STANDARDS RELATED DOCUMENT

SRD-7 to AJMedP-4

VACCINATIONS CATALOGUE WITHIN THE NATO & PfP FORCES

Edition A Version 1

OCTOBER 2019

NORTH ATLANTIC TREATY ORGANIZATION

Published by the
NATO STANDARDIZATION OFFICE (NSO)

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NORTH ATLANTIC TREATY ORGANIZATION (NATO)

NATO STANDARDIZATION OFFICE (NSO)

NATO LETTER OF PROMULGATION

8 October 2019

1. The enclosed Standards Related Document, VACCINATIONS CATALOGUE WITHIN THE NATO & PfP FORCES, which has been approved in conjunction with AJMedP-4 by the nations in the Military Committee Medical Standardization Board, is promulgated herewith.

3. This publication shall be handled in accordance with C-M(2002)60.

Zoltán GULYÁS
Brigadier General, HUNAF
Director, NATO Standardization Office

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Content

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Chapter 1 - Introduction

Aim

This catalogue of vaccination policies provides a snapshot of the vaccination practices, regulations and policies in the NATO & PfP Forces. Within this document, the term "vaccination" is used to describe the use of biological preparations to improve the immunity of individuals against a particular infectious disease. Other terms in common parlance that may refer to this process include "immunisation", and "inoculation".

Ownership of the risk and the responsibility for vacciation policy rests with the nations, and is not a matter for standardisation within the Alliance. Notwithstanding, knowledge of the similarities and differences between the policies of nations sending personnel to multinational operations is useful to medical staffs. It may also be of interest to nations in the process of reviewing their current policies.

Therefore, to better reflect the role of the catalogue, it is now maintained as a Standards Related Document in support of AJMedP-4. It will be updated annually and replaces STANAG 2037, AMedP-23 which is to be cancelled having not been updated since 2012.

Disclaimer

The catalogue is not an authoritative statement of current vaccination policies; nor does it provide evidence to support recommendations for specific vaccination policy. The annual update cycle means that the information may not reflect changes in policy since the catalogue update.

For authoritative information about current policy, or where there is still uncertainty, please refer to the national point of contact.

Data Collection Method

The information contained within the catalogue is obtained via a standardized survey of nominated points of contact for each nation. The survey is issued in January for completion by March of the same year. The update is normally published in April each year.

Custodian

The custodian of the catalogue is the Deployment Health Surveillance Capability of NATO MILMED COE. Please email your comments and/or suggestions to **info.dhsc@coemed.org**

Classification

The information contained within the catalogue is Unclassified. It has been reproduced here with the kind permission of the nations.

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Chapter 2: Vaccinations Practices in NATO & PfP Forces

		AUT	BEL	BGR	CAN	CHE
Updated Data Catalogue		2019	2019		2019	2019
Adenovirus VIS						A,R
Anthrax						
Cholera		S,T			M,T	T,R
Dengue						
Diphteria		A	A,M,S,T		A	A
Hepatitis A		A	M,S,T		A	T,R
Hepatitis B		A	M,S,T,O		A	A,R
HPV					A	
Influenza Seasonal		M,S,R	M,S,T,R,O		A	A,R
Japanese Encephalitis		S,T	T		M,S,T	T,R
Leptospirosis						
Measles		A	M,S,T		A	A
Meningococcal Meningitis	A,C					
	B				O	
	C					
	A,C,Y,W-135	A	M,S,T		M,S,T	A,R
Mumps		A	M,S,T		A	A,R
Pertussis		A	A,M,S,T		A	A,R
Pneumococcal Disesase		R,O	R		O	
Polio	live					
	inactived	A	M,S,T		A,M	A,R
Rabies		M,S,T	M,S,T		M,T,O	T,R
Rubella		A	M,S,T		A	A,R
Smallpox						
Tetanus		A	A,M,S,T		A	A,R
Tickborne Encephalitis		A	S,T		M,T	A,R
Tuberculosis						
Typhoid	live					T,R
	inactived	S,T	S,T		M,T	
Varicella		O			A	A,R
Yellow Fever		S,T	M,S,T		M,S,T	T,R

Codes:

A= **All** Personnel

M= All Deployable Personnel (personnel susceptible to be deployed on a (planned) **Mission**)

S= Alert Forces (**Stand-by** with NTM < 2 months e.g. EUBG, NRF,...)

T= Personnel in areas at risk (e.g. **Travellers**,...)

R= **Recommended** / voluntary

O= **Occupations** at risk (e.g. Nurses,...)

		CZE	DEU	DNK	ESP	EST
Updated Data Catalogue		2019	2019	2019	2019	2019
Adenovirus VIS						
Anthrax		O	O			
Cholera		T,R	T	T	T,R	T
Dengue						
Diphteria		T,R	M,S,R	A	A,R	A,M,S
Hepatitis A		M,S,T,R	M,S,T,O	A	A,R	M,S,T
Hepatitis B		M,S,T,R,O	M,S,T,R,O	A	A,R	M,S,O
HPV			R			
Influenza Seasonal		M,S,R	M,S,T,R,O		M,R,O	A
Japanese Encephalitis		T	S,T	T	T,R	
Leptospirosis						
Measles		T,O	M,S,R	A	A,R	
Meningococcal Meningitis	A,C					M,T
	B	R				
	C					
	A,C,Y,W-135	M,T,R	S,T	T	S,T,R	S,T
Mumps		T,O	M,S,R	A	A,R	
Pertussis		T,O	M,S,R		A,R	
Pneumococcal Disesase						
Polio	live					
	inactived	M	M,S,T,R	A	S,R	M,S,T
Rabies		T	S,T,O	T	T,R	M,S,T
Rubella		T,O	M,S,R	A	A,R	
Smallpox						
Tetanus		A	M,S,R	A	A,R	A,M,S,T
Tickborne Encephalitis		S,T,R,O	M,S,T,R,O	T	T,R	A
Tuberculosis						
Typhoid	live			T		
	inactived	M,T	S,T		M,T,R	M,S,T
Varicella						
Yellow Fever		T	S,T	T	S,T,R	M,S,T

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		FRA	GBR	GRC	HUN	IRL
Updated Data Catalogue		2019	2019			2019
Adenovirus VIS						
Anthrax			S,R,O			
Cholera		T	T			M,S,T
Dengue						
Diphteria		A	A			A,M,S,T
Hepatitis A		M,S,R,O	A			A,M,S,T,O
Hepatitis B		A,O	A			A,M,S,T,O
HPV		R	R			
Influenza Seasonal		A,O	T,O			M,S,T,R,O
Japanese Encephalitis		T	T			M,S,T
Leptospirosis		O				
Measles		A,O	A			A,M,S,T
Meningococcal Meningitis	A,C					
	B					
	C					
	A,C,Y,W-135	A,M,S	A,S,T			M,S,T,O
Mumps		A	A			A,M,S,T,O
Pertussis		A,R,O				A,M,S,T,O
Pneumococcal Disesase		R	T,O			
Polio	live					
	inactived	A,T	A			M,S,T
Rabies		T,O	S,T,O			M,S,T
Rubella		A	A			A,M,S,T
Smallpox			O			
Tetanus		A	A			A,M,S,T,O
Tickborne Encephalitis		T	T			M,S,T
Tuberculosis		O	O			
Typhoid	live		S,T			
	inactived	M,S				A,M,S,T
Varicella		R,O	O			
Yellow Fever		M,S	A			M,S,T

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		ISL	ITA	LTU	LUX	LVA
Updated Data Catalogue			2019	2019	2019	
Adenovirus VIS						
Anthrax						
Cholera			M,S		T	
Dengue						
Diphteria			A	A	A	
Hepatitis A			M,S	M,S	M	
Hepatitis B				M,S,O	M	
HPV						
Influenza Seasonal			M,S	A,R	R	
Japanese Encephalitis			M,S		T	
Leptospirosis					T,O	
Measles				M,S	M	
Meningococcal Meningitis	A,C					
	B			T		
	C					
	A,C,Y,W-135		A	M,T	M	
Mumps			A	M,S	M	
Pertussis			A		A	
Pneumococcal Disesase						
Polio	live					
	inactived		A	M,S	A	
Rabies			M,S	M,S	M	
Rubella			A	M,S	M	
Smallpox			A			
Tetanus			A	A	A	
Tickborne Encephalitis			M,S	A	M	
Tuberculosis						
Typhoid	live					
	inactived		M,S	M,S	M	
Varicella			A			
Yellow Fever			M,S	M	M	

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O= **Occupations** at risk (e.g. Nurses,...)

