"Regional Zoonotic Diseases"

Animals provide many benefits to people, and animal handlers interact with them daily, whether it is related to agriculture or as simple as handling pets, however despite those benefits Animals can carry harmful germs that can be shared with people and cause illness.

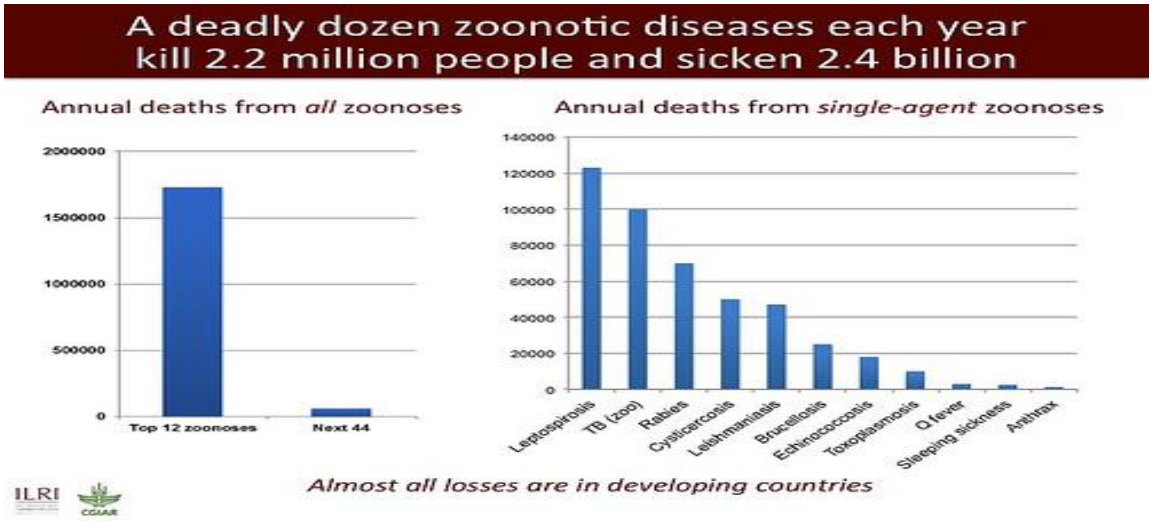
Zoonotic Diseases also known as zoonosis are caused by infections that are shared between animals and people. These diseases can cause illness or death in people.

Types of zoonosis agents:

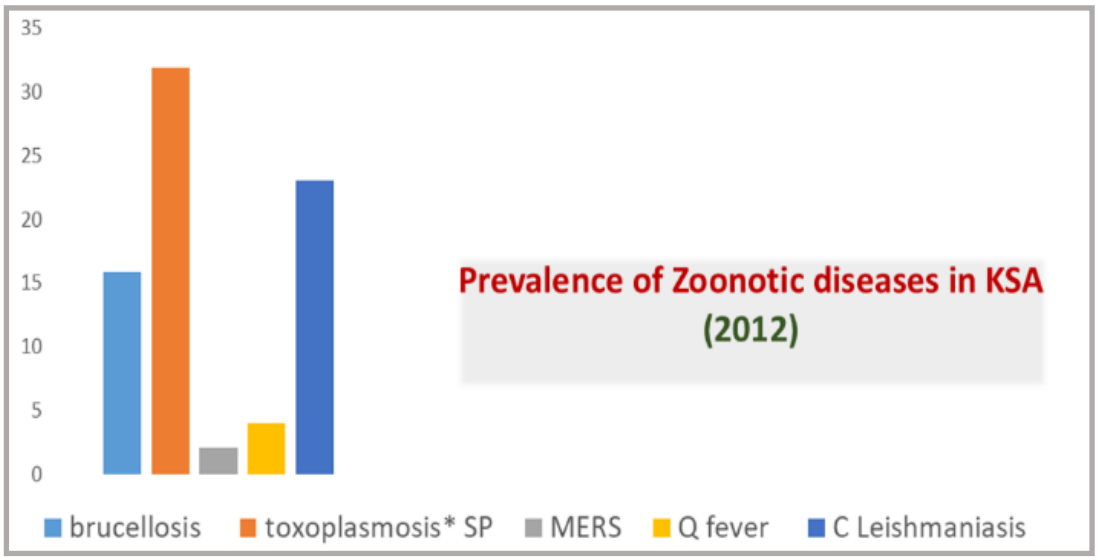
Types of zoonosis causative agents include viruses, bacteria, parasites and fungi.

