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VACCINATION AGAINST YELLOW FEVER

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Superior Health Council

ADVISORY REPORT OF THE SUPERIOR HEALTH COUNCIL no. 9844

Vaccination against Yellow Fever

In this scientific advisory report, which offers guidance to public health policy-makers, the Superior Health Council of Belgium provides recommendations of vaccination against yellow fever.

This version was validated by the Board on
Wednesday January 8, 2025[1]

I INTRODUCTION

Yellow fever (YF), a mosquito-borne viral haemorrhagic disease, poses a significant public health threat in endemic regions of Africa and South America.

Vaccination is essential for preventing yellow fever in individuals and avoiding its spread to non-endemic countries where the vector is present. As a result, vaccination is governed by the International Health Regulations (IHR) set by the World Health Organization (WHO). In some cases, a certificate of vaccination, issued according to strict rules in the "International Certificate of Vaccination and Prophylaxis" (ICVP), may be required for entry into certain countries.

A booster dose was recommended of yellow fever vaccine every 10 years. WHO changed its recommendations in 2013 and a critical amendment to the IHR (2005), Annex 7, stated that as of July 11, 2016, international travellers cannot be required to receive booster doses as a condition of entry to any State Party, regardless of the date their initial ICVP was issued. Despite this regulatory shift, many non-endemic countries have adopted tailored guidelines for specific subpopulations, such as individuals with weakened immune responses, who may require additional boosters.
In Belgium, a single revaccination was recommended for all travellers until this revision.

The yellow fever vaccine (live attenuated) provides strong and durable protection, however recent advancements in immunological and epidemiological research have prompted a reassessment of current vaccination guidelines.
Updating these guidelines ensures alignment with the latest scientific evidence, WHO recommendations, and optimizes vaccination strategies. Special attention is given to vulnerable populations, such as children, people living with HIV, and those with compromised immune systems.

[1] The Council reserves the right to make minor typographical amendments to this document at any time. On the other hand, amendments that alter its content are automatically included in an erratum. In this case, a new version of the advisory report is issued.

II CONCLUSIONS AND RECOMMENDATIONS

The Superior Health Council (SHC) recommends vaccination against yellow fever for people aged ≥ 9 months*:

- When travelling to a **country** with risk of yellow fever.**
- If there is an administrative obligation: traveling to, transiting through, or residing in countries that require an International Certificate of Vaccination or Prophylaxis (ICVP) for entry.
- Laboratory worker or personnel involved in handling live yellow fever virus.

For most people, a single dose of yellow fever vaccine provides lifelong protection. A single revaccination is recommended for certain target groups (listed below).

Vaccination is not recommended when visiting a country with low potential of yellow fever exposure.

A map showing the regions where vaccination is recommended is published on https://www.wanda.be/en/a-z-index/yellow-fever-world-map/

** Only approved travel clinics in Belgium are authorised to give a yellow fever vaccine. The list is available on the website wanda.be: Travel clinics in Belgium | Wanda*

*** A country is considered at risk for yellow fever if certain regions within its borders are at risk for yellow fever. Vaccination is recommended when there is any risk for yellow fever in the country, even when traveller does not plan to visit a known at-risk region. However, exceptions can be considered in case there is a clearly defined region within the country where there is no risk for yellow fever, and it can be ensured with certainty that the traveller will not enter an endemic area during his stay.*

General recommendation

For immunocompetent travellers from the age of 2 years, a single dose of yellow fever vaccine provides lifelong protection. These persons do not require yellow fever revaccination.
Immunisation should be performed at least ten days prior to travel to an endemic area to allow protective immunity to develop and for the ICVP (if required) to become valid.

To be noted in the ICVP: **valid until "lifelong".**

Recommendations on revaccination:

1. **Children who received their first vaccination before the age of 2 years require revaccination after the age of 2 years if the child is travelling (again) to a yellow fever-endemic area. Revaccination should be administered once the child is at least 2 years old, ensuring a minimum interval of 28 days between the initial vaccination and the revaccination.**

   To be noted in ICVP : **valid until "date of 2nd birthday**"

   A "lifelong" stamp can be provided once the revaccination has been administered before the next travel to a yellow fever-endemic area after the child's second birthday.

2. **For pregnant woman travelling to endemic areas, when travel cannot be avoided or postponed and if the women was not vaccinated before, vaccination is recommended. Revaccination is recommended when the women will be exposed again and is not pregnant.**

   To be noted in ICVP: **valid until "the end date of the last planned trip during pregnancy"**

3. **People living with HIV (PLWHIV) can be given yellow fever vaccination when CD4 count is above 200 cells/µl and preferably when HIV viral load is undetectable (< 200 copies/ml). A single yellow fever revaccination is recommended for all PLWHIV and should preferably be administered before the next travel to a yellow fever endemic area with a minimal interval of 28 days.**

   Note: If the primary vaccination was given when the HIV viral load was detectable (viral load ≥ 200 copies/ml), revaccination should preferably be administered when the HIV viral load has been undetectable for ≥6 months.

