedad: de 2 a 6 días
  - Desde ausencia de signos hasta síntomas parecidos a la influenza
    - Fiebre, dolor de cabeza, dolor muscular y en las articulaciones, náuseas y vómito;
    - Recuperación entre 4 y 7 días
  - Enfermedad grave en el 1% de los seres humanos infectados
    - Inflamación de la retina (el ojo)
    - Trastorno hemorrágico
    - Inflamación del cerebro

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The period of time from exposure to the virus until signs of the disease in humans has been reported to be anywhere from 2 to 12 days. The average is 2-6 days. The majority of humans who have RVF are asymptomatic (do not have signs) or have self-limiting flu-like signs. These signs include fever, headache, muscle and joint pain, and possible nausea and vomiting. Recovery is usually in 4-7 days. In less than 1% of humans infected, severe disease can occur. This can include inflammation of the retina of the eye (retinitis), high fever with a bleeding disorder (hemorrhagic fever) or inflammation of the brain (encephalitis). The death rate in humans may reach 1% of the people who are infected.

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Animales enfermos de Fiebre del Valle de Rift

Slide 22

## La enfermedad en los animales

| Tasa de mortalidad 100% | Enfermedad grave Abortos Decesos | Enfermedad grave Virus en sangre Abortos | Infección Virus en sangre | No adquieren la infección |
|---|---|---|---|---|
| Corderos | Borregos | Monos | Caballos | Roedores |
| Becerros | Bovinos | Camellos | Gatos | Conejos |
| Cabritos | Cabras | Ratas | Perros | Aves |
| Cachorros | Humanos | Ardillas | Monos | |
| Gatitos | | | | |
| Algunos roedores | | | | |

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This table is revised from the Foreign Animal Disease, The Gray Book. The death rate may reach 100% in lambs, calves, kids, puppies and kittens. Sheep, goats and cattle have a high death rate of newborn animals and high rate of abortion in pregnant animals. There is a great economic impact from this disease due to the large losses of young animals. Humans can develop severe, life-threatening complications from RVF. Horses, cats, and dogs may have the virus in their blood but they may not become sick. Finally, rodents, rabbits, and birds do not appear to get RVF.

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## Bovinos

- Adultos
  - Fiebre, debilidad, anorexia, babeo, diarrea, piel amarillenta
  - Tasa de mortalidad del 10%
  - Los abortos pueden alcanzar el 100%
- Becerros
  - Fiebre, depresión, muerte súbita
  - Tasa de mortalidad entre 10 y 70%

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Cattle are affected by RVF. Adults usually appear normal. Signs of illness that may be seen include fever, weakness, anorexia, drooling and diarrhea. Yellow skin or mucus membranes (jaundice) is also commonly seen. The death rate in adult cattle may be 10%. Abortions also occur in cattle and can be as high as 100%. Calves develop fever, depression and may suddenly die. The death rate in calves can be from 10-70%.

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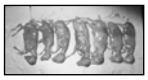
## Borregos y cabras

- Lapso de tiempo desde la exposición hasta la aparición de signos de la enfermedad: menos de 3 días
  - Tasa elevada de abortos
    - En cualquier fase de gestación
  - Los adultos pueden parecer normales
  - Diarrea fétida, piel amarillenta, moqueo nasal
  - Tasa de mortalidad (20-30%)



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Abortion in adult sheep and goats is the most common sign of RVF. It may occur at any state of pregnancy. The fetus will have a decomposed appearance. Abortion rates are very high – in some cases as high as 100%. **Remember birthing tissues and fluid may contain RVF virus which may infect humans.** Adult sheep and goats may appear normal. Clinical signs most commonly seen include fever, snotty nose, yellow skin and mucus membranes (jaundice) and possibly vomiting. Death rate in adults, especially those that have aborted, can be 20-30%; however, abortion may be the only sign seen. This photo of aborted fetuses is from the U.S.D.A.

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## Corderos y cabritos

- Lapso de tiempo desde la exposición hasta la aparición de signos de la enfermedad: de 12 a 36 horas
- Muerte de recién nacidos
  - Fiebre elevada, desgano, sin apetito
  - Muerte – de 12 horas a 2 días
  - Menos de 1 semana de edad
    - Tasa de mortalidad >90%
- Corderos y cabritos de más de 2 semanas de edad
  - Tasa de mortalidad superior al 20%

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The period of time from exposure to RVF virus to signs of the disease in lambs and kids is 12-36 hours. As previously mentioned, aborted fetuses are the most common sign. Newborns most easily get sick. Signs of the disease include high fever (105.8$^{o}$F), listlessness, and lack of appetite (anorexia). Most lambs die within 2 days, but death can occur within 12 hours. The death rate can be over 90% for young less than 1 week old. Lambs and kids over 2 weeks old have a death rate over 20%.

