

## 1 NAME OF THE MEDICINAL PRODUCT

Dengvaxia, powder and solvent for suspension for injection.  
Dengue tetravalent vaccine (live, attenuated).

## 2 QUALITATIVE AND QUANTITATIVE COMPOSITION

After reconstitution, one dose (0.5 mL) contains:

CYD dengue virus serotype 1*	4.5 - 6.0 log <sub>10</sub> CCID <sub>50</sub> /dose**
CYD dengue virus serotype 2*	4.5 - 6.0 log <sub>10</sub> CCID <sub>50</sub> /dose**
CYD dengue virus serotype 3*	4.5 - 6.0 log <sub>10</sub> CCID <sub>50</sub> /dose**
CYD dengue virus serotype 4*	4.5 - 6.0 log <sub>10</sub> CCID <sub>50</sub> /dose**

\* Produced in serum-free Vero cells by recombinant DNA technology

\*\* CCID<sub>50</sub>: 50% Cell Culture Infectious Dose.

No adjuvants and no preservatives are added.

For a full list of excipients, see Section 6.1.

## 3 PHARMACEUTICAL FORM

Powder and solvent for suspension for injection.

Prior to reconstitution, the vaccine is a white, homogenous, freeze-dried powder with possible retraction at the base, and may form a ring-shaped cake.

The solvent is a clear, colorless liquid.

## 4 CLINICAL PARTICULARS

### 4.1 Therapeutic indications

Dengvaxia is indicated for the prevention of dengue disease caused by dengue virus serotypes 1, 2, 3 and 4 in individuals 12 through 45 years of age with test-confirmed previous dengue infection (see Section 4.2 and Section 4.4).

### 4.2 Posology and method of administration

#### Screening

Dengvaxia should only be administered to individuals with a previous dengue infection. Previous dengue infection must be confirmed by a test, either documented in the medical history or performed prior to vaccination.

In non-endemic areas or low transmission settings, the lower the proportion of true seropositive individuals, the higher the risk of false seropositives with any test used to determine dengue serostatus. Thus, testing performed prior to vaccination should be limited to individuals who have been in potential

contact with dengue virus (e.g. individuals who lived before or had recurrent stay in endemic areas) and who are likely to be exposed to dengue in the future. The objective is to minimize the risk of a false positive test, as in non-endemic areas, the proportion of individuals truly infected by dengue is considered generally very low.

### Posology

The vaccination schedule consists of 3 injections of 0.5 mL to be administered at 6 month intervals.

If flexibility in the vaccination schedule is necessary, a time window of +/- 20 days is acceptable (see Section 5.1).

For each injection, the dose is the same for adults and for the paediatric population.

Dengvaxia should not be administered in Singapore in individuals less than 12 years of age.

*For individuals who have not been previously infected by dengue virus or with unknown history of prior dengue exposure*

For individuals with unknown history of prior dengue exposure, previous infection can be substantiated through serotesting. Vaccination is not recommended for individuals who have not been previously infected by dengue virus.

Please refer to Section 4.4 **Special warnings and precautions for use** for individuals who have not been previously infected by dengue virus and Section 5.1, *Singaporean population (data from CYD28 study)* subsection.

### *Booster dose*

Current data suggest that a booster after primary vaccination with Dengvaxia does not provide any additional benefit.

### Method of administration

Once the freeze-dried vaccine has been completely reconstituted using the solvent provided, it is administered by subcutaneous (SC) injection. The recommended injection site is the deltoid region.

### *Precautions to be taken before handling or administering the medicinal product*

Do not administer by intravascular injection.

Dengvaxia must not be mixed with any other injectable vaccine(s) or medicinal product(s).

For instructions on reconstitution of Dengvaxia before administration, see Section 6.6.

## **4.3 Contraindications**

Dengvaxia must not be administered to individuals with a history of severe allergic reaction to any component of Dengvaxia or after prior administration of Dengvaxia or a vaccine containing the same components.

Administration of Dengvaxia must be postponed in individuals suffering from moderate to severe febrile or acute disease.

Dengvaxia must not be administered to individuals with congenital or acquired immune deficiency that impairs cell-mediated immunity, including immunosuppressive therapies such as chemotherapy or high doses of systemic corticosteroids generally given for 2 weeks or more.

Dengvaxia must not be administered to individuals with symptomatic HIV infection or with asymptomatic HIV infection when accompanied by evidence of impaired immune function.

Dengvaxia must not be administered to pregnant women.

Dengvaxia must not be administered to breastfeeding women.

#### **4.4 Special warnings and precautions for use**

##### *Protection*

As with any vaccine, vaccination with Dengvaxia may not protect 100% of vaccinated individuals. It is recommended to continue personal protection measures against mosquito bites after vaccination.