   Currently, there is no data on the necessity for more than 1 revaccination and is therefore not recommended.

   At the primary vaccination, to be noted in ICVP: **valid until "date of the end of the planned trip to an endemic area".**

   After revaccination, a "lifelong" stamp can be provided in the ICVP provided the revaccination has been administered with an undetectable HIV viral load.

4. **Yellow fever revaccination is recommended for people with an underlying immunosuppressive condition or those using immunosuppressive drugs (e.g., disease-modifying drugs), provided there is no contraindication to this live-attenuated vaccine. This applies even if the primary vaccination was administered before the individual became immunocompromised. Revaccination is especially recommended if the primary vaccination was administered when the person was already immunocompromised**.

   From a practical perspective: if revaccination is not possible and time allows, one can measure neutralising antibodies against yellow fever. This can be done at the Institute of Tropical Medicine, for detailed procedures, we refer to https://labo.itg.be/en/analysen/yellow-fever-virus-neutralizing-antibodies/.
   It is unclear how frequently this should be done.

   Patients not yet immunocompromised at the time of primary yellow fever vaccination: to be noted in ICVP: **valid until 'lifelong'.**
   If they are aware of future immunosuppression or already immunocompromised, they can be informed about the possible necessity of revaccination in the future, provided there is no contraindication.

Contraindications

More information on (relative)contraindications can be found on the Wanda website: https://artsen.wanda.be/en/a-z-index/gele-koorts-vaccinatie

Absolute contraindications

- Severe allergy (anaphylaxis) to eggs or latex or any other component from the vaccine
- Child under the age of 6 months
- Thymus dysfunction with abnormal immune cell function, including myasthenia gravis
- HIV with CD4 < 200 cells/µl
- Immunosuppressive or immunomodulatory therapies
- Primary immunodeficiencies
- INF-1 deficiency (due to genetic defect or auto-antibodies)
- Transplant patient (Hematopoietic stem cell, solid organ)

Relative contraindications

Relative contraindications represent clinical conditions associated with either an elevated risk of adverse events following immunization or potential interference with vaccine immunogenicity. These scenarios necessitate individualized risk-benefit assessment prior to vaccine administration.

- Primo-vaccination ≥60 years of age
- Child between 6 and 9 months old
- Pregnancy
- Breastfeeding in infants under 6 months

In particular cases where vaccination is contra-indicated, a waiver (with end date) should be issued in the ICVP stating “vaccination is contra-indicated for medical reasons”.

Summary table of revaccination recommendations

Patient group	Revaccination	Revaccination interval	Validity in the ICVP
Immunocompetent (healthy) travellers (≥2 years old)	Not required	n/a	**Lifelong**
Children vaccinated against yellow fever < 2 years of age	Revaccination	After the age of 2 years, minimum interval of 28 days	<2 years old: **Date of 2nd birthday** >2 years old: **Lifelong**
People living with HIV (CD4 count ≥200 mm^3)	Revaccination before next travel to yellow-fever endemic area for all PLWHIV	For individuals who were not virologically suppressed (viral load ≥200 c/ml) at the time of the first vaccination, revaccination should be given once the viral load has been undetectable for a minimum of 6 months.	At primary YF vaccination: **Date of the end of the planned trip** After revaccination (if HIV viral load<200 c/ml): **Lifelong**
People with immunosuppressive conditions or immunosuppressive drugs / disease modifying drugs	Revaccination	Unknown; only if no contra-indication exists.	**Lifelong** Inform the patient about the uncertainties regarding the duration of protection.
Pregnancy	Revaccination	Repeat when next travel to an endemic area	**The end date of the last planned trip during pregnancy**

Further studies are needed to determine optimal revaccination intervals for immunocompromised individuals and to evaluate long-term vaccine performance in co-administration scenarios. This recommendation will be reassessed when new important data becomes available.

III TABLE OF CONTENT

Keywords

Keywords	***Sleutelwoorden***	***Mots clés***	***Schlüsselwörter***
Yellow fever	*Gele koorts*	*Fièvre jaune*	*Gelbfieber*
Vaccination	*Vaccinatie*	*Vaccination*	*Impfung*
Revaccination	*hervaccinatie*	*Revaccination*	*Auffrischung*
Adults	*Volwassenen*	*Adultes*	*Erwachsene*
Children	*Kinderen*	*Enfants*	*Kinder*
Immunocompromised	*Immuungecompromitteerd*	*Immunodéprimés*	*Immungeschwächte*
HIV	*HIV*	*VIH*	*HIV*

IV METHODOLOGY

The Board and the co-presidents of the National Immunization Technical Advisory Group (NITAG) identified the necessary fields of expertise. An *ad hoc* working group was set up which included experts in travel medicine, paediatrics, infectiology. The experts of this working group provided a general and an *ad hoc* declaration of interests and the Committee on Deontology assessed the potential risk of conflicts of interest.