Most common zoonotic diseases:

Top 12 zoonotic diseases **worldwide** are displayed in the graph



Examples of common zoonotic disease **in Saudi Arabia:**



The Kingdom of Saudi Arabia is characterized by its interest in livestock and the culture of herding, breeding and use of the raw products of cattle, forming a fertile ground for spreading of zoonotic diseases. The diseases that will be discussed in this report include brucellosis, Middle Eastern Reparatory Syndrome coronavirus (MERS-CoV) and toxoplasmosis. These have been selected because their infection circumstances are related to the Saudi culture, either by contact with camels in MERS-CoV infection or consuming the raw dairy products of cattle in brucellosis, and although Toxoplasma gondii reproduces only in cats, wild and domestic cattle are considered as parasite's hosts.

Brucellosis:

Identification:

Brucellosis is also known as Malta fever, undulant fever, or Mediterranean fever. It is a systemic infectious disease that is transmitted to humans through the ingestion of unpasteurized or raw milk and cheese of animals infected with Brucella organisms (e.g. sheep, cattle, camels, pigs, and dogs) or via contact with infected animal.

Infectious agents:

Brucella are small, gram-negative, nonmotile, non-spore-forming, intracellular-reproducing, aerobic coccobacilli.
Four species are pathogenic for humans: Brucella abortus (seven biovars), Brucella melitensis (three biovars), Brucella suis (five biovars) and Brucealla cani.

Epidemiology:

From 2004 to 2012, total number of cases reported in Saudi Arabia for the period was 37,477

2004	2005	2006	2007	2008	2009	2010	2011	2012
5169	3804	3997	4194	3447	4803	4460	3942	3661

- Most cases were in Al-Qassim, Aseer, Hail, Northern Borders, and Najran, while less cases were reported in Al-Jouf, Jazan, Tabouk, Makkah, and Al-Riyadh.
- Highest prevalence of brucellosis was among those aged 15-44 years old, while the lowest number of cases was among those <1-year-old.
- Incidence rate was higher in men than in women.
- Less cases are reported every year; however, they are still more than those of developed countries.

Occurrence:

There has been a noticeable decrease in the incidence and prevalence of brucellosis worldwide . However, it remains a public health concern for local and international health agencies . Among the middle east countries KSA had the highest incidence of brucellosis cases during late 1990s. However, due to implantation of regulations by the Saudi Ministry of Agriculture such as vaccinations for cattle's, better control of livestock and improved cooperation between veterinarians and public health providers. There has been significant decrease in the incidence of brucellosis but still considered as endemic in KSA.

Reservoir:

1. Humans.
2. Animals: sheep, cattle, camels, pigs, and dogs.

Mode of transmissions:

Modes of transmission for the Brucella bacteria include ingestion (undercooked meat), breastfeeding, animal excretions (Bacteria can enter wounds in the skin/mucous membranes through contact with infected animals), and dairy products (unpasteurized).

Incubation period:

The incubation period is highly variable, usually 2-4 weeks, and can be 1 week to 2 months or longer.

Susceptibility:

- Those at direct contact with animals and animal tissue are at high risk of developing brucellosis infection (e.g. Slaughterhouse workers, meat-packing employee, veterinarians, laboratory workers and raw milk consumers) .
- People resining in regions that don't have effective public health and domestic animal health program such as those in the Mediterranean Basin Mexico, South and Central America, Eastern Europe, Asia, Africa, the Caribbean, and the Middle East are also at risk for developing this infection.

Most common causes in Saudi Arabia:

The local custom of consuming raw products of sheep, goats, and camels. Moreover, animal reservoir of infection in the country complicated by importation of live animals both for sacrifice during Haj periods and to enhance the commercial sector.

Symptoms:

Most frequent symptoms are:	The most frequent clinical findings are:
1. Arthralgia 2. Fever 3. Fatigue	1. Fever 2. Hepatomegaly 3. Splenomegaly 4. Peripheral arthritis

Tests:

1. Bacterial Isolation: for culture (a specimen can be isolated from bone marrow, cerebrospinal fluid, purulent discharge, and joint fluid).
2. Serology: Brucella microagglutination test (BMAT) can detect antibodies to Brucella species abortus, melitensis or Brucella suis, but not Brucella canis.

Prevention:

1. Preparation of dairy products by Pasteurization.
2. Practicing of universal precautions in handling animals.

Treatment:

Antibiotics prescription based upon causative species and patient factors.