		NLD	NOR	POL	PRT	ROU
Updated Data Catalogue		2019	2019		2019	
Adenovirus VIS						
Anthrax						
Cholera			S,T		T	
Dengue						
Diphteria		A	A,M,S,T,O		A,M,S,T	
Hepatitis A		M	M,S,T,O		M,S,T	
Hepatitis B		A	M,S,T,O		A,M,S,T,O	
HPV						
Influenza Seasonal		S,T	M,S,T,R,O		R,O	
Japanese Encephalitis		S,T			T	
Leptospirosis						
Measles		A	A,M,S,T,O		A,M,S,T,O	
Meningococcal Meningitis	A,C					
	B					
	C					
	A,C,Y,W-135	S,T	S,T		M,S,T	
Mumps		A	A,M,S,T,O		A,M,S,T,O	
Pertussis		A	A,M,S,T,O		A,M,S,T,O	
Pneumococcal Disesase					R	
Polio	live					
	inactived	A	A,M,S,T,O		A,M,S,T	
Rabies		S,T	S,T		T	
Rubella		A	A,M,S,T,O		A	
Smallpox		T				
Tetanus		A	A,M,S,T,O		A,M,S,T,O	
Tickborne Encephalitis		S,T	S,T		S,T	
Tuberculosis			S,T		A	
Typhoid	live	S,T	S,T			
	inactived				M,S,T	
Varicella					T,O	
Yellow Fever		S,T	S,T		S,T	

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R= **Recommended** / voluntary

O= **Occupations** at risk (e.g. Nurses,...)

		SVK	SVN	SWE	TUR	USA
Updated Data Catalogue		2019		2019		2019
Adenovirus VIS						
Anthrax						T
Cholera		T		T		T
Dengue						
Diphteria		A,M,S,T,O		A,R		A,M,S,T,O
Hepatitis A		A,M,S,T,O		T		A,M,S,T,O
Hepatitis B		A,M,S,T,O		T,O		A,M,S,T,O
HPV						R
Influenza Seasonal		M,S,T,O		M		A,M,S,T,O
Japanese Encephalitis		T		T		T
Leptospirosis						
Measles				A,R		A,M,S,T,O
Meningococcal Meningitis	A,C					
	B					
	C					
	A,C,Y,W-135	A,M,S,T,O		T		A,M,S,T,O
Mumps				A,R		A,M,S,T,O
Pertussis		A,M,S,T,O		A,R		A,M,S,T,O
Pneumococcal Disesase						R
Polio	live					
	inactived	A,M,S,T		A,R		A,M,S,T,O
Rabies		T		O		O
Rubella				A,R		A,M,S,T,O
Smallpox						T
Tetanus		A,M,S,T,O		A,R		A,M,S,T,O
Tickborne Encephalitis		A,M,S,T,O		T,O		
Tuberculosis		R				
Typhoid	live			T		
	inactived	M,S,T,O				M,S,T,O
Varicella						A,M,S,T,O
Yellow Fever		T		T		T

Codes:

A= **All** Personnel

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S= Alert Forces (**Stand-by** with NTM < 2 months e.g. EUBG, NRF,...)

T= Personnel in areas at risk (e.g. **Travellers**,...)

R= **Recommended** / voluntary

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Nations Comments		
1	**AUT**	No comment.
2	**BEL**	ACWB-GID-INFECT-001" are the Belgian Military Guidelines about vaccination.
3	**BGR**	---
4	**CAN**	1. Anthrax and smallpox vaccines would be provided only in the case of a deliberate release. 2. Adenovirus, dengue, leptospirosis, and tuberculosis vaccines are not offered. 3. Meningococcal B and pneumococcal vaccines are offered to personnel at higher risk for the disease only.
5	**CHE**	In the Swiss Armed Forces all vaccinations are voluntary.
6	**CZE**	No comment.
7	**DEU**	No comment.
8	**DNK**	No comment.
9	**ESP**	Due to Spanish regulations vaccines are all recommended and cannot be compulsory, even to take part in an operation. In the event that somebody doesn´t give his/her consent to be vaccinated prior to deployment, it is the commander´s decision wether to take this person to the operation or not. In any case, the person who rejects the vaccination must sign a document of "refusal to vaccination". At recruitment all personnel are checked for the "all personnel" (A) vaccines. ESP Armed Forces offer catch-up in case of any gap.
10	**EST**	Vaccination against HPV, measles, mumps, pertussis, rubella and tuberculosis belongs to Estonian national routine immunization program and therefore is not reflected in the current catalogue.
11	**FRA**	- Influenza seasonal vaccine: the schedule is based on a three yearly immunization for service members (each year, a third of the workforce is vaccinated); however, annual vaccination is recommended for healthcare workers. - ACWY meningitis vaccine: newly recruited service members systematically receive the injection of tetravalent vaccine within 1 week after their recruitment. Boosters vaccines are injected only for deployable service members (booster = 5 years after the previous injection). - Rabies vaccine: recommended for occupations at risk (veterinary personnel) and military personnel travelling to isolated areas. - Cholera vaccine: cholera vaccination is mandatory since 2018 only for peacekeeping military personnel who are deploying into areas where there is active cholera disease (in order to follow UNITED NATIONS decision)
12	**GBR**	All immunisations given on the basis of informed consent. * Influenza vaccine offered to HCWs and those in recognised (health) risk categories. *HPV vaccine offered to recruits who have missed the childhood immunisation offer. *Men ACWY offered to all recruits and then offered as booster prior to deployment or high readiness perio. *Rabies vaccine offered dependent on role, readiness or deployment location. *Polio vaccine offered to all Personnel and in relation to current IHR requirements.
13	**GRC**	---
14	**HUN**	---
15	**IRL**	No comment.
16	**ISL**	---
17	**ITA**	The choice among mandatory vaccines for all deployable personnel (including alert forces, personnel in areas at risk) is based on a score obtained by a risk matrix. The risk assessment process that leads to that risk matrix is the risult of MEDINT products in addition to informations from the area of operations, operational engagement, logistic situation and short or long lasting deployment.