This advisory report is based on a review of the scientific literature published in both scientific journals and reports from national and international organisations competent in this field (peer-reviewed), as well as on the opinion of the experts.

Once the advisory report was endorsed by the working group and NITAG it was ultimately validated by the Board. The Belgian Study Group Travel Medicine endorsed the recommendations.

V ELABORATION AND ARGUMENTATION

List of abbreviations used

CI	Confidence Interval
EMA	European Medicines Agency
HIV	Human Immunodeficiency Virus
IATA	International Air Transport Association
ICVP	International Certificate of Vaccination or Prophylaxis
INF-1	Interferon-1
NITAG	National Immunization Technical Advisory Group
PLWHIV	People Living With HIV
SHC	Superior Health Council
VRR	Vaccine Response Rate
WHO	World Health Organization
YEL-AND	Yellow Fever-Associated Neurotropic Disease
YEL-AVD	Yellow Fever-Associated Viscerotropic Disease
YF	Yellow Fever

1 Yellow Fever

Yellow fever is a life-threatening infection that is caused by an arbovirus of the flavivirus genus. The 'yellow' in the name refers to the jaundice that affects some patients.

1.1 Symptoms

Most infections (50-85 %) are subclinical or have minor symptoms like fever, muscle pain, headache, loss of appetite, nausea or vomiting which disappear after three to four days. After a short remission of symptoms, lasting up to 48 hours, a smaller proportion (15-20 %) will develop a severe life threatening disease with fever, jaundice, renal failure and hemorrhage. Approximately half (20 %-50 %) of those die within seven to ten days.

1.2 Transmission

1.2.1 Vector

Mosquitoes belonging to the *Aedes* and *Haemogogus* species that primarily bite during the day. The virus is transmitted by these vector species in a forest or rural cycle and by *Aedes aegypti* in an urban environment.

1.2.2 Reservoirs

Monkeys are the primary reservoirs. Humans are only infected occasionally (sporadic infection of forest yellow fever). However, humans can act as amplifying hosts during urban outbreaks. Large epidemics of yellow fever occur when infected people introduce the virus into heavily populated areas with high mosquito density and where most people have little or no immunity, due to a lack of vaccination. In these conditions, infected mosquitoes of the *Aedes aegypti* species transmit the virus from person to person.

1.3 Incubation period

Short, 3 to 6 days.

1.4 Epidemiology and risk areas

The virus is endemic in tropical areas of Africa and Central and South America. There is no risk above an altitude of approximately 2300-2500 metres (Hamrick et al., 2017).

2 Yellow fever vaccine (Stamaril®)

We refer to the Summary of Product Characteristics (SPC) of Stamaril® on the EMA website for more details on the vaccine:

https://www.ema.europa.eu/en/documents/referral/stamaril-article-30-referral-annex-i-ii-iii_en.pdf

2.1 Type of vaccine

Live-attenuated vaccine, produced by the inoculation of embryonated chicken eggs.

2.2 Posology and method of administration

The vaccine must be administered at least ten days prior to arrival.

It is preferable that the vaccine is injected by the subcutaneous route.

A fractional dose, generally 0,1 ml (or 1/5 of the standard dose) has been administered via intradermal route during emergencies in outbreaks resulting in comparable immunogenicity (Abdala-Torres et al., 2024). However, WHO notes that a fractional dose does not meet YF vaccination requirements under the IHR and proof of vaccination for international travel cannot be issued.

2.3 Effectiveness

Schnyder et al. recently published a systematic review and meta-analysis, showing that most primary vaccine recipients maintain neutralising antibody levels above protective thresholds for 10 years or longer post-vaccination. Especially in healthy adults in non-endemic settings, who were mostly travellers, high rates of seroprotection were observed 10 to 60 years post-vaccination (overall seroprotection rate 94 %) (Schnyder et al., 2024b).

2.4 Safety

Serious adverse events such as severe hypersensitivity or anaphylactic reactions, neurotropic or viscerotropic disease (YEL-AND; YEL-AVD) have been reported from post-marketing experience.

Anaphylaxis
It's estimated in five to twenty per one million persons (1/50 000 – 1/200 000). This is most likely due to an allergy to egg or gelatine components. The tip caps of the prefilled syringes contain a natural rubber latex derivative, which may cause allergic reactions in latex sensitive individuals.

