STANDARDS RELATED DOCUMENT

SRD-7 TO AJMedP-4

VACCINATIONS CATALOGUE WITHIN THE NATO & PfP FORCES

Edition A Version 2

JULY 2021

NORTH ATLANTIC TREATY ORGANIZATION

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NATO STANDARDIZATION OFFICE (NSO)

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NORTH ATLANTIC TREATY ORGANIZATION (NATO)

NATO STANDARDIZATION OFFICE (NSO)

NATO LETTER OF PROMULGATION

13 July 2021

1. The enclosed Standards Related Document SRD-7 to AJMedP-4, Edition A, Version 2, 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.

2. SRD-7 to AJMedP-4, Edition A, Version 2 is effective upon receipt and supersedes SRD-7 to AJMedP-4, Edition A, Version 1, which shall be destroyed in accordance with the local procedure for the destruction of documents.

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

Dimitrios SIGOULAKIS
Major General, GRC (A)
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		2021	2021	2021	2021	2021
Adenovirus VIS						
Anthrax						
Cholera		S,T			M,S,T	T,R
Dengue						
Diphteria		A	A,M,S,T	A,M,S,T	A	A
Hepatitis A		A	M,S,T	M,S,T	A	M,S,T,R
Hepatitis B		A	M,S,T,O	A,M,S,T	A	A,R
HPV				R	A	R
Influenza Seasonal		M,S,R	M,S,T,R,O	R	A	A,R
Japanese Encephalitis		S,T	T		M,S,T	S,T,R
Leptospirosis						
Measles		A	M,S,T	A	A	A,R
Meningococcal Meningitis	A,C					
	B				O	
	C					
	A,C,Y,W-135	A	M,S,T	M		A,R
Mumps		A	M,S,T	A	A	A,R
Pertussis		A	A,M,S,T	A	A	A,R
Pneumococcal Disesase		R,O	R	A	O	
Polio	live					
	inactived	A	M,S,T	A	A,M	A,R
Rabies		M,S,T	M,S,T	R	M,T,O	S,T
Rubella		A	M,S,T	A	A	A,R
Smallpox						
Tetanus		A	A,M,S,T	A,M,S,T	A	A,R
Tickborne Encephalitis		A	S,T		M,T	A,R
Tuberculosis				A		
Typhoid	live					M,S,T,R
	inactived	S,T	S,T	M	M,S,T	
Varicella		O			A	A
Yellow Fever		S,T	M,S,T	T	M,S,T	M,S,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		2021	2019	2021	2021	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		A	M,S,T,O	A	A,R	M,S,T
Hepatitis B		A	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	T,R	
Meningococcal Meningitis	A,C					M,T
	B	R				
	C					
	A,C,Y,W-135	A	S,T	T	S,T,R	S,T
Mumps		T	M,S,R	A	A,R	
Pertussis		T	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	M,S,R	A	A,R	
Smallpox						
Tetanus		A	M,S,R	A	A,R	A,M,S,T
Tickborne Encephalitis		A	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		2021	2019		2019	2019
Adenovirus VIS						
Anthrax			S,R,O			
Cholera		T	T		S,T	M,S,T
Dengue						
Diphteria		A	A		A,M,S,T	A,M,S,T
Hepatitis A		M,S,O	A		M,S,T,O	A,M,S,T,O
Hepatitis B		A,O	A		M,S,T,O	A,M,S,T,O
HPV		R	R			
Influenza Seasonal		A,M,S,O	T,O		A,M,S,T	M,S,T,R,O
Japanese Encephalitis		T	T		T	M,S,T
Leptospirosis		O				
Measles		A,M,S	A		A,M,S,T	A,M,S,T
Meningococcal Meningitis	A,C					
	B					
	C					
	A,C,Y,W-135	A,M,S	A,S,T		M,S,T	M,S,T,O
Mumps		A	A		A,M,S,T	A,M,S,T,O
Pertussis		A			A,M,S,T	A,M,S,T,O
Pneumococcal Disesase			T,O			
Polio	live					
	inactived	A,T	A		M,S,T	M,S,T
Rabies		T,O	S,T,O		S,T	M,S,T
Rubella		A	A		A,M,S,T	A,M,S,T
Smallpox			O			
Tetanus		A	A		A,M,S,T	A,M,S,T,O
Tickborne Encephalitis		T	T		S,T	M,S,T
Tuberculosis		O	O			
Typhoid	live		S,T			
	inactived	M,S			M,S,T	A,M,S,T
Varicella		R,O	O			
Yellow Fever		M,S,T	A		T	M,S,T