Nations Comments

18	**LTU**	A: During extraordinarily situations all personnel get vaccination against Anthrax, Smallpox and etc. M: Deployable personnel vaccination depends on region of mission. T: Soldiers of compulsory military service (conscripts) get additional vaccination against Meningococcal B and A, C, Y, W-135 infections.
19	**LUX**	No comment.
20	**LVA**	---
21	**NLD**	No comment.
22	**NOR**	M=absolute minimum, depending on region of mission others will be added S= all vaccines indicated T= not neccesarily all, dependent on destination
23	**POL**	---
24	**PRT**	BCG was generally given to every newborn in Portugal until 2016, and so all military born in Portugal has been vaccinated.
25	**ROU**	---
26	**SVK**	Head sanitarian of Ministry of Defence guidance is in line with STANAG 2037 (Ed.9,2012) AMedp - 23 and as well as with currend WHO guidance.
27	**SVN**	---
28	**SWE**	No comment.
29	**TUR**	---
30	**USA**	Note that in the U.S. Department of Defense, some training locations require adenovirus vaccination of trainees Additional Points of Contact: Ms. Tara Reavey, DoDvaccines@mail.mil COL Mark Ireland, mark.a.ireland.mil@mail.mil

National Guidelines References

AUT	2018	Vaccination Plan in Austrian Army
BEL	2018	ACWB-GID-INFECT-001
BGR		
CAN		No Data
CHE	2019	Swiss Federal Office of Public Health
CZE		Regulations of Chief of Public Health MoD
DEU	2014	Zentralvorschrift A1-840/8-4000
DNK	2018	Danish Armed Defense Vaccination Policy
ESP	2018	ESP Technical Instruction 2018 + MoH recommendat
EST	2013	Chief of Defence guidance # 227
FRA	2019	French armed forces immunization schedule
GBR	2018	Public Health England; Immunisation against infectious disease JSP 950 Lflt 7-1-1
GRC		
HUN		
IRL		No Data
ISL		
ITA	2018	MOD and Ministry of Health regulation
LTU	2018	Order of the Minister of National Defense
LUX	2018	Internal SOP based on various civ/mil recommend.
LVA		
NLD		No Data
NOR	2019	NOR regulation on vaccine and medical prophylaxis
POL		
PRT		No Data
ROU		
SVK	2008	Head sanitarian of Ministry of Defence guidance
SVN		
SWE	2018	National vaccination program Internal regulations (FM 2018-2646:4)
TUR		
USA	Various	Advisory Cmte on Imm Practices/combat command req

Diseases Description and Vaccines

Sources: http://www.who.int/immunization/en/ - https://www.cdc.gov/ - http://www.phac-aspc.gc.ca

Adenovirus

Adenoviruses are medium-sized (90-100 nm), non-enveloped icosohedral viruses with double-stranded DNA. More than 50 types of immunologically distinct adenoviruses can cause infections in humans. Adenoviruses are relatively resistant to common disinfectants and can be detected on surfaces, such as doorknobs, objects, and water of swimming pools and small lakes.
Adenoviruses most commonly cause respiratory illness. The illnesses can range from the common cold to pneumonia, croup, and bronchitis. Depending on the type, adenoviruses can cause other illnesses such as gastroenteritis, conjunctivitis, cystitis, and, less commonly, neurological disease.
People with weakened immune systems are at high risk for developing severe illness caused by adenovirus infection. Some people infected with adenoviruses, especially those who have weakened immune systems, can have ongoing infections in their tonsils, adenoids, and intestines that do not cause symptoms. They can shed the virus for weeks or longer.
Adenoviruses have historically been a common cause of acute respiratory illness in military recruits, although the frequency has significantly decreased since the reinstitution in March 2011 of adenovirus vaccine administration
Currently, there is no adenovirus vaccine available for the general public.
A live, oral vaccine against adenovirus types 4 and 7 is approved by the U.S. Food and Drug Administration for U.S. military personnel ages 17 through 50 who may be at higher risk for infection from these two adenovirus types.

Anthrax

Anthrax is a serious infectious disease caused by gram-positive, rod-shaped bacteria known as Bacillus anthracis. Although it is rare, people can get sick with anthrax if they come in contact with infected animals or contaminated animal products.
Anthrax can be found naturally in soil and commonly affects domestic and wild animals around the world. People can get sick with anthrax if they come in contact with infected animals or contaminated animal products. Contact with anthrax can cause severe illness in both humans and animals.
You cannot catch anthrax from another person the way you might catch a cold or the flu. In rare cases, person-to-person transmission has been reported with cutaneous anthrax, where discharges from skin lesions might be infectious. The type of illness a person develops depends on how anthrax enters the body.
Typically, anthrax gets into the body through the skin, lungs, or gastrointestinal system. All types of anthrax can eventually spread throughout the body and cause death if they are not treated with antibiotics.
While there is a vaccine licensed to prevent anthrax, it is not typically available for the general public. Anthrax Vaccine Adsorbed (AVA) protects against cutaneous and inhalation anthrax, according to limited but well researched evidence. The vaccine is approved by the Food and Drug Administration (FDA) for at-risk adults before exposure to anthrax. The vaccine does not contain any anthrax bacteria and cannot

give people anthrax.
Currently, FDA has not approved the vaccine for use after exposure for anyone.
However, if there were ever an anthrax emergency, people who are exposed might be given anthrax vaccine to help prevent disease. This would be allowed under a special protocol for use of the vaccine in emergencies.

Cholera

Cholera is an acute intestinal infection caused by ingestion of food or water contaminated with the bacterium *Vibrio cholerae*. It is a disease of poverty, closely linked to poor sanitation and lack of clean drinking water. It has a short incubation period of a few hours to five days, and is characterized in the majority of cases by acute, profuse watery diarrhoea lasting from one to a few days. In its extreme form, cholera can be rapidly fatal.
The disease occurs in both endemic and epidemics patterns. Cholera incidence worldwide has increased steadily since 2005 with outbreaks affecting several continents. Further, its impact can be dramatic in areas where basic environmental infrastructures are disrupted or have been destroyed and provision of potable water and sanitation is challenging. As such, acute humanitarian emergencies are a particular risk factor for cholera outbreaks. The annual burden of cholera has been estimated at 1.3 to 4.0 million cases and 21 000 to 143 000 deaths worldwide (2017).
Currently there are three WHO pre-qualified oral cholera vaccines (OCV): Dukoral®, Shanchol™, and Euvichol®. All three vaccines require two doses for full protection. Dukoral® is administered with a buffer solution that, for adults, requires 150 ml of clean water. Dukoral can be given to all individuals over the age of 2 years. There must be a minimum of 7 days, and no more than 6 weeks, delay between each dose. Children aged 2-5 require a third dose. Dukoral® is mainly used for travellers. Two doses of Dukoral® provide protection against cholera for 2 years. Shanchol™ and Euvichol® are essentially the same vaccine produced by two different manufacturers. They do not require a buffer solution for administration. They are given to all individuals over the age of one year. There must be a minimum of two weeks delay between each dose of these vaccines. Two doses of Shanchol™ and Euvichol® provide protection against cholera for 3 years, while a single dose provides short term protection.
Shanchol™ and Euvichol® are the vaccines currently available for mass vaccination campaigns through the Global OCV Stockpile, which is supported by Gavi, the Vaccine Alliance. More than 20 million doses of OCVs have been used in mass vaccination campaigns. The campaigns have been implemented in areas experiencing an outbreak, in areas at heightened vulnerability during humanitarian crises, and among populations living in highly endemic areas, known as “hotspots”.