MERS-COV:

Identification:

Middle East Respiratory Syndrome (MERS) is respiratory viral illness that was first found in humans. The causative agent is corona virus (CoV). Most infected individuals with MERS-CoV have develop severe acute respiratory illness including fever, cough, and shortness of breath. About 3 to 4 out of 10 infected individuals were reported dead.

Infectious agents:

MERS-CoV is a RNA virus, corona viridae family, corona Virus.

Epidemiology:

From 2012 to 2015, total number of cases reported in Saudi Arabia for the period was 939 with mortality percentage 57.3%

2012	2013	2014	2015
241	557	136	5

- The Highest proportions of MERS-CoV of cases were from Riyadh followed by Jeddah.
- Highest prevalence was among those aged those aged ≥ 40 years old.
- The prevalence among men was higher than women.

Occurrence:

MERS-Co was first reported by health officials in Saudi Arabia in September 2012. A retrospective (backward-looking) investigations later showed that the first known cases of MERS happened in Jordan in April 2012. Up until now all cases of MERS have been associated with travel or residence in the Arabian Peninsula or countries surrounding it. in 2015 the Republic of Korea had the largest known outbreak of MERS outside the Arabian Peninsula. It was associated with traveler returning from the Arabian Peninsula.

Reservoir:

Most of human cases of MERS-CoV have been linked to direct human-to-human infections in health care settings. Dromedary camels are a major reservoir for MERS-CoV and an animal source of MERS-CoV infection in humans. It is also thought that human bats are a reservoir of MERS-CoV.

Mode of transmissions:

MERS-CoV, from coronaviruses. the precise ways the virus spreads are not currently well understood (cite). MERS-CoV has spread from ill people to others through close contacts, such as caring for or living with an infected person. Infected people have spread MERS-CoV to healthcare providers in the hospital. Researchers studying MERS have not seen any ongoing spreading of MERS-CoV in the community.

Incubation period:

Incubation period approximately is range from 2 to 14 days.

Susceptibility:

1. Travelers who came from the Arabian Peninsula recently.
2. Close contacts people who Close contacts to a patient with MES-COV.

3. Healthcare providers who do not follow the recommended infection-control precautions
4. People who contact to Camels recreantly or recently

Most common causes in Saudi Arabia:

Epidemiological data available showed that the infection is primarily zoonotic in nature, with a limited human-to-human transmission.

Bats are found to be the natural host, but it's unlikely to have a direct contact between bats and humans so a possible scenario is that a single variant from a spectrum of related beta coronaviruses in bats successfully was transmitted to an intermediate animal host species (at least in the middle east), with subsequent incidental transmission into the human population.

Symptoms:

Most infected people present with severe acute respiratory symptoms including:	Some patients come with gastrointestinal symptoms including:
1. Cough 2. Fever 3. Shortness of breath	1. Diarrhea 2. Nausea 3. Vomiting

Infected people which under of other medical conditions are at higher risk to having severe and serious complication likes pneumonia, kidney failure and die (cite).

Tests:

1. Molecular Tests (diagnostic test): To detect viral RNA by real-time reverse-transcription polymerase chain reaction (rRT-PCR) assays.
2. Serology Tests (for previous infection): To detect antibodies to MERS-CoV including;
   - Screening test (ELISA): To detect for antibodies against two different MERS-CoV proteins, the nucleocapsid (N) and spike (S), if either of ELISAs positive we will do confirmatory test.
   - Confirmatory test (microneutralization assay): used to measure neutralizing antibodies. It's a highly specific but the results take long times at least 5 days.

Prevention:

1. Wash your hand with soap and water if you could or keep alcohol-based hand sanitizer with you everywhere.
2. Don't touch your eyes, nose, and mouth with uncleaned hands.
3. Reduce personal contact as much as, you can Like kissing and handshake especially with the sick people.
4. If you a cough or sneezing, you should Cover your nose and mouth with a tissue then throw.
5. Regularly clean and disinfect MERS-CoV patients' rooms and frequently touched surfaces and objects.

Treatment:

There is no specific antiviral treatment, Just provide a medical care for the patients to help relieve symptoms and care to support vital organ functions.

Toxoplasmosis:

Identification:

Toxoplasmosis is caused by a protozoan parasite called “toxoplasma gondii”. This parasite can last in the host’s body for a lifetime after the infection, but it can cause very few symptoms due to the body’s immune system. However, it can be serious for those who are pregnant or immunocompromised.