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		ISL	ITA	LTU	LUX	LVA
Updated Data Catalogue			2021	2021	2019	
Adenovirus VIS						
Anthrax						
Cholera			M,S		T	
Dengue						
Diphteria			A	A,M,S,O	A	
Hepatitis A			M,S	M,S	M	
Hepatitis B				M,S,O	M	
HPV						
Influenza Seasonal			M,S	A,M,S,O	R	
Japanese Encephalitis			M,S		T	
Leptospirosis					T,O	
Measles				A,M,S,O	M	
Meningococcal Meningitis	A,C					
	B			A,M,S		
	C					
	A,C,Y,W-135		A	A,M,S	M	
Mumps			A	A,M,S,O	M	
Pertussis			A		A	
Pneumococcal Disesase						
Polio	live					
	inactived		A	M,S	A	
Rabies			M,S	M,S	M	
Rubella			A	A,M,S,O	M	
Smallpox						
Tetanus			A	A,M,S,O	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	2021	2021	2019	
Adenovirus VIS						
Anthrax						
Cholera			S,T	M,S,T	T	
Dengue						
Diphteria		A	A,M,S,T,O	M,S,T,R	A,M,S,T	
Hepatitis A		M	M,S,T,O	M,S,T,R,O	M,S,T	
Hepatitis B		A	M,S,T,O	M,S,T,R,O	A,M,S,T,O	
HPV						
Influenza Seasonal		S,T	M,S,T,R,O	M,S,T,R,O	R,O	
Japanese Encephalitis		S,T		S,T,R	T	
Leptospirosis						
Measles		A	A,M,S,T,O	M,S,T,R	A,M,S,T,O	
Meningococcal Meningitis	A,C					
	B			M,S,T,R		
	C					
	A,C,Y,W-135	S,T	S,T	M,S,T,R	M,S,T	
Mumps		A	A,M,S,T,O	M,S,T,R	A,M,S,T,O	
Pertussis		A	A,M,S,T,O	R	A,M,S,T,O	
Pneumococcal Disease					R	
Polio	live					
	inactived	A	A,M,S,T,O	M,S,T,R	A,M,S,T	
Rabies		S,T	S,T	M,S,T,R,O	T	
Rubella		A	A,M,S,T,O	M,S,T,R	A	
Smallpox		T				
Tetanus		A	A,M,S,T,O	M,S,T,R	A,M,S,T,O	
Tickborne Encephalitis		S,T	S,T	M,S,T,R,O	S,T	
Tuberculosis			S,T		A	
Typhoid	live	S,T	S,T			
	inactived			M,S,T,R	M,S,T	
Varicella				R	T,O	
Yellow Fever		S,T	S,T	M,S,T	S,T	

Codes:

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		SVK	SVN	SWE	TUR	USA
Updated Data Catalogue		2019		2019	2021	2021
Adenovirus VIS						
Anthrax						T
Cholera		T		T	T	T
Dengue						
Diphteria		A,M,S,T,O		A,R	A	A,M,S,T,O
Hepatitis A		A,M,S,T,O		T	A	A,M,S,T,O
Hepatitis B		A,M,S,T,O		T,O	A	A,M,S,T,O
HPV						R
Influenza Seasonal		M,S,T,O		M	M,S,T,O	A,M,S,T,O
Japanese Encephalitis		T		T	T	T
Leptospirosis						
Measles				A,R	A	A,M,S,T,O
Meningococcal Meningitis	A,C					
	B					R,O
	C					
	A,C,Y,W-135	A,M,S,T,O		T	A	A,M,S,T,O
Mumps				A,R	A	A,M,S,T,O
Pertussis		A,M,S,T,O		A,R	A	A,M,S,T,O
Pneumococcal Disesase					O	R
Polio	live					
	inactived	A,M,S,T		A,R	A	A,M,S,T,O
Rabies		T		O	T	O
Rubella				A,R	A	A,M,S,T,O
Smallpox						T
Tetanus		A,M,S,T,O		A,R	A	A,M,S,T,O
Tickborne Encephalitis		A,M,S,T,O		T,O		
Tuberculosis		R				
Typhoid	live			T		
	inactived	M,S,T,O			T	M,S,T,O
Varicella					A	A,M,S,T,O
Yellow Fever		T		T	T	T