Dengue

Dengue is a mosquito-borne flavivirus found in tropical and sub-tropical regions of the world, mostly in urban and semi-urban settings. Day-biting Aedes mosquitos spread disease. It is the fastest spreading vector-borne viral disease and is now endemic in over 100 countries, resulting in 40% of the world’s population living in an area at risk for dengue. It is caused by one of four distinct serotypes (dengue 1-4). While the first infection with one of the four dengue serotypes is typically non-severe or asymptomatic, individuals who are subsequently exposed in later years to one of the other serotypes are more likely to develop severe dengue. Non-severe dengue illness often presents as

flu-like illness, with symptoms included high fever, severe headache, pain behind the eyes, muscle and joint pains, nausea, vomiting, swollen glands, or rash. Severe dengue, including dengue hemorrhagic fever or dengue shock syndrome, is characterized by severe abdominal pain, persistent vomiting, rapid breathing, bleeding gums, fatigue, restlessness, and blood in vomit, and may be fatal due to plasma leakage, fluid accumulation, respiratory distress, severe bleeding, or organ impairment. Although there is no specific treatment for dengue, case fatality rates can be below 1% with proper case management. In its absence, the case fatality rate can be has high at 20% in patients with severe dengue.

The first dengue vaccine, Dengvaxia (CYD-TDV) by Sanofi Pasteur, was first licensed in December, 2015, in Mexico. It has been registered for use in individuals 9-45 years of age living in endemic areas. CYD-TDV is a live recombinant tetravalent vaccine based on the yellow fever 17d backbone and is registered as a 3-dose vaccine given on a 0/6/12 month schedule. Several other vaccine candidates are in clinical or pre-clinical development.

WHO recommends prevention of dengue through vector control methods such as mosquito habitat removal and use of insecticides. WHO recommends that countries should consider introduction of the dengue vaccine CYD-TDV only in geographic settings (national or subnational) where epidemiological data indicate a high burden of disease.

The development of a safe and effective dengue vaccine is a high priority and WHO supports this effort through technical guidance and advice.

Diphteria

Diphtheria is an infectious disease caused by the bacterium *Corynebacterium diphtheria*, which primarily infects the throat and upper airways, and produces a toxin affecting other organs. The illness has an acute onset and the main characteristics are sore throat, low fever and swollen glands in the neck, and the toxin may, in severe cases, cause myocarditis or peripheral neuropathy. The diphtheria toxin causes a membrane of dead tissue to build up over the throat and tonsils, making breathing and swallowing difficult. The disease is spread through direct physical contact or from breathing in the aerosolized secretions from coughs or sneezes of infected individuals.

Vaccination against diphtheria has reduced the mortality and morbidity of diphtheria dramatically, however diphtheria is still a significant child health problem in countries with poor EPI coverage. In countries endemic for diphtheria, the disease occurs mostly as sporadic cases or in small outbreaks. Diphtheria is fatal in 5 - 10% of cases, with a higher mortality rate in young children. Treatment involves administering diphtheria antitoxin to neutralize the effects of the toxin, as well as antibiotics to kill the bacteria.

Diphtheria vaccine is a bacterial toxoid, ie. a toxin whose toxicity has been inactivated. The vaccine is normally given in combination with other vaccines as DTwP/DTaP vaccine or pentavalent vaccine. For adolescents and adults the diphtheria toxoid is frequently combined with tetanus toxoid in lower concentration (Td vaccine).

WHO recommends a 3-dose primary vaccination series with diphtheria containing vaccine followed by 3 booster doses. The primary series should begin as early as 6-week of age with subsequent doses given with a minimum interval of 4 weeks between doses. The 3 booster doses should preferably be given during the second year of life (12-23 months), at 4-7 years and at 9-15 years of age. Ideally, there should be at least 4 years between booster doses.

Hepatitis A

Hepatitis A is a viral liver disease that can cause mild to severe illness. Globally, there are an estimated 1.4 million cases of hepatitis A every year. Unlike hepatitis B and C, hepatitis A infection does not cause chronic liver disease and is rarely fatal, but can cause debilitating symptoms and lead to acute liver failure, which is associated with high mortality.
Hepatitis A virus is transmitted primarily via the faecal/oral route through ingestion of contaminated food and water, or through direct contact with an infectious person. Improved sanitation and vaccination are the most effective ways to combat the disease.
Several hepatitis vaccines are available internationally. Both inactivated and live attenuated hepatitis A vaccines are highly immunogenic and immunization will generate long-lasting, possibly life-long, protection against hepatitis A in children as well as in adults.
Vaccination against hepatitis A should be part of a comprehensive plan for the prevention and control of viral hepatitis, including measures to improve hygiene and sanitation and measures for outbreak control.
WHO recommends that vaccination against hepatitis A virus be integrated into the national immunization schedule for children aged 1 year or older, if indicated on the basis of local factors, including incidence of acute hepatitis A, level of endemicity, and consideration of cost-effectiveness.

Hepatitis B

Hepatitis B is a viral infection that attacks the liver and can cause both acute and chronic disease. It is a major global health problem, and the most serious type of viral hepatitis. It is estimated that about 780,000 people die each year due to consequences of hepatitis B, such as liver cirrhosis and liver cancer.
The virus is highly contagious and is transmitted through contact with the blood or other body fluids of an infected person. Hepatitis B virus can survive outside the body for at least 7 days, and is an important occupational hazard for health workers.
Hepatitis B is preventable with currently available safe and effective vaccines.
WHO recommends that all infants should receive their first dose of vaccine as soon as possible after birth, preferably within 24 hours. Delivery of hepatitis B vaccine within 24 hours of birth should be a performance indicator for all immunization programmes. The birth dose should be followed by 2 or 3 doses to complete the primary series.
There is no evidence to support the need for a booster dose of hepatitis B vaccine. Protection lasts at least 20 years, and is possibly life-long.
WHO strongly recommends that all regions and associated countries develop goals for hepatitis B control appropriate to their epidemiological situation.

Human Papillomavirus (HPV)

Human papillomavirus (HPV) causes cervical cancer, which is the fourth most common cancer in women, with an estimated 266,000 deaths and 528,000 new cases in 2012. A

large majority (around 85%) of the global burden occurs in the less developed regions, where it accounts for almost 12% of all female cancers.
Although most infections with HPV cause no symptoms, persistent genital HPV infection can cause cervical cancer in women. Virtually all cervical cancer cases (99%) are linked to genital infection with HPV and it is the most common viral infection of the reproductive tract. HPV can also cause other types of anogenital cancer, head and neck cancers, and genital warts in both men and women. HPV infections are transmitted through sexual contact.
Three HPV vaccines are now being marketed in many countries throughout the world - a bivalent, a quadrivalent, and a nonavalent vaccine. All three vaccines are highly efficacious in preventing infection with virus types 16 and 18, which are together responsible for approximately 70% of cervical cancer cases globally. The vaccines are also highly efficacious in preventing precancerous cervical lesions caused by these virus types. The quadrivalent vaccine is also highly efficacious in preventing anogenital warts, a common genital disease which is virtually always caused by infection with HPV types 6 and 11. The nonavalent provides additional protection against HPV types 31, 33, 45, 52 and 58. Data from clinical trials and initial post-marketing surveillance conducted in several continents show all three vaccines to be safe.
The primary target group in most of the countries recommending HPV vaccination is young adolescent girls, aged 9-14. For all three vaccines, the vaccination schedule depends on the age of the vaccine recipient.

- *Females <15 years="" at="" the="" time="" of="" first="">* a **2-dose schedule** (0, 6 months) is recommended.
    - If the interval between doses is shorter than 5 months, then a third dose should be given at least 6 months after the first dose.
- *Females ≥15 years at the time of first dose:* a **3-dose schedule** (0, 2, 6 months) is recommended.

NB: A 3-dose schedule remains necessary for those known to be immunocompromised and/or HIV-infected.