As a precaution, healthcare professionals should follow-up and appropriately manage any vaccines with signs and symptoms of dengue fever, with particular attention to dengue warning signs (e.g., high fever, severe abdominal pain or tenderness, persistent vomiting, mucosal bleeding, somnolence and hyperactivity according to WHO guidelines 2009).

##### *Special patient groups*

Individuals who have not been previously infected by dengue virus or for whom this information is unknown

Individuals who have not been previously infected by the dengue virus should not be vaccinated because an increased risk of hospitalization for dengue and clinically severe dengue (predominantly grade 1 or 2 Dengue Hemorrhagic Fever [WHO 1997]) has been observed in not previously infected, vaccinated individuals during the long-term follow up of clinical trials (see Section 4.8).

In the absence of documented prior dengue virus infection, previous infection must be confirmed by a test before vaccination (see Section *Screening*). To avoid vaccination of false positives, only test methods with adequate performance in terms of specificity and cross-reactivity based on the local disease epidemiology should be used.

##### *Altered immune status*

For patients receiving treatment with high doses of systemic corticosteroids given for 2 weeks or more (daily receipt of prednisone or equivalent 20 mg or 2 mg/kg body weight is considered as a substantially immunosuppressive dose), it is advisable to wait until immune function has recovered, i.e., for at least 4 weeks after stopping treatment, before administering Dengvaxia.

##### *Travelers*

Vaccination is not recommended for individuals, living in non-endemic areas, who have not been in potential contact with dengue virus and who only occasionally travel to endemic areas.

#### *Precautions for administration*

Dengvaxia must not be administered by intravascular injection under any circumstances.

#### *Precautions related to serious and severe adverse events*

- In individuals who have a history of serious or severe reactions within 48 hours after a prior administration of Dengvaxia or of a vaccine containing similar components, the risks and benefits of administering Dengvaxia must be carefully considered.
- Before administering any biological, the person responsible for administration must take all precautions to prevent allergic or other reactions. As with all injectable vaccines, appropriate medical treatment and supervision must always be readily available in the event of an anaphylactic reaction following administration of the vaccine.
- Epinephrine (1:1000) and other appropriate agents used to control immediate allergic reactions must be available to treat unexpected events such as anaphylaxis.
- Syncope (fainting) can occur following, or even before, any vaccination as a psychogenic response to injection with a needle. Procedures should be in place to prevent injury from falling and to manage syncopal reactions.

### **4.5 Interaction with other medicinal products and other forms of interaction**

#### *Concomitant administration*

Dengvaxia must not be mixed with any other injectable vaccine(s) or medicinal product(s).

Separate syringes and needles, separate injection sites and preferably separate limbs must be used if any other vaccine(s) or medicinal product(s) is/are concomitantly administered.

Dengvaxia has been evaluated in one clinical study on concomitant administration with Tdap (Tetanus Toxoid, Reduced Diphtheria Toxoid and Acellular Pertussis Vaccine, Adsorbed) (688 subjects, 9 through 60 years of age), and in two clinical studies with two HPV vaccines (Human Papillomavirus Vaccine, Recombinant) (528 subjects, 9 through 13 years of age and 480 subjects, 9 through 14 years of age).

There was no evidence of an increased rate of reactogenicity or change in the safety profile of the vaccines when Tdap and HPV vaccines were administered concomitantly with Dengvaxia in any of these studies. Antibody responses to Dengvaxia and Tdap vaccine or HPV vaccine components were not negatively affected by concomitant administration.

For patients receiving treatment with immunoglobulins or blood products containing immunoglobulins, such as blood or plasma, it is advisable to wait for at least 6 weeks, and preferably for 3 months, following

the end of treatment before administering Dengvaxia, in order to avoid neutralization of the attenuated viruses contained in the vaccine.

For immunosuppressive therapy or corticosteroid therapy, see Sections 4.3 and 4.4.

#### ***Vaccine-food interactions***

*No studies have been performed on interactions between food and Dengvaxia.*

### **4.6 Fertility, pregnancy and lactation**

#### **Pregnancy**

Pregnancy constitutes a contraindication (see Section 4.3).

Women of childbearing age should avoid becoming pregnant for 4 weeks after receiving any dose of Dengvaxia.

*No specific studies have been performed on the vaccine in pregnant women. A limited number of cases of inadvertent exposure during pregnancy were reported during clinical studies. Isolated adverse pregnancy outcomes (stillbirth, intrauterine death, spontaneous abortion, blighted ovum) have been observed for these exposed pregnancies, with similar frequency and nature in the vaccinated individuals compared to the control group, and with risk factors identified for all cases. However, these data are not sufficient to conclude on the absence of potential effects of Dengvaxia on pregnancy, embryo-fetal development, parturition and post-natal development.*

*Animal studies did not indicate any direct or indirect harmful effects with regard to pregnancy, embryo-fetal development, parturition or post-natal development (see Section 5.3).*

#### **Breastfeeding**

Dengvaxia is contraindicated during breastfeeding (see Section 4.3).