Codes:

A= **All** Personnel

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Nations Comments	
AUT	No comment
BEL	No comment
BGR	Order of the Minister of the Republic of Bulgaria N 724 / National immunization schedule.
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.
CHE	No comment
CZE	Hepatitis A, Hepatitis B, Meningococcal Meningitis (A,C,Y, W-135) and Tickborne Encephalitis vaccination compulsory for all personnel since 2020 - occupations at risk.
DEU	No comment
DNK	No comment
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 whether 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.
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.
FRA	- Influenza seasonal vaccine: mandatory three yearly immunization. Since 2020, annual vaccination is mandatory for deployable service members (OPEX) and for healthcare workers too. - Yellow vaccine: a one booster dose is needed for mission in endemic countries - 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. - 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)
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 period. *Rabies vaccine offered dependent on role, readiness or deployment location. *Polio vaccine offered to all Personnel and in relation to current IHR requirements.
GRC	---
HUN	No comment
IRL	No comment
ISL	---

Nations Comments	
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 that encompasses MEDINT products, information from the area of operations, operational engagement, logistic situation and short or long lasting deployment.
LTU	A: During extraordinarily situations all personnel get vaccination against Anthrax, Smallpox, and etc. M: Deployable personnel vaccination depends on region of mission.
LUX	No comment
LVA	---
NLD	No comment
NOR	M = absolute minimum, depending on region of mission others will be added S = all vaccines indicated T = not neccesarily all, dependent on destination
POL	Types of vaccinations for deployable personnel depends on region of mission. Vaccination against Ebola virus is recommended for soldiers deployed to endemic region(s).
PRT	BCG was generally given to every newborn in Portugal until 2016, and so all military born in Portugal has been vaccinated.
ROU	---
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.
SVN	---
SWE	No comment
TUR	According to the Directive on Combating Infectious Diseases and Epidemics of the MoD, pneumococcal vaccine is administered to personnel, flying personnel, personnel working in closed areas (submarine, etc.) as well as personnel working in occupations at risks (nurses,…) who are in the risk group due to the underlying disease.
USA	The Joint Regulation on the Immunizations and Chemoprophylaxis for the Prevention of Infectious Diseases is undergoing revision. Additional updates to vaccination have occurred since Oct 2013 IAW ACIP recommendations.

National Guidelines References		
AUT	2019	Vaccination Plan in Austrian Army
BEL	2018	ACWB-GID-INFECT-001
BGR	2008	Order of the Minister of the Republic of Bulgaria N 724 / National immunization schedule.
CAN	2016	CDCP/2007/02; 6643-12
CHE	2020	Swiss Federal Office of Public Health FOPH
CZE		Regulations of Chief of Public Health MoD
DEU	2021	Allgemeine Regelung AR A1-840/8-4000 Impf-und ausgewählte Prophylaxemaßnahmen – Fachlicher Teil -
DNK	2018	Danish Armed Defense Vaccination Policy
ESP		Spanish Ministry of Health Immunization Recommend
EST	2013	Chief of Defence guidance # 227
FRA	2020	French armed forces immunization schedule
GBR	2018	Public Health England; Immunisation against infectious disease JSP 950 Lflt 7-1-1
GRC		---
HUN	2019	Hungarian Vaccination Program and International Regulations
IRL		No Data
ISL		---
ITA	2018	MOD and Ministry of Health Regulations
LTU	2019	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	2014	Polish National Regulations
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	----	Directive on Combating Infectious Diseases and Epidemics of MoD
USA	2013	Joint Regulation

Diseases Description and Vaccines

Updated: **APR 2021**
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. The vaccine is recommended by the U.S. Department of Defense for military recruits entering basic training in order to prevent acute respiratory disease. It may also be recommended for other military personnel at high risk for adenovirus infection.