Influenza (Seasonal)

Influenza is a contagious, acute respiratory illness caused by influenza viruses, usually influenza A or B subtypes. Influenza can cause mild to severe illness, and it may predispose to exacerbations of underlying disease or development of secondary bacterial infections. Some people are at risk for serious influenza complications, such as pregnant women, older people, young children, and people with certain chronic health conditions. Immunization is the best intervention to prevent influenza virus infection.
Influenza viruses can infect humans and other animals. Viruses that infect humans circulate in seasonal epidemics, although some tropical regions experience endemic influenza circulation. Influenza viruses are continuously changing, necessitating annual updates of influenza vaccine formulations. Occasionally, animal influenza viruses may also infect humans. These infections can manifest in a broad range of clinical symptoms from mild disease to death. If new or adapted influenza viruses cause disease in humans, and if they can be efficiently transmitted from person to person, then an influenza pandemic may occur. Pandemics are characterized by the rapid dissemination of a new, virulent influenza A viruses to which there is little or no existing immunity within the population. There have been four influenza pandemics since 1900, with the most recent pandemic occurring in 2009 caused by a new influenza A (H1N1) virus. Animal

influenza viruses, including influenza A (H5N1) and influenza A (H7N9) have occasionally caused illness in humans. While efficient human-to-human transmission of these viruses has not been identified, the high case fatality rates of human infection by these viruses underscore the importance of these pathogens to public health.
There are numerous licensed seasonal influenza vaccines available. Several of these vaccines have been prequalified by the WHO for purchase by UN agencies. This process of vaccine prequalification provides independent opinion and advice on the quality, safety, and efficacy of vaccines. There are also several vaccine candidates under development against animal influenza viruses.
WHO has identified several conditions which are associated with elevated risk of complications from influenza virus infection. These groups include pregnant women, children aged 6–59 months, the elderly, individuals with specific chronic medical conditions, and health-care workers. For countries considering the initiation or expansion of programmes for seasonal influenza vaccination, WHO recommends that pregnant women should have the highest priority.
For WHO, the development of vaccines against animal influenza viruses, as well as seasonal influenza vaccines that induce broadly protective and long-lasting immune responses, are high priorities. WHO supports these efforts through provision of technical guidance and advice.

Japanese Encephalitis

Japanese encephalitis (JE) is the main cause of viral encephalitis in many countries of Asia. The JE virus is a flavivirus related to dengue, yellow fever and West Nile viruses. The virus exists in a transmission cycle between mosquitoes, pigs and/or water birds. Humans get infected when bitten by an infected mosquito. The disease is predominantly found in rural and periurban settings. Most JE virus infections are mild (fever and headache) or without apparent symptoms, but approximately 1 in 200 infections results in severe disease characterized by rapid onset of high fever, headache, neck stiffness, disorientation, coma, seizures, spastic paralysis and death. The case fatality rate can be as high as 30% among those with disease symptoms; 20-30% of those who survive suffer permanent neuropsychiatric sequelae. In areas where the JE virus is common, encephalitis occurs mainly in young children because older children and adults have already been infected and are immune.
There are four main types of JE vaccines currently in use: inactivated mouse brain-based vaccines, inactivated cell-based vaccines, live attenuated vaccines, and live recombinant vaccines.
JE vaccination should be integrated into national immunization schedules in all areas where JE is recognized as a public health priority.
Monitoring vaccine impact in settings where JE vaccine has been introduced is a research priority.

Leptospirosis

Leptospirosis is a bacterial disease that affects both humans and animals. Humans become infected through direct contact with the urine of infected animals or with a urine-contaminated environment. The bacteria enter the body through cuts or abrasions on the skin, or through the mucous membranes of the mouth, nose and

eyes. Person-to-person transmission is rare.
In the early stages of the disease, symptoms include high fever, severe headache, muscle pain, chills, redness of the eyes, abdominal pain, jaundice, hemorrhages in the skin and mucous membranes, vomiting, diarrhea, and rash.
Although human vaccines have been used in some countries with varying degrees of success, there are no WHO pre-qualified vaccines currently available.

Mealses (Rubeola)

Measles is a highly contagious viral disease. It remains an important cause of death among young children globally, despite the availability of a safe and effective vaccine.
Under the Global Vaccine Action Plan, measles and rubella are targeted for elimination in five WHO Regions by 2020. WHO is the lead technical agency responsible for coordination of immunization and surveillance activities supporting all countries to achieve this goal.
Measles is transmitted via droplets from the nose, mouth or throat of infected persons. Initial symptoms, which usually appear 10–12 days after infection, include high fever, a runny nose, bloodshot eyes, and tiny white spots on the inside of the mouth. Several days later, a rash develops, starting on the face and upper neck and gradually spreading downwards.
Severe measles is more likely among poorly nourished young children, especially those with insufficient vitamin A, or whose immune systems have been weakened by HIV/AIDS or other diseases. The most serious complications include blindness, encephalitis (an infection that causes brain swelling), severe diarrhoea and related dehydration, and severe respiratory infections such as pneumonia.
Routine measles vaccination for children, combined with mass immunization campaigns in countries with low routine coverage, are key public health strategies to reduce global measles deaths.
While global measles deaths have decreased by 84 percent worldwide in recent years — from 550,100 deaths in 2000 to 89,780 in 2016 — measles is still common in many developing countries, particularly in parts of Africa and Asia. An estimated 7 million people were affected by measles in 2016. The overwhelming majority (more than 95%) of measles deaths occur in countries with low per capita incomes and weak health infrastructures.
The measles vaccine has been in use since the 1960s. It is safe, effective and inexpensive. WHO recommends immunization for all susceptible children and adults for whom measles vaccination is not contraindicated. Reaching all children with 2 doses of measles vaccine, either alone, or in a measles-rubella (MR), measles-mumps-rubella (MMR), or measles-mumps-rubella-varicella (MMRV) combination, should be the standard for all national immunization programmes.

Meningococcal Meningitis

Neisseria meningitidis (meningococcus) is a leading cause of bacterial meningitis and septicaemia. Endemic disease occurs worldwide, with outbreaks most frequently occurring in the “meningitis belt” of sub-Saharan Africa. There are no reliable estimates of global meningococcal disease burden due to inadequate surveillance in several parts of the world. Invasive meningococcal disease has a very high fatality rate (>50% if

untreated) and many survivors develop permanent sequelae. Of the 12 *N. meningitidis* serogroups identified, A, B, C, X, W, and Y are responsible for the majority of disease, but serogroup distribution varies by location and time. Meningococcal infections are transmitted through contact with respiratory droplets or secretions.
Currently there are several polysaccharide and conjugate vaccines available for protection from the most common serogroups of meningococcal disease. Polysaccharide vaccines are available in bivalent (A, C), trivalent (A, C, W135), and quadrivalent (A, C, W135, Y) formulations. Conjugate vaccines, which are more immunogenic and can provide herd protection, are available in monovalent (A or C), quadrivalent (A, C, W135, Y), or combination (serogroup C and *Haemophilus influenzae* type b) formulations. Two protein-based vaccines are available for immunization against serogroup B invasive disease. There are no vaccines available against serogroup X disease.
In 2010, a new meningococcal A conjugate vaccine (MenAfriVac, Serum Institute of India), developed through the WHO-PATH Meningitis Vaccine Project, was introduced in Africa, and has dramatically reduced the number of cases due to *N. meningitidis* A in these epidemic-prone areas. MenAfriVac is also the first vaccine to be approved for use in a controlled-temperature chain (CTC), allowing the vaccine to be kept at a broader range of temperatures than the traditional cold chain for a limited period of time under monitored and controlled conditions.
WHO recommends that countries with high (>10 cases per 100,000 population/year) or intermediate (2-10 cases per 100,000 population/year) endemic rates and/or frequent epidemics of invasive meningococcal disease conduct appropriate large scale meningococcal vaccination programmes. The importance of conducting high quality surveillance and vaccination programme evaluation in these countries is also stressed.
In addition, WHO recommends that countries of the African meningitis belt complete their campaigns in individuals aged 1-29 years and introduce 1 dose of meningococcal A conjugate vaccine at 9-18 months of age, into the routine immunization programme within 1-5 years following their mass campaign. A one-time catch-up campaign should also be conducted for birth cohorts born since the initial mass vaccination and who will be outside the target age for the routine dose. In areas where routine coverage is less than 60%, periodic campaigns should be considered. Vaccination of pregnant women with MenAfriVac is safe, as assessed in a well-conducted observational study, and they should be vaccinated if in the age range targeted by the mass vaccination campaigns.
In countries where the disease occurs less frequently (< 2 cases per 100,000 population/year), meningococcal vaccination is recommended for defined risk groups. Laboratory worker and travelers at risk of exposure should be vaccinated against the prevalent serogroup(s), and vaccination should be offered to all individuals suffering from immunodeficiency.