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## Otras especies

- Perros
  - Abortos de hasta el 100%
  - Enfermedad grave y muerte de cachorros
- Gatos: Muerte de gatitos
- Caballos: No se enferman
- Cerdos: No se enferman
- Aves: No contraen la RVF

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Other species can be infected by RVF, but such cases are less common. Dogs can have abortion rates as high as 100%. Puppies become very sick and typically die. Kittens have also been reported to become easily sick from RVF virus. Horses have been experimentally shown to have a low grade virus in their bloodstream; however, to date there have been no cases of RVF in horses. Pigs have been reported to either be very resistant to the virus or develop an infection without signs of the disease. Birds do not get RVF.

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## Medidas a tomar

- A quién llamar si existe sospecha de RVF:
  - Al médico veterinario local;
  - Al médico de atención primaria

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If RVF is suspected, contact your local veterinarian immediately. If human illnesses are noted, contact your primary care physician. These skilled medical professionals can determine if further action is needed.

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Prevención y control

Now we will discuss the prevention and control of Rift Valley Fever. Since mosquitoes (the vector) are necessary to spread the virus among animals, we will focus on vector control which will include; control of mosquito breeding sites, control of mosquito eggs and larvae, and a discussion about adult mosquito control. This picture shows how ordinary trash can become a mosquito breeding site. The jar full of rainwater has several mosquito eggs and larvae in it. (Picture from CDC Public Health Image Library).

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## Prevención

- Control de lugares de ovipostura del mosquito
- Control de huevecillos y larvas de mosquitos
- Control de mosquitos adultos

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## Prevención

- Hábitat del mosquito *Aedes*
  - Deposita los huevecillos en zonas propensas a inundarse
  - Deposita los huevecillos en recipientes
    - Tanques para ganado
    - Fuentecillas para pájaros
    - Neumáticos desechados

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RVF requires a mosquito to spread from animal to animal. One of the most important aspects of prevention and control of this disease is the control of the mosquitoes' habitat. This is because mosquitoes lay their eggs in predictable areas and therefore control efforts can be concentrated. The *Aedes* mosquito typically carries the RVF virus. This mosquito prefers to lay eggs in areas that are prone to flooding, such as a low lying area in a pasture or a ditch. They may also lay eggs in containers that will fill with water. Examples include; stock tanks, buckets, birdbaths, tires, roof gutters and trash. The top photo depicts a flood-prone area after heavy rains in Africa (source: CDC). The bottom photo is a silage pile covered with full tires; half tires or punching holes in them for drainage is ideal to minimize mosquito habitats (source: Danelle Bickett-Weddle, ISU).

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## Prevención

- Eliminar lugares que faciliten la reproducción
  - Drenar o rellenar tierras bajas
  - Nivelar tierras recién urbanizadas
  - Agujerar recipientes para que drenen
  - Disponer correctamente de la basura
  - Limpiar las cunetas
  - Cambiar semanalmente el agua de mascotas/ganado

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Altering the mosquito habitat is a long-term solution to mosquito control and the best mean of control. There are several steps that may be taken to identify and to reduce or eliminate mosquito breeding habitats. Drain or fill in low-lying, flood-prone areas. Grade newly developed land to prevent standing water. Add drainage holes on structures and containers that may trap water such as barrels and old tires. Pick up and properly dispose of all trash, especially anything that could hold water. Clean roof gutters to prevent them from becoming clogged and holding water. Change water in pet bowls, birdbaths, and stock tanks at least once a week. Fill tree holes with sand or mortar or place drainage holes to prevent standing water. Check and drain pool tarps and covers for collected rainwater. This photo depicts old tires that could provide a breeding site for mosquitoes. The document on Pest management for Prevention and Control of Mosquitoes can be found through Washington State University Extension http://pep.wsu.edu/pdf/pls121mosquito.pdf

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## Prevención

- Identificar como objetivo a las larvas del mosquito
  - Conocer las zonas de problemas potenciales
  - Existen productos inocuos, sin substancias químicas
    - BTI en gránulos – zonas de pastizales propensas a inundarse
    - BTI en pastillas sumergibles – tanques para el ganado

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There are non-chemical pesticides that target mosquito larva that are safe and easy to use. These pesticides are used to target known mosquito breeding sites or areas that pose a potential problem. This might include an area that is impractical to drain or difficult to fill. These non-chemical methods include a bacteria that specifically targets mosquito larva. It is called BTI (*Bacillus thuringiensis israelensis*) pronounced ba-SILL-us thur-in-GEN-sus iz-REEL-en-sus. It is available in two different forms. The granules may be used over an area of pasture that is prone to flooding. It is used at the beginning of "mosquito season" and re-applied at the middle of the "mosquito season". The second form, known as a dunk, may be used to treat stock tanks. One dunk will last approximately 30 days. Your local extension office can assist you when making a decision to use any pesticide. This picture depicts cattle standing in water at the edge of an irrigated pasture. (Source: CDC)