Yellow fever vaccine- associated neurologic disease (YEL-AND)
YEL-AND is rare with an overall risk of 0.8 per 100 000 vaccinations according to CDC, 2/3 of the cases occurred in children younger than 6 months. It consists of different neurological complications (e.g., meningoencephalitis, Guillain-Barré syndrome, acute disseminated encephalomyelitis, cranial nerve palsies) due to an immunological reaction or due to invasion of the vaccine virus in neurological tissue. This complication is seen 2 to 56 days after vaccination.

Yellow fever vaccine- associated viscerotropic diseases (YEL-AVD)
YEL-AVD is a syndrome of fever with multi- organ failure that resembles severe yellow fever disease. It was first described in 2001 and over a hundred confirmed cases have been reported worldwide, death has occurred in more than 60 % of reported cases. It has only been seen with people receiving their first vaccination and develops 3 to 5 days (range 1 to 18 days) following administration.
YEL-AVD has been estimated to be reported in 0.3 cases per 100 000 doses distributed according to CDC. The rates increase with increasing age: from 1 per 100 000 vaccines in people aged 60-70 year up to 2.3 per 100 000 vaccines when older than 70 years. Risk factors for developing YEL-AVD are increasing age and thymus disorders and INF-1 deficiencies.

In studies performed for market authorization (in general healthy population) with 4896

participants receiving Stamaril®, the most frequently reported adverse events (between 12 % and 18 % of subjects) were headache, asthenia, injection site pain and myalgia.

In the most representative study in toddler population, the most frequently reported adverse events (between 32 % and 35 % of toddlers) were irritability, crying and appetite loss.

Common adverse events usually occurred within the first three days following vaccination except pyrexia, which occurred between Day 4 and Day 14. These events usually lasted for not more than 3 days. Both local and systemic events were usually of mild intensity; however at least one severe injection site reaction was reported in 0.8% of subject in general population and in 0.3 % of toddlers and at least one severe systemic event was reported in 1.4 % of subjects in general population and 4.9 % in toddlers.

2.5 Co-administration

There is no evidence that yellow fever vaccine interferes with the immune response of inactivated vaccines.

Co-administration with life attenuated vaccines
Most data indicate no significant interference between yellow fever and measles vaccination. Ferrara et al. reviewed 20 studies, of which 16 showed no decrease in vaccine response rates (VRRs). However, two studies identified lower VRRs for both yellow fever and MMR (measles, mumps, and rubella) vaccines in children who received the vaccinations on the same day compared to those who received the two vaccines at longer intervals. The random-effects meta-regression analyses of Ferrara et al. did not reveal any differences in relation to the co-administration of other vaccines, including live-attenuated platforms..
There are no data available about co-administration of yellow fever vaccine and measles vaccine in adults.

As with other life attenuated vaccines, **it is preferred to administer the yellow fever vaccine separately from other life attenuated vaccines, with a minimum interval of 28 days.**

However, if separating the vaccinations is not feasible, simultaneous administration is advised, but preferable in a different limb.
If this is also not possible and there is an indication for both vaccines, the yellow fever vaccine and other live-attenuated vaccines can be administered at any interval, as the risk of delaying vaccination outweighs the potential risks of shorter interval (Ferrara et al., 2024).

We do not recommend revaccination if the yellow fever vaccine was administered simultaneously or within a 28-day interval with measles vaccine.

3 Elaboration of recommendations

3.1 Vaccination indications

The working group has decided to align closely with WHO recommendations and most other international guidelines by no longer recommending yellow fever vaccination for travellers visiting countries with a low risk of exposure, such as Tanzania, Somalia, Eritrea, Rwanda, and Zambia (at time of publication, we refer to Wanda for updates). A literature review found no reported yellow fever cases in these countries. The International Air Transport Association (IATA) and other countries' experiences were consulted regarding any administrative requirements for travel to Tanzania and Zanzibar. IATA confirmed that a vaccination certificate is no longer required, leading the working group to conclude that no certificate should be issued for these destinations.

For countries with some regions that have a yellow fever risk, the working group has chosen to align more closely with WHO guidelines. Vaccination is not advised if travellers are certain they will not visit endemic areas and if there is no administrative obligation (such as when crossing certain borders). However, vaccination is still recommended in cases of uncertainty. Information about yellow fever risk and administrative requirements can be found at www.wanda.be.

3.2 Single-dose vaccination for travellers

(Strength of recommendation: Strong, level of evidence: moderate (GRADE)).

In immunocompetent individuals, some data point to a decrease in circulating antibodies with time after a primary vaccination: 88 % after 5-10years and 63-71 % after > 10 years (Campi-Azevedo et al. 2019b, Gotuzzo, Yactayo and Córdova 2013, Kling et al. 2022).

However, several papers (Lindsey et al. 2018, Schnyder et al. 2024a) and a recent meta-analysis (Schnyder et al. 2024b) support the fact that healthy travellers will stay protected for life after a primary (single) yellow fever vaccination. The seroprotection rate for healthy adults in this meta-analysis for non-endemic areas was 94 % (95 % CI 86-99 %).