Anthrax

Anthrax is a serious infectious disease caused by gram-positive, rod-shaped bacteria known as *Bacillus anthracis*. Anthrax can be found naturally in soil and commonly affects domestic and wild animals around the world. Although it is rare in the United States, people can get sick with anthrax if they come in contact with infected animals or contaminated animal products. Anthrax can cause severe illness in both humans and animals. Anthrax is **not** contagious, which means you can't catch it from another person like the cold or flu. People get infected with anthrax when spores get into the body. When anthrax spores get inside the body, they can be "activated." When they become active, the bacteria can multiply, spread out in the body, produce toxins (poisons), and cause severe illness.
This can happen when people breathe in spores, eat food or drink water that is contaminated with spores, or get spores in a cut or scrape in the skin. It is very uncommon for people in the United States to get infected with anthrax.

Anthrax is rare, and most people will never be exposed to it. There is a vaccine licensed to prevent anthrax, but it is only recommended for routine use in certain groups of at-risk adults (for example, some members of the military and laboratory workers).

Cholera

Cholera is an acute diarrhoeal infection caused by eating or drinking food or water that is contaminated with the bacterium *Vibrio cholerae*. Cholera remains a global threat to public health and is an indicator of inequity and lack of social development. Researchers have estimated that every year, there are 1.3 to 4.0 million cases of cholera, and 21 000 to 143 000 deaths worldwide due to the infection.
Cholera is an extremely serious disease that can cause severe acute watery diarrhoea with severe dehydration. It takes between 12 hours and 5 days for a person to show symptoms after consuming contaminated food or water. Cholera affects both children and adults and can kill within hours if untreated.
Most people infected with *Vibrio cholerae* do not develop any symptoms, although the bacteria are present in their faeces for 1-10 days after infection. This means the bacteria are shed back into the environment, potentially infecting other people.
Cholera is often predictable and preventable. It can ultimately be eliminated where access to clean water and sanitation facilities, as well as good hygiene practices, are ensured and sustained for the whole population.

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”.
A mix of live, killed and conjugated vaccines are in development that have the potential of providing longer term protection with an easier-to-administer schedules.

Dengue

Dengue is a mosquito-borne viral infection that is common in warm, tropical climates. Infection is caused by any one of four closely related dengue viruses (called serotypes) and these can lead to a wide spectrum of symptoms, including some which are extremely mild (unnoticeable) to those that may require medical intervention and hospitalization. In severe cases, fatalities can occur. There is no treatment for the infection itself but the symptoms that a patient experiences can be managed.
Earlier this year, WHO listed dengue as a potential threat among ten diseases for 2019 and current outbreaks in many countries confirm this observation. Dengue epidemics tend to have seasonal patterns, with transmission often peaking during and after rainy seasons. There are several factors contributing to this increase and they include high

mosquito population levels, susceptibility to circulating serotypes, favourable air temperatures, precipitation and humidity, all of which affect the reproduction and feeding patterns of mosquito populations, as well as the dengue virus incubation period. Lack of proactive control interventions and staff are some of the other challenges.

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 routine childhood immunization 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, including tetanus and pertussis (e.g. DTwP/DTaP, 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 liver disease caused by the hepatitis A virus (HAV). The virus is primarily spread when an uninfected (and unvaccinated) person ingests food or water that is contaminated with the faeces of an infected person. The disease is closely associated with unsafe water or food, inadequate sanitation, poor personal hygiene and oral-anal sex.

Unlike hepatitis B and C, hepatitis A does not cause chronic liver disease and is rarely fatal, but it can cause debilitating symptoms and fulminant hepatitis (acute liver failure), which is often fatal. Overall, WHO estimated that in 2016, 7 134 persons died from hepatitis A worldwide (accounting for 0.5% of the mortality due to viral hepatitis).

Hepatitis A occurs sporadically and in epidemics worldwide, with a tendency for cyclic recurrences. The hepatitis A virus is one of the most frequent causes of foodborne infection. Epidemics related to contaminated food or water can erupt explosively, such as the epidemic in Shanghai in 1988 that affected about 300 000 people. They can be also prolonged, affecting communities for months through person-to-person transmission. Hepatitis A viruses persist in the environment and can withstand food-production processes routinely used to inactivate and/or control bacterial pathogens.

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.

The use of hepatitis A vaccine, rather than passive prophylaxis with immune globulin, is recommended for pre-exposure prophylaxis for individuals considered at increased risk, such as travellers to areas of higher hepatitis A endemicity, men who have sex with men, and people with chronic liver diseases. The vaccine can also be given as post-exposure prophylaxis to close contacts of acute cases of hepatitis A.