Infectious agents:

1. Protozoa parasite
2. Apicomplexa, Eimeriida: toxoplasma gondii
3.

Prevalence:

From 2012 to 2015, total number of cases reported in Saudi Arabia for the period was 939 with mortality percentage 57.3%

2002	2004	2009	2010	2011	2012	2013	2015	2016
35.6%	21%	22.6%	51.4%	44.7%	31.9%	24.1%	27.9%	32.5 %

- The incident of toxoplasmosis in Saudi Arabia was covered in some articles from 2002 - 2016
- Most cases were in Eastern Region, Jizan, Najran, Qassim and Abha.
- The highest incidence of the toxoplasmosis was in pregnant women and Foreign workers.

Occurrence:

Cats in the neighborhood increased the risk of toxoplasmosis among children whilst socio-economic status did not play a role in the transmission of toxoplasmosis.

Reservoir:

Mostly the cats who ingest the oocyte (68.3%).

Mode of transmissions:

Toxoplasma infection occurs by one of the following:

1. Eating undercooked, contaminated meat or shellfish was contaminated by knives, utensils, cutting boards.
2. Drinking water contaminated with toxoplasma.
3. Swallowing the parasite through contact with cat feces that contain Toxoplasma.
4. Congenital mother to child transmission.
5. Receiving an infected organ transplant or infected blood via transfusion, though this is rare.
6. No human to human transmission.

Incubation period:

- In children it takes weeks or months.
- Short incubation periods in case of ingestion raw liver (hours or days). But eggs require 1-3 weeks.

Susceptibility:

Having 3 or more kittens:

1. Eating meat which is locally produced cured, dried, or smoked.

2. Eating rare lamb
3. Working with meat
4. Pregnant women.

Most common causes in Saudi Arabia:

The seroprevalence of toxoplasmosis in KSA is more common among women who live in rural regions. Because of exposure to the risk factors such as, consumption of unpasteurized milk, unfiltered water, non-washed vegetables or fruit and soil contact. In addition, the higher number of cats in rural area and the local habits in these areas by more responsibilities of the females concerning houses and farms more than their husbands, which increased their chances of exposure and infection.

Symptoms:

1. Fever
2. Lymphadenopathy
3. Hepatic dysfunctions
4. Congenital hydrocephalus with mental retardation
5. Seizures
6. Blindness

Tests:

1. Serologic testing: To measure immunoglobulin G (IgG) and determine if a person has been infected.
2. Diagnostic test: for detecting parasites and it done by cerebrospinal fluid (CSF) or other biopsy material but this process requires time and efforts.
3. Molecular techniques: To detect the parasite's DNA in the amniotic fluid in case of mother to child congenital transmission.
4. Ocular disease is diagnosed depend on the appearance of the lesions in the eye and related symptoms and often serologic testing.

Epidemiology:

Prevention of primary infection is best achieved through health education. Recommendation include cooking meat on high temperatures at least 150 degrees' f and avoiding handling with the raw meat without wearing gloves. Cat owners are warned to avoid direct contacting with litter trays or soil that may be stain or contaminated with cat feces, and cats that are fed a brand cat food less likely to get infected. Also, pregnant women should avoid contacting with cats or their stuffs. Early diagnosis of acute infection in pregnant women can prevent of congenital transmission by administration of a prophylactic regimen of spiramycin.

Treatment:

- Healthy people:

Most healthy people recover from toxoplasmosis without any treatment, and persons who are sick can treat by combination of drugs as pyrimethamine and sulfadiazine, plus folinic acid.

- Pregnant women, newborns, and infants:

They can be treated, even if the parasite is not eliminated.

- Persons with ocular disease:

Treated depend on the size of the eye lesion and the characteristics of it.

- Persons with compromised immune systems

  Compromised immune systems patient need to treat until they have improvement in their condition, and for AIDS patient they need to take medication for the rest of their lives or for as long as they immunosuppressed.

Conclusion

In conclusion, zoonotic diseases can spread around the world very quickly and could be fetal, so it's important for our country to work closely with other countries to build strong partnerships with human, animal, and environmental health organizations like:

- ✓ The World Health Organization (WHO) External
- ✓ The World Organization for Animal Health (OIE) External
- ✓ The Food and Agriculture Organization of the United Nations (FAO)External

This will protect Saudis from illnesses that cross borders and affect travelers and protect from zoonotic diseases.