Moreover, very few clinical yellow fever vaccine failures are described in the literature in primo-vaccinated individuals, suggesting that even in people who have lost their circulating antibodies, persistent cellular immunity is sufficient to protect against either the infection or its complications (Schnyder et al. 2024a).

It is still unclear whether someone who has been primo-vaccinated against yellow fever could still suffer from subclinical yellow fever and, through vector transmission, contribute to the persistence of the disease in animal, human, and mosquito reservoirs, but this is not a concern for travellers returning to non-endemic areas.

Finally, there is a chronic worldwide shortage of yellow fever vaccines driven by repeated resurgences of this infection and the need for mass vaccination campaigns, which adds complexity to vaccination strategies elaboration.

Given all these factors, it seems rational and reasonable to align with WHO Guidelines from 2013, and to prioritize single-dose vaccination for the largest number of people, rather than routine revaccination with a second dose for Belgian travellers (WHO, 2013).

3.3 Revaccination for children < 2 years

(Strength of recommendation: Strong, level of evidence: low (GRADE)).

Existing pediatric data predominantly derive from studies conducted in regions with endemic disease transmission.

A review showed that in general, children respond well to yellow fever vaccination, the seroconversion < 2 years was 91,4 % (Ferrara et al. 2024), but some articles have shown lower seroconversion rates in children before the age of 2 years compared to older children and adults, especially in coadministration with the MMR vaccine.
Additionally, the persistence of antibodies wanes more quickly in young children compared to older children or adults, often within a few years following the primary vaccination (Ferrara et al. 2024). A 10-year cross-sectional study first evaluated the duration of immunity in children who received a single dose of the 17DD-YF vaccine at 9-12 months of age and found that seropositivity significantly declined after 2 years, dropping below 60 % by 4 years. Additionally, yellow fever-specific memory T and B-cell responses declined after 4 years (Campi-Azevedo

et al. 2019a). In a longitudinal study in Mali and Ghana with children vaccinated at the age of 9 months, the antibodies dropped below seroprotection in more than 50 % of the children within 4-5 years (Domingo et al. 2019).
These findings support the need for revaccination in children below the age of 2 years. While the exact minimum interval for revaccination is unknown, it is theoretically possible to revaccinate after 4 weeks (as generally recommended in other life attenuated vaccines). However, countries such as the Netherlands and France recommend a minimum interval of 1 year or vaccination after the age of 6 years, respectively, based on expert opinion. After this revaccination, life-long immunity is expected. As far as we know, no countries advise more than one revaccination when primo-vaccinated at a young age.

Given the limited immunological evidence supporting the ideal timing for revaccination, we suggest 2 years as the minimum age for revaccination to ensure optimal protection (expert opinion, low confidence of evidence).

It should be noted that there are very limited data to evaluate the need of more than one revaccination in young children. This led to significant discussion within the working group about whether one revaccination would suffice if the first dose was administered before the age of 2 years. Therefore, some experts, particularly paediatricians, suggest considering a third dose if the second dose was given more than 10 years earlier (expert opinion). However, this would remain a case-by-case decision and is therefore not generally recommended unless additional evidence emerges to support it.

At the same time, it is important to acknowledge that there have been no widespread reports of breakthrough infections to justify such a recommendation (Schnyder et al. 2024a) and WHO recommends just one vaccination for all ages.

3.4 Pregnant woman

Usually life attenuated vaccines are contra indicated in pregnant women and it is recommended to delay pregnancy until 4 weeks after vaccination. In general, it is safer to avoid travel to yellow fever risk areas.
However, in 2 observational studies, no major congenital problems were observed in children exposed to yellow fever vaccination in early pregnancy. A slight increase in minor abnormalities (mainly naevi) was observed in one study (Cavalcanti et al. 2007).
Yellow fever vaccination in pregnant women results in less seroconversions, especially in during third trimester (Suzano at al. 2006, Cavalcanti et al. 2007, Fantinato et al. 2023, WHO 2013). Therefore, a single revaccination when the women will be exposed again and is not pregnant.

3.5 People living with HIV (PLWHIV)

(Strength of recommendation: Strong, level of evidence: low (GRADE)).

The recommendation for yellow fever revaccination in PLWHIV is supported by findings from both systematic review and study by Martin et al. Both papers highlight the shortened persistence of neutralizing antibodies in PLWHIV.
A meta-analysis demonstrated that 97.6 % of the included population of PLWHIV seroconverted, if the HIV viral load was undetectable (< 200 copies/µl) at time of vaccination. Persistence of neutralizing antibodies decreased to 72 % after 1 to 10 years and to 62 % more than 10 years after vaccination. An undetectable viral load was a significant predictor for seroconversion and for persistence of seroprotection.
These data suggest that at least one revaccination should be offered to PLWHIV to maintain adequate protection. Revaccination should preferably be given once the viral load has been

undetectable for at least 6 months to optimize immune response. No clear data exists on the need for a second revaccination.