Hepatitis B

Hepatitis B is a potentially life-threatening liver infection caused by the hepatitis B virus (HBV). It is a major global health problem. It can cause chronic infection and puts people at high risk of death from cirrhosis and liver cancer.

A safe and effective vaccine that offers a 98-100% protection against hepatitis B is available. Preventing hepatitis B infection averts the development of complications including the development of chronic disease and liver cancer.

Several hepatitis B vaccines are available internationally. Both monovalent and products with multiple antigens are highly immunogenic and vaccination in a series of three doses will generate long-lasting, possibly life-long, protection against hepatitis B.

Vaccination against hepatitis B should be part of a comprehensive plan for the prevention and control of viral hepatitis, including measures for blood safety.

WHO recommends that all infants should receive their first dose of Hepatitis B vaccine as soon as possible after birth, preferably within 24 hours. The birth dose should be followed by 2 or 3 doses to complete the primary series. WHO also recommends that all health care workers receive this vaccine to prevent the risk of Hepatitis B in health care settings.

Human Papillomavirus (HPV)

Human papillomavirus (HPV) is the most common viral infection of the reproductive tract. Most sexually active women and men will be infected at some point in their lives and some may be repeatedly infected.

The peak time for acquiring infection for both women and men is shortly after becoming sexually active. HPV is sexually transmitted, but penetrative sex is not required for transmission. Skin-to-skin genital contact is a well-recognized mode of transmission.

There are many types of HPV, and many do not cause problems. HPV infections usually clear up without any intervention within a few months after acquisition, and about 90% clear within 2 years. A small proportion of infections with certain types of HPV can persist and progress to cervical cancer.

Cervical cancer is by far the most common HPV-related disease. Nearly all cases of cervical cancer can be attributable to HPV infection.

The infection with certain HPV types also causes a proportion of cancers of the anus, vulva, vagina, penis and oropharynx, which are preventable using similar primary prevention strategies as those for cervical cancer.

Non-cancer causing types of HPV (especially types 6 and 11) can cause genital warts and respiratory papillomatosis (a disease in which tumours grow in the air passages leading from the nose and mouth into the lungs). Although these conditions very rarely result in death, they may cause significant occurrence of disease. Genital warts are very common, highly infectious and affect sexual life.

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)

Seasonal influenza is an acute respiratory infection caused by influenza viruses which circulate in all parts of the world. It represents a year-round disease burden. It causes illnesses that range in severity and sometimes lead to hospitalization and death.
Most people recover from fever and other symptoms within a week without requiring medical attention. However, influenza can cause severe illness or death, particularly among high risk groups including the very young, the elderly, pregnant women, health workers and those with serious medical conditions.
In temperate climates, seasonal epidemics occur mainly during winter, while in tropical regions, influenza may occur throughout the year, causing outbreaks more irregularly.

Immunization is the major public health measure for the prevention of influenza virus infection. There are numerous licensed seasonal influenza vaccines available, several of which have been prequalified by the WHO for purchase by UN agencies . There are also several vaccine candidates under development against animal influenza A viruses – influenza strains considered at greatest risk for causing a future pandemic.
For WHO, the development of vaccines against influenza viruses with pandemic potential, as well as seasonal influenza vaccines that induce broadly protective and long-lasting immune responses are high priorities.

Japanese Encephalitis

Japanese encephalitis virus JEV is the most important cause of viral encephalitis in Asia. It is a mosquito-borne flavivirus, and belongs to the same genus as dengue, yellow fever and West Nile viruses.
The first case of Japanese encephalitis viral disease (JE) was documented in 1871 in Japan.
The annual incidence of clinical disease varies both across and within endemic countries, ranging from <1 to >10 per 100 000 population or higher during outbreaks. A literature review estimates nearly 68 000 clinical cases of JE globally each year, with approximately 13 600 to 20 400 deaths. JE primarily affects children. Most adults in endemic countries have natural immunity after childhood infection, but individuals of any age may be affected.

There are four main types of Japanese Encephalitis (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, haemorrhages in the skin and mucous membranes, vomiting, diarrhoea, and rash.

Immunization by means of vaccines seems to provide a certain degree of protection. Vaccines are, in principle, suspensions of killed leptospires. Protection is largely serovar-specific. In areas where many serovars are causing leptospirosis, a vaccine must consist of different serovars matching those circulating locally. In some countries, e.g. China, where many serovars occur, vaccines consist of a mixture of a few of the most prevalent. Protective antibodies are produced only against the serovars present in the particular vaccine used.