Compulsory Vaccines in KSA(Seminar)

Vaccine	Infectious agent	Mode of transmission	Type of vaccine	Route of administration	Side effects	Age group	Contraindications
BCG	Myco-bacterium tuberculosis .	Spreads through the air from one person to another when coughing.	Live attenuated vaccine.	Intradermal	1. Hardness at the injection site, followed by a raised blister. 2. Headache 3. Fever 4. Swelling of lymph nodes 5. Lymphadenitis - Very rare: 6. Anaphylactic reaction	- Babies and children under 16. - Adults up to 35 years of age if their job has a high risk of contact with people or animals infected with TB.	- Immunosuppressed - immunocompromised - Pregnancy
HBV	Hepatitis B virus (HBV)	The virus is transmitted through contact with the blood or other body fluids of an infected person. - Parental: IV drug abuser and healthcare workers. - Sexual - Perinatal: Vertical from the mother.	Inactivated	Intramuscular	1. Headache 2. Pain, redness and hardness at the injection site 3. Feeling tired or irritable 4. Loss of appetite	Infants (3 doses): **After birth** for the first dose **1 through 2 months** **6 through 18 months** Adults with risk factors: High-risk sexual behaviour Partners and household contacts of HBsAgpositive persons. Injecting drug users Health care workers International travellers to HBV-endemic countries.	History of allergic reactions to any of the vaccine's components or yeast.
DTaP	**Diphtheria :** Corynebacterium diphtheria **Tetanus:** Clostridium tetani **Pertussis:** Bordetella pertussis	**Diphtheria and pertussis:** Transmitted from person to person, usually through respiratory droplets, like from coughing or sneezing **Tetanus:** Through contaminated puncture wounds, lacerations or burns, or contaminated injected 'street drugs'.	**Diphtheria and tetanus:** Toxoid vaccine **Pertussis:** Subunit, recombinant, polysaccharide , and conjugate vaccine	Intramuscular route **Children:** the vastus lateralis muscle of the thigh. **Older children and adults:** the deltoid muscle in the upper arm.	1. Fever 2. Redness and swelling at the site of injection 3. Soreness and tenderness at the site of injection 4. Fussiness 5. Tiredness 6. Vomiting	2,4,6,18 months and at primary school age	1. Hyper sensitivity to the vaccine 2. Fever 3. Serious neurological symptoms
Hib	haemophilus influenzae type B	Respiratory droplets	Inactivated	Intramuscular	1-Redness, heat, or swelling at the site of injection. 2-Fever.	Infants and children age 5 and younger	-Infants younger than 6 weeks -People who have had a life-threatening allergic reaction to the Hib vaccine in the past -People who have a serious allergy to any ingredient in the vaccine
PCV	Streptococcus pneumoniae	Person-person through direct contact to respiratory secretions	Inactivated	Intramuscular	1. Drowsiness 2. Loss of appetite 3. Redness or tenderness 4. Fever 5. Irritability	2, 4, 6, and 12–15 months of age.	Severe allergic reaction to previous dose of vaccine.