3.6 Immunocompromised individuals

(Strength of recommendation: Weak, level of evidence: very low (GRADE)).

The recommendation for yellow fever revaccination in individuals with underlying immunosuppressive conditions or those using immunosuppressive drugs, such as disease-modifying agents, is based on limited and low-quality evidence, as highlighted by *Snyder et al.* (Schnyder et al. 2024b). The available data on the long-term immune response to yellow fever vaccination in immunosuppressed populations are sparse (Burkhard et al. 2020), and most studies focus on specific conditions rather than broad immunosuppressive states.

Snyder et al. point out that immunocompromised individuals, including those on immunosuppressive therapy, tend to have lower seroprotection rates and may experience faster waning of immunity following yellow fever vaccination even when the primovaccination was given when the person was not yet immunocompromised.

VI REFERENCES

Abdala-Torres T, Campi-Azevedo AC, da Silva-Pereira RA et al.. Immune response induced by standard and fractional doses of 17DD yellow fever vaccine. NPJ Vaccines. 2024 Mar 8;9(1):54. doi: 10.1038/s41541-024-00836-w. PMID: 38459059; PMCID: PMC10923915.

Burkhard J, Ciurea A, Gabay C et al.Long-term immunogenicity after yellow fever vaccination in immunosuppressed and healthy individuals. Vaccine. 2020 Apr 23;38(19):3610-3617. doi: 10.1016/j.vaccine.2019.12.042. Epub 2020 Jan 5. PMID: 31911033.

Campi-Azevedo AC, Peruhype-Magalhães V, Coelho-Dos-Reis JG et al. 17DD Yellow Fever Revaccination and Heightened Long-Term Immunity in Populations of Disease-Endemic Areas, Brazil. Emerg Infect Dis. 2019 Aug;25(8):1511-1521. doi: 10.3201/eid2508.181432. Epub 2019 Aug 17. PMID: 31298654; PMCID: PMC6649311.

Campi-Azevedo AC, Reis LR, Peruhype-Magalhães V et al. Short-Lived Immunity After 17DD Yellow Fever Single Dose Indicates That Booster Vaccination May Be Required to Guarantee Protective Immunity in Children. Front Immunol. 2019 Sep 26;10:2192. doi: 10.3389/fimmu.2019.02192. PMID: 31616412; PMCID: PMC6775283.

Cavalcanti DP, Salomão MA, Lopez-Camelo J et al. Early exposure to yellow fever vaccine during pregnancy. Trop Med Int Health. 2007 Jul;12(7):833-7. doi: 10.1111/j.1365-3156.2007.01851.x. PMID: 17596249.

Coulter FJ, Messer WB. Breakthroughs and insights: A comprehensive review of yellow fever vaccine breakthrough infection across 8 decades. Vaccine. 2025 Jan 1;43(Pt 1):126423. doi: 10.1016/j.vaccine.2024.126423. Epub 2024 Nov 21. PMID: 39577331.

Domingo C, Fraissinet J, Ansah PO et al. Long-term immunity against yellow fever in children vaccinated during infancy: a longitudinal cohort study. Lancet Infect Dis. 2019 Dec;19(12):1363-1370. doi: 10.1016/S1473-3099(19)30323-8. Epub 2019 Sep 19. PMID: 31543249; PMCID: PMC6892259.

Fantinato FFST, Wachira VK, Porto VBG et al. Factors associated with yellow fever vaccine failure: A systematic literature review. Vaccine. 2023 Mar 24;41(13):2155-2169. doi: 10.1016/j.vaccine.2023.02.007. Epub 2023 Feb 24. PMID: 36841725.

Ferrara P, Losa L, Mantovani LG et al. Humoral immunogenicity of primary yellow fever vaccination in infants and children: a systematic review, meta-analysis and meta-regression. J Travel Med. 2024 Apr 6;31(3):taae039. doi: 10.1093/jtm/taae039. PMID: 38438165.

Gotuzzo E, Yactayo S, Córdova E. Efficacy and duration of immunity after yellow fever vaccination: systematic review on the need for a booster every 10 years. Am J Trop Med Hyg. 2013 Sep;89(3):434-44. doi: 10.4269/ajtmh.13-0264. PMID: 24006295; PMCID: PMC3771278.

Hamrick PN, Aldighieri S, Machado G et al. Geographic patterns and environmental factors associated with human yellow fever presence in the Americas. PLoS Negl Trop Dis. 2017 Sep 8;11(9):e0005897. doi: 10.1371/journal.pntd.0005897. PMID: 28886023; PMCID: PMC5607216.