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.
While vaccination has drastically reduced global measles deaths — a 73% drop between 2000-2018 worldwide — measles is still common in many developing countries, particularly in parts of Africa and Asia. More than 140,000 people died from measles in 2018. The overwhelming majority (more than 95%) of measles deaths occur in countries with low per capita incomes and weak health infrastructures.
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.

Measles is a highly contagious viral disease. Despite the availability of a safe and effective vaccine, measles remains an important cause of death among young children globally, and can also lead to serious adverse outcomes such as blindness, pneumonia and encephalitis.
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. 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

Meningitis is a serious infection of the meninges, the membranes covering the brain and spinal cord. It is a devastating disease and remains a major public health challenge. The disease can be caused by many different pathogens including bacteria, fungi or viruses, but the highest global burden is seen with bacterial meningitis.

Several different bacteria can cause meningitis. *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Neisseria meningitidis* are the most frequent ones. N. meningitidis, causing meningococcal meningitis, is the one with the potential to produce large epidemics. There are 12 serogroups of N. meningitidis that have been identified, 6 of which (A, B, C, W, X and Y) can cause epidemics.

Meningococcal meningitis can affect anyone of any age, but mainly affects babies, preschool children and young people. The disease can occur in a range of situations from sporadic cases, small clusters to large epidemics throughout the world, with seasonal variations. Geographic distribution and epidemic potential differ according to serogroup. The largest burden of meningococcal meningitis occurs in the meningitis belt, an area of sub-Saharan Africa, which stretches from Senegal in the west to Ethiopia in the east.

N. meningitidis can cause a variety of diseases. Invasive meningococcal disease (IMD) refers to the range of invasive diseases caused by N. meningitidis, including septicemia, arthritis and meningitis. Similarly, *S. pneumoniae* causes other invasive diseases including otitis and pneumonia.

Meningococcal polysaccharide vaccines are safe and effective in children and adults but weakly immunogenic in infants, do not induce a booster response, do not provide herd protection and can induce immunologic hypo responsiveness upon repeated vaccination. They are still used for outbreak control and gradually being replaced by polysaccharide-protein conjugate vaccines, which are more immunogenic and effective in preventing nasopharyngeal carriage of the bacteria and thus its transmission. They are available in monovalent (A or C), quadrivalent (A, C, W, Y), or combination (serogroup C and *Haemophilus influenzae* type b) formulations. There are no vaccines available against serogroup X disease.

Meningococcal meningitis is largely a vaccine preventable disease and several vaccines are available for protection from the most common serogroups causing disease. They are used both for routine immunization and to respond to meningitis epidemics.

Until recently, serogroup A strains were the major cause of epidemic and endemic meningococcal disease in the meningitis belt in sub-Saharan African. The introduction of a meningococcal A conjugate vaccine (MenACV) in belt countries has led to a dramatic reduction in the number of cases due to N. *meningitidis* A. A significant residual disease burden is now caused by serogroups C, W and X in these epidemic-prone areas. The meningococcal B polysaccharide capsule cross-reacts with human antigens and is poorly immunogenic. Tailored serogroup B vaccines based on the outer membrane vesicles of clonal strains have been developed to control specific outbreaks. Two protein-based vaccines are now available that offer broad protection against serogroup B meningococcal disease.

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, also known as whooping cough, is a highly contagious respiratory infection caused by the bacterium *Bordetella pertussis.* In 2018, there were more than 151 000 cases of pertussis globally.
Pertussis spreads easily from person to person mainly through droplets produced by coughing or sneezing. The disease is most dangerous in infants, and is a significant cause of disease and death in this age group.
The first symptoms generally appear 7 to 10 days after infection. They include a mild fever, runny nose and cough, which in typical cases gradually develops into a hacking cough followed by whooping (hence the common name of whooping cough). Pneumonia is a relatively common complication, and seizures and brain disease occur rarely.
People with pertussis are most contagious up to about 3 weeks after the cough begins, and many children who contract the infection have coughing spells that last 4 to 8 weeks. Antibiotics are used to treat the infection.