Rotarix	Rota Virus	person-to-person spread mainly through the faecal-oral route	Live attenuated	Oral	Crying, mild irritability, fever, abdominal pain, diarrhea, vomiting.	Children under 5 years of age, especially those ages 6 months - 2 years	- Infants with a history of severe allergic reaction after previous exposure to Rotavirus vaccine or its components - Infants diagnosed with severe combined immunodeficiency - Infants with a history of intussusception
DPV and IVP	Polio virus	• person-to-person spread mainly through the faecal oral route • In areas with high hygiene: oral oral route (saliva)	1- Inactivated polio vaccine (IPV) –against poliovirus types 1, 2, and 3 2- Poliovirus vaccine inactivated enhanced potency (eIPV) 3- Live attenuated: Monovalent and Bivalent polio vaccines: against poliovirus types 1, and 3.	1,2- By injection: intramuscular or subcutaneous 3- Orally (Aren't used anymore in the United States, but used in other areas)	Fever, joint pain, fatigue, irritability, nausea, vomiting, and loss of appetite. Injection site reactions (hives, itching, skin redness, a sore spot where they got the shot)	**All children and infants** should get four doses total: 2 months old 4 months old 6 through 18 months old 4 through 6 years old **Adults**: - Who are traveling to countries where polio is spreading. - Study polio in a lab. - Healthcare professionals working with people who could have polio.	1- Patients with any acute, febrile illness. 2- Cases of anaphylaxis within 24 hours of a previous dose of the vaccine or any of its components. 3- Cases of thrombocytopenia, vitamin K deficiency, coagulopathy (hemophilia), or Patients on anticoagulants should be monitored.
Measles	Measles virus	Coughing and sneezing via close personal contact or direct contact with secretions.	Live attenuated vaccine	Intramuscular	1. Fever. 2. Injection site pain. 3. Red or purple discolorations on the skin known as thrombocytopenic purpura. 4. Seizures related to fever (febrile seizure).	Children: 9 months old.	1. Pregnancy. 2. Anaphylaxis after previous dose or severe allergy to vaccine component. 3. Severe allergy to gelatin. 4. HIV-infected children (may receive the vaccine if their CD4+ lymphocyte count is greater than 15%).
Varicella	Varicella zoster virus (VZV).	By touching or breathing in the virus particles that come from chickenpox blisters, and possibly through tiny droplets from infected people that get into the air after they breathe or talk.	Live attenuated vaccine	subcutaneous	1. Pain, tenderness or swelling at the site of injection. 2. Soreness. 3. Fever. 4. Redness or mild rash at site of injection. 5. Serious allergic reaction (anaphylaxis), are rare. 6. Seizures. 7. Infection of the lungs (pneumonia) or the brain and	kids are between 12 and 15 months old. They receive a booster shot for further protection at 4 to 6 years of age. Kids who are older than 6 but younger than 13 who have not had chickenpox also may receive the vaccine, with the two doses given at least 3 months apart. Kids 13 years or older who have not had either chickenpox or the vaccine need two vaccine doses at least 1 month apart.	1. History of a serious reaction (e.g., anaphylaxis). 2. Pregnant now or may become pregnant within 1 month. 3. Having any malignant condition affecting the bone marrow or lymphatic system. 4. Receiving high-dose systemic immunosuppressive therapy. 5. Family history of congenital or hereditary immunodeficiency in first-degree relatives.

					spinal cord coverings (meningitis). 8. Rash all over the body.		
MMR	-Measles -Mumps -Rubella	Person-to-person through respiratory droplets, direct contact with saliva of an infected person.	attenuated (weakened) live virus vaccine.	subcutaneous injection.	1. injection site reactions (pain, redness, swelling, or a lump). 2. Fever. 3. Rash. 4. Headache. 5. Dizziness. 6. joint or muscle pain. 7. Nausea. 8. vomiting, or diarrhea. 9. easy bruising or bleeding. 10. Seizures. 11. mental/mood changes (such as confusion).	CHILDREN: -First dose at 12 through 15 months of age. -Second dose at 4 through 6 years of age. STUDENTS POST HIGH SCHOOL: who do not have evidence of immunity need **two doses** of MMR ADULTS: who do not have evidence of immunity should get **at least one** dose of MMR vaccine.	1. Life-threatening allergic reaction to the antibiotic neomycin, or any other component of MMR vaccine or previous dose of MMR. 2. people who are sick at the time the shot is scheduled. 3. Pregnant women.
HAV	Hepatitis A virus	person-to-person spread mainly through the faecal-oral route (contaminated food or water)	Inactivated vaccines	Intramuscular Injection	1. Low fever, general ill feeling. 2. Nausea, loss of appetite. 3. Headache. 4. Swelling, tenderness, redness, warmth, or a hard lump where the shot was given.	CHILDREN: -12 through 23 months for the first dose. -2 through 4 years for the second dose. ADULTS: Who are at risk for hepatitis A can get vaccinated. The shot is given in 2 doses each dose 6 to 18 months apart.	1. Life-threatening allergic reaction to the hepatitis A vaccine or any ingredient in the vaccine. 2. People who are moderately or severely ill.
CV4	Neisseria meningitidis	sharing respiratory and throat secretions (saliva or spit) for example, coughing or kissing.	polysaccharide–protein conjugate vaccine	intramuscular	1. Injection site pain Swelling or 2. redness 3. Malaise 4. Headache 5. Fever 6. Serious allergic reaction, are very rare.	- 9 months to 55 years old. - 1st dose: at age of 9 months. 2nd dose: at age of 12 months.	1. People who have had a serious allergic reaction to a previous dose of either meningococcal vaccine or to one of the vaccine components. The packaging of some meningococcal vaccines may contain latex. Information on the contents of each vaccine is included with each vaccine. 2. People who are moderately or severely ill.