Kling K, Domingo C, Bogdan C et al. Duration of Protection After Vaccination Against Yellow Fever: A Systematic Review and Meta-Analysis. Clin Infect Dis. 2022 Dec 19;75(12):2266-2274. doi: 10.1093/cid/ciac580. Erratum in: Clin Infect Dis. 2023 Mar 21;76(6):1158. doi: 10.1093/cid/ciac822. PMID: 35856638; PMCID: PMC9761887.

Lindsey NP, Horiuchi KA, Fulton C et al. Persistence of yellow fever virus-specific neutralizing antibodies after vaccination among US travellers. J Travel Med. 2018 Jan 1;25(1):10.1093/jtm/tay108. doi: 10.1093/jtm/tay108. PMID: 30346562; PMCID: PMC7135922.

Martin C, Domingo C, Bottieau E et al. Immunogenicity and duration of protection after yellow fever vaccine in people living with human immunodeficiency virus: a systematic review. Clin Microbiol Infect. 2021 Jul;27(7):958-967. doi: 10.1016/j.cmi.2021.03.004. Epub 2021 Apr 1. PMID: 33813107.

Martin C, Florence E, Domingo C et al. Seroconversion and antibody persistence after yellow fever vaccination in people living with HIV: impact of baseline HIV viral load and yellow fever seropositivity. J Travel Med. 2022 Dec 27;29(8):taac024. doi: 10.1093/jtm/taac024. PMID: 35285913.

Schnyder JL, Bache BE, Welkers MRA et al. Yellow fever breakthrough infections after yellow fever vaccination: a systematic review and meta-analysis. Lancet Microbe. 2024 Dec;5(12):100937. doi: 10.1016/j.lanmic.2024.06.004. Epub 2024 Nov 7. PMID: 39522518.

Schnyder JL, de Jong HK, Bache BE et al. Long-term immunity following yellow fever vaccination: a systematic review and meta-analysis. Lancet Glob Health. 2024 Mar;12(3):e445-e456. doi: 10.1016/S2214-109X(23)00556-9. Epub 2024 Jan 22. PMID: 38272044.

Suzano CE, Amaral E, Sato HK, Papaiordanou PM; Campinas Group on Yellow Fever Immunization during Pregnancy. The effects of yellow fever immunization (17DD) inadvertently used in early pregnancy during a mass campaign in Brazil. Vaccine. 2006 Feb 27;24(9):1421-6. doi: 10.1016/j.vaccine.2005.09.033. Epub 2005 Oct 3. PMID: 16236402.

WHO. Vaccines and vaccination against yellow fever. WHO position paper -- June 2013. Wkly Epidemiol Rec. 2013 Jul 5;88(27):269-83. English, French. PMID: 23909008.

VII COMPOSITION OF THE WORKING GROUP

The composition of the Committee and that of the Board as well as the list of experts appointed by Royal Decree are available on the following website: About us.

All experts joined the working group ***in a private capacity***. Their general declarations of interests as well as those of the members of the Committee and the Board can be viewed on the SHC website (site: conflicts of interest).

The following experts were involved in drawing up and endorsing this advisory report. The working group was chaired by **Ula MANIEWSKI-KELNER** ; the scientific secretary was Veerle MERTENS.

Maniewski-Kelner Ula	Infectiology, Travel medicine	ITG
Martin Charlotte	Infectiology, Travel medicine	CHU Saint-Pierre
Vanderfaeillie Anna	Pediatrics, Infectiology	CHU Saint-Pierre
Visser Jelle	Infectiology, Internal medicine, Travel medicine	ITG
Hoyoux Marie	Pediatrics, Infectiology, Travel medicine	Citadelle
Van der Linden Dimitri	Pediatrics, Infectiology, Travel medicine	UCL

The standing working group Vaccination (NITAG) has endorsed the advisory report. The standing working group was chaired by **Steven CALLENS and David TUERLINCKX**; the scientific secretary was Veerle MERTENS and Fabrice PETERS. The following experts endorsed the conclusions presented at the NITAG meeting of November 21 2024 or approved the report by email by December 19 2024.

ALDERS Nele	Pediatrics, Infectiology, Travel and Tropical Medicine	ITG
BLUMENTAL Sophie	Pediatrics, Infectious Disease Medicine, Vaccinology, Primary Immunodeficiency Diseases, Pneumococcal Infections, Tuberculosis.	ULB, CHIREC
BOIY Tine	Pediatrics, Rare Diseases, Congenital Hereditary and Neonatal Diseases and Abnormalities, Down Syndrome.	UAntwerpen, UZA
CALLENS Steven	Internal Medicine, Infectious Disease Medicine, Emerging Communicable Diseases, Travel Medicine, Vaccinology, Tuberculosis, AIDS-HIV, Ebola, COVID-19.	UGent, UZ Gent
CARRILLO SANTISTEVE Paloma	General Practice, Infectious Disease Medicine, Vaccinology, Preventive Medicine, Public Health.	ONE
CHATZIS Olga	Pediatrics, Infectious Disease Medicine, Congenital Hereditary and Neonatal Diseases and Abnormalities, Vaccinology.	UCLouvain, Cliniques universitaires Saint-Luc