The best way to prevent pertussis is through immunization. The three-dose primary series diphtheria-tetanus-pertussis (DTP3) (- containing) vaccines decrease the risk of severe pertussis in infancy. In 2018, 86% of the global target population had received the recommended three doses of DTP-containing vaccine during infancy.
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. A booster dose is recommended, preferably during the second year of life. Based on local epidemiology, further booster doses may be warranted later in life.
Vaccination of pregnant women is effective in preventing disease in infants too young to be vaccinated. National programmes may consider vaccination of pregnant women with pertussis-containing vaccine as a strategy additional to routine primary infant pertussis vaccination in countries or settings with high or increasing infant morbidity/mortality from pertussis.

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

Poliomyelitis (polio) is a highly infectious viral disease that largely affects children under 5 years of age. The virus is transmitted by person-to-person spread mainly through the faecal-oral route or, less frequently, by a common vehicle (e.g. contaminated water or food) and multiplies in the intestine, from where it can invade the nervous system and cause paralysis.
In 1988, the World Health Assembly adopted a resolution for the worldwide eradication of polio, marking the launch of the Global Polio Eradication Initiative, spearheaded by national governments, WHO, Rotary International, the US Centers for Disease Control and Prevention (CDC), UNICEF, and later joined by the Bill & Melinda Gates Foundation and Gavi, the Vaccine Alliance. Wild poliovirus cases have decreased by over 99% since 1988, from an estimated 350 000 cases in more than 125 endemic countries then to 175reported cases in 2019.
Of the 3 strains of wild poliovirus (type 1, type 2 and type 3), wild poliovirus type 2 was eradicated in 1999 and no case of wild poliovirus type 3 has been found since the last reported case in Nigeria in November 2012. Both strains have officially been certified as globally eradicated. As at 2020, wild poliovirus type 1 affects two countries: Pakistan and Afghanistan.
The strategies for polio eradication work when they are fully implemented. This is clearly demonstrated by India's success in stopping polio in January 2011, in arguably the most technically challenging place, and polio-free certification of the entire WHO Southeast Asia Region in March 2014.

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 viral zoonotic disease that causes progressive and fatal inflammation of the brain and spinal cord. Clinically, it has two forms:

1. Furious rabies – characterized by hyperactivity and hallucinations.
2. Paralytic rabies – characterized by paralysis and coma.

Although fatal once clinical signs appear, rabies is entirely avoidable; vaccines, medicines and technologies have long been available to prevent death from rabies. Nevertheless, rabies still kills tens of thousands of people each year. Of these cases, approximately 99% are acquired from the bite of an infected dog.

Dog-mediated human rabies can be eliminated by tackling the disease at its source: infected dogs. Making people aware of how to avoid the bites of rabid dogs, to seek treatment when bitten and to vaccinate animals can successfully disrupt the rabies transmission cycle.

Rabies is estimated to cause 59 000 human deaths annually in over 150 countries, with 95% of cases occurring in Africa and Asia. Due to underreporting and uncertain estimates, this number is likely a gross underestimate. The burden of disease is disproportionally borne by rural poor populations, with approximately half of cases attributable to children under 15 years of age.

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

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, fetal 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.

Rubella vaccines are commonly given in a combination vaccine with 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 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 most devastating diseases known to humanity and caused millions of deaths before it was eradicated. It is believed to have existed for at least 3000 years.

The smallpox vaccine, created by Edward Jenner in 1796, was the first successful vaccine to be developed. He observed that milkmaids who previously had caught cowpox did not catch smallpox and showed that a similar inoculation could be used to prevent smallpox in other people.
The World Health Organization launched an intensified plan to eradicate smallpox in 1967. Widespread immunization and surveillance were conducted around the world for several years. The last known natural case was in Somalia in 1977. In 1980 WHO declared smallpox eradicated – the only infectious disease to achieve this distinction. This remains among the most notable and profound public health successes in history.

Tetanus

Tetanus is a serious illness contracted through exposure to the spores of the bacterium, *Clostridium tetani*, which live in soil, saliva, dust, and manure. The bacteria can enter the body through a deep cuts, wounds or burns affecting the nervous system. The

infection leads to painful muscle contractions, particularly of the jaw and neck muscle, and is commonly known as “lockjaw”.
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 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”.
The disease remains an important public health problem in many parts of the world, but especially in low-income countries or districts, where immunization coverage is low and unclean birth practices are common. WHO estimates that in 2017 (the latest year for which estimates are available), 30,848 newborns died from neonatal tetanus, 85% reduction from the situation in 2000.