Mumps

Mumps is an infection caused by a virus and spread human-to-human via direct contact or by airborne droplets. It is sometimes called infectious parotitis, and it primarily affects the salivary glands. Initial symptoms are typically non-specific, such as headache, malaise and fever, followed within a day by the characteristic swelling of the parotid (salivary) glands.

Mumps is generally a mild childhood disease, most often affecting children between five and nine years old. However, the mumps virus can infect adults as well and when it does, possible complications are more likely to be serious. Complications of mumps can include meningitis (in up to 15% of cases), orchitis and deafness. Very rarely, mumps can cause encephalitis and permanent neurological damage.

Safe and effective vaccines against mumps have been available since the 1960s. The vaccine is most often incorporated into national immunization programmes in a combined measles-mumps-rubella (MMR) vaccine. In countries where large-scale immunization against mumps has been implemented, the incidence of the disease has dropped dramatically.

WHO recommends integrating strategies to control mumps with existing high priority goals of measles and rubella control or elimination. Once the decision has been made to include mumps vaccine, the use of combined MMR vaccine is strongly encouraged.

Pertussis

Pertussis is a highly contagious disease of the respiratory tract caused by *Bordetella pertussis*, a bacteria that lives in the mouth, nose, and throat. Many children who contract pertussis have coughing spells that last four to eight weeks. The disease is most dangerous in infants and spreads easily from person to person, mainly through droplets produced by coughing or sneezing. The first symptoms generally appear 7–10 days after infection, and include mild fever, runny nose, and cough, which in typical cases gradually develops into a paroxysmal cough followed by whooping (hence the common name of whooping cough). In the youngest infants, the paroxysms may be followed by periods of apnoea. Pneumonia is a relatively common complication; seizures and encephalopathy occur more rarely. Untreated patients may be contagious for three weeks or more following onset of the cough. Pertussis can be prevented by immunization.

For several decades, infant immunization programmes around the world have been highly successful in using pertussis vaccines of documented quality to prevent severe pertussis in infants. WHO estimates that in 2008 global vaccination against pertussis prevented approximately 687 000 deaths.

The main aim of pertussis vaccination is to reduce the risk of severe pertussis in infancy. The ongoing priority of immunization programmes worldwide is to vaccinate at least 90 percent of infants with three doses of high-quality pertussis vaccine. WHO recommends the first dose be administered as early as 6 weeks of age; with subsequent doses given 4–8 weeks apart, at age 10–14 weeks and 14–18 weeks.

Although vaccination can prevent pertussis in adolescents and adults, there is insufficient evidence that vaccine boosters in these age groups can reduce severe pertussis in infants. When a country implements a programme for adults, vaccination of health care workers should be prioritized, especially those with direct contact with pregnant mothers and infant patients. Vaccination of pregnant women is likely to be the most cost-effective additional strategy for preventing disease in infants too young to be vaccinated and appears to be more effective and favourable than cocooning.

Pneumococcal

Streptococcus pneumoniae is a bacterium that is the cause of a number of common diseases, ranging from serious diseases such as meningitis, septicaemia and pneumonia to milder but commoner infections such as sinusitis and otitis media.

Pneumococcal diseases are a common cause of morbidity and mortality worldwide, though rates of disease and death are higher in developing countries than in industrialized country settings, with the majority of deaths occurring in sub-Saharan Africa and Asia. Disease is most common at the extremes of age, i.e, in young children and among the elderly. The organism is transmitted mainly through respiratory droplets and colonizes the back of the nose (nasopharynx). Infection of other parts of the body, resulting in disease, occur through direct spread or through invasion of the blood stream. Out of over 90 serotypes, only a small minority cause most disease. There are 2 available pneumococcal conjugate vaccines (PCV) that target either 10 or 13 of the most prevalent serotypes.

Currently available PCVs are safe and efficacious. WHO recommends the inclusion of PCVs in childhood immunization programmes worldwide. In particular, countries with high childhood mortality (i.e. under 5 mortality rate of >50 deaths/1000 births) should make the introduction of these multicomponent PCVs a high priority.

In many countries, the routine use of pneumococcal conjugate vaccines has dramatically reduced the incidence of serious diseases due to the organism with virtual disappearance of disease due to serotypes of the organism in the vaccines used.

Polio

Polio (poliomyelitis) is a highly infectious viral disease. The poliovirus invades the nervous system and can cause irreversible paralysis in a matter of hours. Polio is spread through person-to-person contact. When a child is infected with wild poliovirus, the virus enters the body through the mouth and multiplies in the intestine. It is then shed into the environment through the faeces where it can spread rapidly through a community, especially in situations of poor hygiene and sanitation. If a sufficient number of children are fully immunized against polio, the virus is unable to find susceptible children to infect, and dies out.

Most infected people (90%) have no symptoms or very mild symptoms and usually go unrecognized. In others, initial symptoms include fever, fatigue, headache, vomiting, stiffness in the neck and pain in the limbs.

There is no cure for polio, only treatment to alleviate the symptoms. Heat and physical therapy is used to stimulate the muscles and antispasmodic drugs are given to relax the muscles. While this can improve mobility, it cannot reverse permanent polio paralysis.

There are 3 types of wild poliovirus (WPV) - types 1, 2 and 3. **In September 2015, WPV type 2 was officially declared eradicated.** Since WPV type 3 has not been detected since November 2012, WPV type 1 is probably the only wild poliovirus type that remains in circulation.

Polio can be prevented through immunization. Polio vaccine, given multiple times, almost always protects a child for life. The development of effective vaccines to prevent paralytic polio was one of the major medical breakthroughs of the 20th century. There are six different vaccines to stop polio transmission:

- Inactivated polio vaccine (IPV) – protects against poliovirus types 1, 2, and 3
- Trivalent oral polio vaccine (tOPV) – protects against poliovirus types 1, 2, and 3 - **following the "OPV Switch" in April 2016, tOPV is no longer in use**
- Bivalent oral polio vaccine (bOPV) – protects against poliovirus types 1, and 3
- Monovalent oral polio vaccines (mOPV1, mOPV2 and mOPV3) – protect against each individual type of poliovirus, respectively

If enough people in a community are immunized, the virus will be deprived of susceptible hosts and will die out. High levels of vaccination coverage must be maintained to stop transmission and prevent outbreaks occurring.