CORNELISSEN Laura	Obstetrics, Gynecology, Epidemiology, Infectious Disease Medicine, Maternal Health, Public Health.	Sciensano
DAELEMANS Siel	Pediatrics, Infectious Disease Medicine, Pulmonary Medicine, Cystic Fibrosis, RSV, COVID-19.	VUB, UZ Brussel
DESMET Stéfanie	Clinical microbiology, epidemiology	UZ Leuven, NRC for Pneumococci
CHRISTIAENS Thierry	Pharmacology.	CBIP/BCFI, UGent
DE SCHEERDER Marie Angélique	Internal Medicine, Infectious Disease Medicine, Travel Medicine, AIDS-HIV, Anti-Bacterial Agents.	UGent, UZ Gent
DE SCHRYVER Antoon	Occupational and environmental medicine	U Antwerpen
FRERE Julie	Pediatrics and infectiology	CHR Citadelle
MAERTENS Kirsten	Vaccinology and maternal immunization	U Antwerpen
PELEMAN Renaat	Pediatrics, infectiology, vaccinology healthcare services management	UZ Gent
SCHELSTRAETE Petra	Pediatrics, pneumology and infectiology	UZ Gent
SOENTJENS Patrick	Travel medicine and vaccinology	ITG, Defense
SWENNEN Béatrice	Epidemiology and vaccinology	ULB
TUERLINCKX David	Pediatrics and vaccinology	CHU UCL Namur
VANDEN DRIESSCHE Koen	Pediatrics, infectiology, oncology	UZA
VEKEMAN Veerle	General medicine	Kind en Gezin
VERHAEGEN Jan	Immunology, clinical microbiology, transplantation	UZ Leuven
WAETERLOOS Geneviève	Quality of vaccines and blood products	Sciensano

The following administrations and/or ministerial cabinets were heard:

DAEMS Joêl	Directorate Drugs	RIZIV-INAMI
JONG Veerle	Infection control and vaccinology	VAZG
PERIN Belinda	General medicine, Vaccinology	AVIQ - ONE
SABBE Martine	Vaccinovigilance and safety of vaccines	AFMPS-FAGG
TAAME Adrae	General medicine	CCC-GGC
THEETEN Heidi	Vaccinology	VAZG
TEUGHELS Stefan	Medical Director Domus Medica General medicine, public health, EBM	Domus Medica

The Belgian Study Group of Travel Medicine (link) reviewed the conclusions and endorses the advisory report.

About the Superior Health Council (SHC)

The Superior Health Council is a federal advisory body. Its secretariat is provided by the Federal Public Service Health, Food Chain Safety and Environment. It was founded in 1849 and provides scientific advisory reports on public health issues to the Ministers of Public Health and the Environment, their administration, and a few agencies. These advisory reports are drawn up on request or on the SHC's own initiative. The SHC aims at giving guidance to political decision-makers on public health matters. It does this on the basis of the most recent scientific knowledge.

Apart from its 25-member internal secretariat, the Council draws upon a vast network of over 500 experts (university professors, staff members of scientific institutions, stakeholders in the field, etc.), 300 of whom are appointed experts of the Council by Royal Decree. These experts meet in multidisciplinary working groups in order to write the advisory reports.

As an official body, the Superior Health Council takes the view that it is of key importance to guarantee that the scientific advisory reports it issues are neutral and impartial. In order to do so, it has provided itself with a structure, rules and procedures with which these requirements can be met efficiently at each stage of the coming into being of the advisory reports. The key stages in the latter process are: 1) the preliminary analysis of the request, 2) the appointing of the experts within the working groups, 3) the implementation of the procedures for managing potential conflicts of interest (based on the declaration of interest, the analysis of possible conflicts of interest, and a Committee on Professional Conduct) as well as the final endorsement of the advisory reports by the Board (ultimate decision-making body of the SHC, which consists of 30 members from the pool of appointed experts). This coherent set of procedures aims at allowing the SHC to issue advisory reports that are based on the highest level of scientific expertise available whilst maintaining all possible impartiality.

Once they have been endorsed by the Board, the advisory reports are sent to those who requested them as well as to the Minister of Public Health and are subsequently published on the SHC website (www.hgr-css.be). Some of them are also communicated to the press and to specific target groups (healthcare professionals, universities, politicians, consumer organisations, etc.).

In order to receive notification about the activities and publications of the SHC, please contact: info.hgr-css@health.belgium.be.

www.shc-belgium.be

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