Tetanus can be prevented through immunization with tetanus-toxoid-containing vaccines (TTCV), which are included in routine immunization programmes globally and administered during antenatal care contacts.
To be protected throughout life, WHO recommends that an individual receives 6 doses (3 primary plus 3 booster doses) of TTCV. 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 of age, and at 9–15 years of age. Ideally, there should be at least 4 years between booster doses.
There are many kinds of vaccines used to protect against tetanus:

- Diphtheria and tetanus (DT) vaccines
- Diphtheria, tetanus, and pertussis (whooping cough) (DTaP) vaccines
- Tetanus and diphtheria (Td) vaccines
- Tetanus, diphtheria, and pertussis (Tdap) vaccines

Neonatal tetanus can be prevented by immunizing women of reproductive age with TTCV, either during pregnancy or outside of pregnancy. Additionally, robust medical practices can also prevent tetanus disease including clean delivery and cord care during childbirth, and proper wound care for surgical and dental procedures.

Tick-borne Encephalitis

Tick-borne encephalitis (TBE) is an important cause of viral infections of the central nervous system in eastern, central, northern and increasingly western European countries, and in northern China, Mongolia, and the Russian Federation. Tick-borne encephalitis virus is a member of the family *Flaviviridae.*
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 number of clinical cases.
The vast majority of infections with the virus result from infected ticks, which often remain firmly attached to the skin for days. On rare occasions, infection can result from consumption of unpasteurized milk from infect goats, sheep or cows. People come in contact with the ticks during outdoor activities in forested areas up to an altitude of about 2000 meters. There is no direct person-to-person transmission.

Immunization offers the most effective protection. Currently, there are 4 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 4 vaccines are considered to be safe and effective.
In areas where the disease is highly endemic, WHO recommends that vaccination be offered to all age groups, including children.
Ticks also transmit Borreliosis (Lyme disease), which is a bacterial infection. TBE vaccination is not effective against this disease, which however is treatable with antimicrobials.

BCG (Tuberculosis)

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.

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 by WHO for control of endemic and epidemic typhoid fever:

- 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.

Among the available typhoid vaccines, TCV is preferred at all ages for routine programmatic use 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 is an epidemic-prone mosquito-borne vaccine preventable disease that is transmitted to humans by the bites of infected mosquitoes. Yellow fever is caused by an arbovirus (a virus transmitted by vectors such mosquitoes, ticks or other arthropods) transmitted to humans by the bites of infected *Aedes* and *Haemagogus* mosquitoes. These day-biting mosquitoes breed around houses (domestic), in forests or jungles (wild), or in both habitats (semi-domestic). Yellow fever is a high-impact high-threat disease, with risk of international spread, which represents a potential threat to global health security.

There are 3 types of transmission cycles. The first is sylvatic (or jungle) yellow fever in which monkeys, which are the primary reservoir of yellow fever, are bitten by wild mosquitoes that pass the virus on to other monkeys and occasionally humans. The

second is intermediate yellow fever in which semi-domestic mosquitoes infect both monkeys and people. This is the most common type of outbreak in Africa. The third is urban yellow fever of which large epidemics occur when infected people introduce the virus into heavily populated areas with high mosquito density and where people have little immunity. In these conditions, infected mosquitoes transmit the virus from person to person.
Strong case-based surveillance for yellow-fever can help detect outbreaks early as well as spread to new areas. Occasionally, infected travellers have exported cases to countries that are free of yellow fever. However, the disease can only spread easily if the country it is imported to has mosquito species able to transmit it, specific climatic conditions and the animal reservoir needed to maintain it. To prevent international spread, it is essential that the International Health Regulations (2005) are applied and that travellers to high risk areas present yellow fever vaccination certificates – these certificates are valid for life.

Vaccination is the most important measure for preventing yellow fever. Yellow fever vaccine is safe, affordable, and a single dose provides life-long protection against yellow fever disease. The yellow fever vaccine provides immunity within one week in 95% of people vaccinated. A booster dose is not needed.
Yellow fever vaccination is carried out for the following reasons:

- to protect populations living in areas at high-risk or endemic for yellow fever disease;
- to protect travelers visiting these areas; and,
- to prevent international spread by minimizing the risk of importation of the virus to unaffected areas

All currently available yellow fever vaccines are live and attenuated formulations. Vaccines from four manufacturers are currently prequalified by WHO.

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