Rabies

Rabies is a zoonotic viral disease which infects domestic and wild animals. It is transmitted to other animals and humans through close contact with saliva from infected animals (i.e. bites, scratches, licks on broken skin and mucous membranes). Once symptoms of the disease develop, rabies is fatal to both animals and humans.
Approximately 59 000 people die from rabies each year. The vast majority of these deaths occur in Asia and Africa. Children are at particular risk.
Two types of vaccines to protect against rabies in humans exist - nerve tissue and cell culture vaccines. WHO recommends replacement of nerve tissue vaccines with the more efficacious, safer vaccines developed through cell culture as soon as possible. Cell culture vaccines which are more affordable and require less vaccine have been developed in recent years.
Intradermal immunization using cell-culture-based rabies vaccines is an acceptable alternative to standard intramuscular administration. Intradermal vaccination has been shown to be as safe and immunogenic as intramuscular vaccination, yet requires less vaccine, for both pre- and post-exposure prophylaxis, leading to lower direct costs. This alternative should thus be considered in settings constrained by cost and/or supply issues.
Pre-exposure prophylaxis is recommended for anyone at continual, frequent or increased risk of exposure to rabies virus, either by nature of their residence or occupation.
Periodic booster injections are recommended as an extra precaution only for people whose occupation puts them at continual or frequent risk of exposure. If available, antibody monitoring of personnel at risk is preferred to the administration of routine boosters.
Recommendations for post-exposure depend on the type of contact with the suspected rabid animal. For category I exposure (touching or feeding animals, licks on intact skin), no prophylaxis is required; for category II (nibbling of uncovered skin, minor scratches or abrasions without bleeding), immediate vaccination; and for category III (single or multiple transdermal bites or scratches, contamination of mucous membrane with saliva from licks, licks on broken skin, exposures to bats), immediate vaccination and administration of rabies immunoglobulin are recommended.

Rubella

Under the Global Vaccine Action Plan, measles and rubella are targeted for elimination in 5 WHO Regions by 2020. WHO is the lead technical agency responsible for coordination of immunization and surveillance activities supporting all countries to achieve this goal.
Transmitted in airborne droplets when infected people sneeze or cough, rubella is an acute, usually mild viral disease traditionally affecting susceptible children and young adults worldwide. Rubella infection just before conception and in early pregnancy may

result in miscarriage, foetal death or congenital defects known as congenital rubella syndrome (CRS). The highest risk of CRS is found in countries with high rates of susceptibility to rubella among women of childbearing age.
In 1996, an estimated 22 000 babies were born with CRS in Africa, an estimated 46 000 in South-East Asia and close to 13 000 in the Western Pacific. Very few countries in these regions had introduced rubella-containing vaccine by the year 2008, and therefore the current burden of CRS in these settings is thought to be similar to that estimated for 1996.
Rubella vaccines are available either in monovalent formulation or in combinations with other vaccine viruses, as rubella-containing vaccines (RCVs). Commonly used RCVs are combinations with vaccines against measles (MR), measles and mumps (MMR), or measles, mumps and varicella (MMRV).
Large-scale rubella vaccination during the last decade has drastically reduced or practically eliminated rubella and CRS in many developed and in some developing countries. Indeed, the western hemisphere and several European countries have eliminated rubella and CRS.
WHO recommends that countries take the opportunity of accelerated measles control and elimination activities to introduce rubella-containing vaccines. All countries that have not yet introduced rubella vaccine, and are providing two doses of measles vaccine using routine immunization and/or supplementary immunization activities should consider the inclusion of RCV in their immunization programme.

Smallpox

Smallpox is an acute contagious disease caused by the variola virus, a member of the orthopoxvirus family. It was one of the world's most devastating diseases known to humanity. The last known natural case was in Somalia in 1977. It was declared eradicated in 1980 following a global immunization campaign led by the World Health Organization.
Smallpox is transmitted from person to person via infective droplets during close contact with infected symptomatic people.
After human-to-human transmission of smallpox had been interrupted the likelihood of reintroduction or re-emergence of smallpox was negligible. Nevertheless a Smallpox Vaccine Emergency Stockpile was created to ensure that smallpox vaccine is immediately available should there be a need.

Tetanus

Tetanus is a non-communicable disease contracted through exposure to the spores of the bacterium, *Clostridium tetani*, that exists worldwide in soil and in animal intestinal tracts, and as such can contaminate many surfaces and substances. As a result of the ubiquity of the bacterium causing tetanus, the disease cannot be eradicated. Neurotoxins produced under anaerobic conditions in wounds contaminated with the bacterial spores lead to tetanus. Tetanus occurring during pregnancy or within 6 weeks of the end of pregnancy is called “maternal tetanus”, while tetanus occurring within the first 28 days of life is called “neonatal tetanus”.
People of all ages can get tetanus but the disease is particularly common and serious in newborn babies and their mothers when the mothers` are unprotected from tetanus by the vaccine, tetanus toxoid. Tetanus requires treatment in a medical facility, often in a referral hospital. Neonatal tetanus, which is mostly fatal, is particularly common in

difficult to reach and rural areas where deliveries take place at home without adequate sterile procedures and in unclean environment. WHO estimated that neonatal tetanus killed about 30,848 newborn children in 2017, a 96% reduction from the situation in 1988 when an estimated 787,000 newborn babies died of tetanus within their first month of life.

Tetanus can be prevented through immunization with tetanus-toxoid-containing vaccines (TTCV). WHO recommends the use of combination vaccines containing diphtheria toxoid as well, for example Td. Neonatal tetanus can be prevented by immunizing women of reproductive age with TTCV, either during pregnancy or outside of pregnancy. This protects the mother and - through a transfer of tetanus antibodies to the fetus - also her baby. Additionally, clean practices when a mother is delivering a child are also important to prevent neonatal and maternal tetanus.

People who recover from tetanus do not have natural immunity and can be infected again and therefore need to be immunized. **To be protected throughout life, WHO recommends that an individual receives 6 doses (3 primary plus 3 booster doses) of TTCV through routine immunization.**

WHO recommends a 3-dose primary vaccination series with tetanus-diphtheria containing vaccine followed by 3 booster doses. The 3-dose primary series should begin as early as 6 weeks of age, with subsequent doses given with a minimum interval of 4 weeks between doses. The 3 booster doses should preferably be given during the second year of life (12-23 months), at 4-7 years, and at 9-15 years of age. Ideally, there should be at least 4 years between booster doses.

Worldwide, all countries are committed to "elimination" of maternal and neonatal tetanus (MNT), i.e. a reduction of neonatal tetanus incidence to below one case per 1000 live births per year in every district. **As of March 2019, 13 countries remain that have not eliminated MNT.**

Tick-borne Encephalitis

Tick-borne encephalitis is an important cause of viral infections of the central nervous system in eastern, central and northern European countries, and in northern China, Mongolia, and the Russian Federation.

Approximately 10 000–12 000 clinical cases of tick-borne encephalitis are reported each year, but this figure is believed to be significantly lower than the actual total. Most infections with the virus result from tick bites acquired during outdoor activities in forested areas.

Immunization offers the most effective protection. Currently, there are four widely used vaccines of assured quality: FSME-Immun and Encepur, manufactured in Austria and Germany respectively, and based on European strains of the virus; and TBE-Moscow and EnceVir, manufactured in the Russian Federation and based on Far-Eastern strains. The four vaccines are considered to be safe and efficacious.