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## Prevención

- El control del mosquito adulto es más problemático
  - Puede ser necesario cuando otras medidas de control no tuvieron éxito
  - Es el menos eficiente
  - Es necesario conocer el tipo adecuado y el momento correcto para su aplicación
  - Requiere de personal adecuadamente capacitado
  - Para mayores informes, acudir a la oficina local de servicios de extensión

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Adult mosquito control may be difficult and a single person attempting control may find this difficult and impractical due to a large area that may need to be treated. However it may be necessary when other control measures, such as mosquito breeding site elimination, are unsuccessful. Adult mosquito pesticides are the least efficient and they required knowledge of what type of pesticide to use and the time of the application to be successful. Your local extension office can assist you when making a decision to use any pesticide. This picture depicts a man spraying for adult mosquitoes.

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## Control

- Mosquitos
  - Centrarse en la eliminación de los sitios de ovipostura de la hembra del mosquito
- Vacunación de bovinos, borregos y cabras
  - Puede ocasionar malformaciones congénitas y abortos
  - No está aprobada para utilizarse en EE.UU
- Restringir la movilización de animales
- Restringir la permanencia de personal no esencial en la explotación agropecuaria

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The same information applies while trying to control a RVF outbreak as it does to preventing one--through mosquito control. The focus should be on elimination of mosquito egg laying sites. In addition, vaccination of cattle, sheep, and goats is the most effective method of controlling the disease. However, the current vaccine can cause abortions and birth defects but is usually less than the effect of the disease. This vaccine is not approved for use in the United States. Research is being conducted to develop a safer vaccine. If RVF is suspected, contact your local veterinarian immediately and restrict movement of animals. Humans that are sick with RVF may be a source of virus for mosquitoes. Restrict all non-essential personnel and visitors to your farm during an outbreak.

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## Control

- Evitar a los mosquitos
  - Permanecer en el interior al atardecer, cuando los mosquitos están más activos;
  - Usar pantalones y mangas largas
- Utilizar repelente
  - N,N-dietil-meta-toluamida (DEET)
  - Seguir las instrucciones de la etiqueta
  - No aplicar a mascotas

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Mosquitoes can transmit RVF to people. People should avoid mosquitoes vectors. Stay inside during the evening when mosquitoes are most active. When outside wear long pants and sleeves and use a repellants on exposed skin. Repellant with N,N-diethyl-meta-toluamide (DEET) is the most effective. DEET is an insect repellant that is safe to use on people. Make sure to follow the label directions when using. Do not use on pets. This picture depicts a child being sprayed with a mosquito repellent.

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## Control

- No sacrificar animales enfermos
  - Enterrar o incinerar a los animales muertos durante un brote
- Equipo de protección personal
  - Guantes, overoles, botas, anteojos protectores, máscaras
- Evitar contacto con tejidos y sangre infectados
  - Fetos abortados, necropsia
- El mayor riesgo es para los viajeros

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Although humans may contract RVF through the bite of an infected mosquito, they may also inhale the virus when handling infected animal tissues. This is why sick animals should not be slaughtered during a RVF outbreak. Bury or burn carcasses. Wear personal protective equipment such as gloves, coveralls, boots, protective eyewear and a respirator when handling aborted fetuses or performing necropsies. If possible, avoid contact with infected tissues and blood. Currently the greatest risk for RVF is for travelers to endemic African countries.

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## Control

- Limpiar las áreas donde se aloja a los animales
  - Usar equipo de protección personal
  - Eliminar todo material orgánico de la superficie (estiércol, alimento, tejido animal)
  - Utilizar jabón o detergente con agua tibia
  - Dejar secar
- Desinfectar las áreas donde se aloja a los animales
  - 1 parte de blanqueador:10 partes de agua
  - Virkon-S®

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The RVF virus is easily destroyed by disinfectants. However, some disinfectants are easily inactivated by organic material (manure, feed, animal tissues, etc.). Therefore, cleaning is the first important step when treating an area that has become contaminated with RVF virus. When cleaning and disinfecting, it is important to wear personal protective equipment (gloves, coveralls, boots, protective eyewear and a respirator) since the virus may become airborne. Cleaning begins by removing all organic material from the surface. Next, use soap or a detergent with warm water and let the surface dry. Then apply the disinfectant. One part bleach diluted with 10 parts water or using the product Virkon-S® by DuPont will destroy the RVF virus.

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## Recursos adicionales

- Center for Food Security and Public Health
  - www.cfsph.iastate.edu
- CDC – Sección Especial de Patógenos
  - www.cdc.gov/ncidod/dvrd/spb/mnpages/dispages/rvf.htm
- Nota Informativa de la OMS
  - www.who.int/inf-fs/en/ fact207.htm

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## Agradecimientos

*La elaboración de esta presentación fue financiada con recursos aportados por la Risk Management Agency del USDA al Center for Food Security and Public Health de la Iowa State University.*

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## Agradecimientos

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