Since the incidence of tick-borne encephalitis may vary considerably between and even within geographical regions, public immunization strategies should be based on risk assessments conducted at country, regional or even district level. Therefore, establishing case reporting of the disease is essential before deciding on the most appropriate preventive measures to be taken. Similarly, health authorities' decision-making on programmatic vaccination could be informed by an analysis of the cost–effectiveness. WHO has issued vaccination recommendations against TBE as summarized in the position on TBE vaccines

In areas where the disease is highly endemic (i.e. where the average prevaccination incidence of clinical disease is ≥5 cases/100 000 population per year), implying that there is a high individual risk of infection, WHO recommends that vaccination be offered to all age groups, including children. Where the prevaccination incidence of the disease is moderate or low, or is limited to particular geographical locations or certain outdoor activities, immunization should target individuals in the most severely affected.
People travelling from nonendemic areas to endemic areas should be offered vaccination if their visits will include extensive outdoor activities.

BCG (Tuberculosis)

Tuberculosis (TB) is a disease that is caused by a bacterium, which resulted in estimated 10.4 million new cases in 2016 and 1.7 million deaths. Over 90% of TB cases occur in low and middle income countries that have fragile healthcare infrastructures and constrained resources available, and therefore struggle to tackle one of the world's deadliest communicable diseases.
The bacterium responsible for TB, called Mycobacterium tuberculosis (Mtb), is transmitted by people infected with pulmonary (lung) TB who release Mtb into the air through coughing, sneezing or spitting. Approximately 1/3 of the world's population carry the disease but don't have any symptoms (known as latent infection), however approximately 10% of these people will likely develop active disease during their lifetime and become capable of transmitting the bacterium. The TB epidemic continues in spite of an available, cost-effective and broadly implemented vaccine for infants – Bacille Calmette-Guerin (BCG) – and the carefully managed use of drugs for those who do become infected through directly observed therapy (DOTs). This is because BCG vaccination is only partially effective: it provides some protection against severe forms of pediatric non-pulmonary TB, such as TB meningitis, but is unreliable against adult pulmonary TB, which accounts for most of the TB disease burden (and transmission) worldwide. In addition, infection with Human Immunodeficiency Virus (HIV) infection can increase the likelihood of TB acquisition by up to 25-fold, and resistance to previously effective TB drug regimens is increasing.
WHO continues to recommend the vaccination of neonates with BCG, due to its protective effect in infants and young children. However, children infected with HIV through vertical transmission from their HIV-infected mother are at risk of developing severe vaccine-related disease. Therefore, children known to be HIV infected should not be vaccinated with BCG.
In 2014, the World Health Assembly adopted WHO's End TB Strategy to eliminate the global TB epidemic by 2035, by reducing 90% of TB cases (compared to the 2015 baseline). Achieving this target is contingent on the introduction of new, more effective tools to prevent, diagnose, and treat TB. As such, new vaccines that protect against both latent and new infections of TB, in all age groups, and in all populations including those with HIV are urgently needed. It is likely that we will need more than one vaccination strategy to effectively target all sub-populations, so a variety of vaccine candidates are advancing in the clinic and their success will be essential to controlling the global TB epidemic.

Typhoid

Typhoid fever is a systemic infection caused by *Salmonella* Typhi, usually through ingestion of contaminated food or water. The acute illness is characterized by

prolonged fever, headache, nausea, loss of appetite, and constipation or sometimes diarrhoea. Symptoms are often non-specific and clinically non-distinguishable from other febrile illnesses. However, clinical severity varies and severe cases may lead to serious complications or even death. It occurs predominantly in association with poor sanitation and lack of clean drinking water. According to the most recent estimates, between 11 and 21 million cases and 128 000 to 161 000 typhoid-related deaths occur annually worldwide. A similar but often less severe disease, paratyphoid fever, is caused by *Salmonella Paratyphi* A and B (or uncommonly Paratyphi C).
Three typhoid vaccines are currently recommended for use by:

- an injectable typhoid conjugate vaccine (TCV), consisting of Vi polysaccharide antigen linked to tetanus toxoid protein licensed for children from 6 months of age and adults up to 45 years of age;
- an injectable unconjugated polysaccharide vaccine based on the purified Vi antigen (known as Vi-PS vaccine) for persons aged two years and above; and
- an oral live attenuated Ty21a vaccine in capsule formulation for those over six years of age.

WHO recommends vaccination to control endemic typhoid fever and for outbreak control. Among the available typhoid vaccines, TCV is preferred at all ages in view of its improved immunological properties, suitability for use in younger children and expected longer duration of protection. WHO further recommends that all typhoid fever vaccination programmes should be implemented in the context of other efforts to control the disease, including health education, water quality and sanitation improvements, and training of health professionals in diagnosis and treatment.

Varicella-Zoster (Chickenpox)

Varicella, also commonly referred to as “chickenpox”, is an acute and highly contagious disease. It is caused by primary infection with the varicella-zoster virus (VZV). Varicella occurs worldwide and in the absence of a vaccination programme, affects nearly every person by mid-adulthood. The epidemiology of the disease differs between temperate and tropical climates. The reasons for the differences are poorly understood and may relate to properties of VZV (known to be sensitive to heat), climate, population density and risk of exposure (e.g., attendance at childcare facility or school or the number of siblings in the household).
VZV is highly transmissible via respiratory droplets or direct contact with characteristic skin lesions of the infected person. The first symptoms of clinical varicella generally appear after a 10-21 day incubation period and include fever, malaise and the characteristic itchy rash. Varicella is generally self-limited and vesicles gradually develop crusts, which disappear over a period of 7-10 days. Individuals remain contagious until all lesions have crusted over. The disease is typically mild, but severe complications may arise, including bacterial infections (e.g. cellulitis, pneumonia) and neurological complications (e.g. encephalitis), and these can be fatal. Disease is associated with higher morbidity and mortality in infants and in individuals with an impaired immune system.
Following infection, the virus remains latent in nerve cells and may be reactivated causing a secondary infection - herpes zoster, commonly referred to as “shingles”. This generally occurs in adults aged >50 years or in the immunocompromised and is associated with a painful rash that may result in permanent nerve damage.
Varicella can be prevented by immunization and multiple vaccine formulations of the live attenuated vaccine, based on the Oka VZV strain, have been available since 1974.

Varicella vaccines are available as a single antigen and in combination with measles, mumps and rubella vaccine.

Yellow Fever

Yellow Fever (YF) is a mosquito-borne viral disease of humans and other primates, and is currently endemic in over 43 countries in the tropical regions of Africa and The Americas. Infection with the YF virus can be asymptomatic or cause a wide spectrum of disease, from mild symptoms to severe illness with bleeding, jaundice and, ultimately, death. Over 30,000 deaths occur each year and this figure would be much higher without vaccination. Aedes aegypti, is the most important vector. Transmission is complex with different characteristics in different endemic areas.

All currently available yellow fever vaccines are live, attenuated and based on the 17D attenuation variant. Vaccines from four manufacturers are currently prequalified by WHO.

Yellow fever vaccination is carried out for 3 reasons: to protect populations living in areas subject to endemic and epidemic disease; to protect travellers visiting these areas; and to prevent international spread by minimizing the risk of importation of the virus by viraemic travellers.

A single dose of YF vaccine is sufficient to confer sustained life-long protective immunity against YF disease. In view of the ongoing transmission of YF virus, and the proven efficacy and safety of YF vaccination, WHO recommends that all endemic countries should introduce YF vaccine into their routine immunization programmes. Vaccine should be offered to all unvaccinated travellers aged >9 months, travelling to and from at-risk areas, unless they belong to the group of individuals for whom YF vaccination is contraindicated.

Well designed and adequately powered studies are needed to assess co-administration of YF vaccine with other live vaccines, including MMR, and to assess safety and immunogenicity of YF vaccine in pregnant women, in people aged ≥60 years, and in HIV positive adults with CD4 T cell values >200 per mm(3).

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