*It is not known whether Dengvaxia is excreted into human milk. The effect on breastfed infants of administration of Dengvaxia to their mothers has not been studied.*

*Animal studies did not indicate any direct or indirect harmful effects with regard to lactation (see Section 5.3).*

#### **Fertility**

No specific studies have been performed on fertility.

Animal studies did not indicate any harmful effects with respect to female fertility (see Section 5.3).

### **4.7 Effects on ability to drive and use machines**

No studies have been performed on the effects of Dengvaxia on the ability to drive, to use machines or to perform other hazardous tasks.

## 4.8 Undesirable effects

### Data in subjects 9 years of age or older

#### Summary of the safety profile

A total of approximately 20,667 subjects 9 through 60 years of age received at least one dose of the final formulation of Dengvaxia according to the claimed vaccination schedule in 13 randomized, observer-blinded, placebo-controlled Phase II to Phase III clinical studies.

The safety profile presented below is based on a pooled analysis including a total of 1547 subjects 18 through 60 years of age and 19,120 subjects 9 through 17 years of age. Reactogenicity was assessed in a subset of 4615 subjects, including 1547 subjects 18 through 60 years of age and 3068 subjects 9 through 17 years of age.

Safety was monitored during the first 28 days following each dose in the reactogenicity subset, and serious adverse events (SAEs), including dengue cases, were collected throughout the studies in all subjects, up to at least 6 months after the last dose of Dengvaxia. *The database allowed for the detection of adverse events (AEs) occurring at a frequency of 0.1% or above.*

In subjects 9 through 60 years of age, the most frequently reported ARs following any dose of Dengvaxia were headache, injection site pain, malaise and myalgia.

The ARs were usually mild to moderate in severity and of short duration (0 to 3 days). Onset was typically observed 0 to 3 days after the injection of Dengvaxia, except for fever which appeared within 14 days after the injection.

Systemic ARs tended to be less frequent after the second and third dose of Dengvaxia as compared to the first dose.

#### Tabulated list of adverse reactions

Adverse reactions are listed according to the following frequency categories:

Very common:  $\geq 10\%$

Common:  $\geq 1\%$  and  $< 10\%$

Uncommon:  $\geq 0.1\%$  and  $< 1\%$

Rare:  $\geq 0.01\%$  and  $< 0.1\%$

Very Rare:  $< 0.01\%$

ARs within 28 days after any injection in subjects 9 through 60 years of age are presented in [Table 1](#), based on safety data collected during clinical studies.

**Table 1: Adverse Reactions from Clinical Studies and reported during commercial use – Subjects 9 through 60 years of age**

System-organ Class	Very Common (≥ 10%)	Common (≥ 1% and < 10%)	Uncommon (≥ 0.1% and < 1%)	Very Rare (< 0.01%)
<b>Infections and infestations</b>			Upper respiratory tract infection	
<b>Blood and lymphatic tissue disorders</b>			Lymphadenopathy	
<b>Immune system disorders</b>				Allergic including anaphylactic reactions*
<b>Nervous system disorders</b>	Headache		Dizziness, Migraine	
<b>Respiratory, thoracic and mediastinal disorders</b>			Oropharyngeal pain, Cough, Rhinorrhoea	
<b>Gastrointestinal disorders</b>			Nausea	
<b>Skin and subcutaneous tissue disorders</b>			Rash, Urticaria	
<b>Musculoskeletal and connective tissue disorders</b>	Myalgia		Neck pain, Arthralgia	
<b>General disorders and administration site conditions</b>	Injection site pain, Malaise, Asthenia, Fever	Injection site reactions (erythema, hematoma, swelling, pruritus)	Injection site induration, Influenza-like illness	

\*Adverse reactions from spontaneous reporting

“Very common” and “common” ARs were similar in nature for subjects 9 through 17 years of age and subjects 18 through 60 years of age, however there were differences in terms of frequency. Fever was less frequently reported in subjects 18 through 60 years of age (frequency: common) and injection site haematoma and pruritus were less frequently reported in subjects 9 through 17 years of age (frequency: uncommon).

“Uncommon” ARs were observed with the following age-group specificities:

- Lymphadenopathy, migraine, arthralgia and influenza-like illness were only reported in subjects 18 through 60 years of age;
- Urticaria was only reported in subjects 9 through 17 years of age;

- Upper respiratory tract infection, dizziness, oropharyngeal pain, cough, rhinorrhoea, nausea, rash and neck pain were less frequently reported in subjects 9 through 17 years of age (frequency: rare or very rare, i.e., with a frequency < 0.1%).

In phase III efficacy studies (CYD14 and CYD15), isolated neurological disorder related SAEs have been observed in subjects 8 through 11 years of age: acute polyneuropathy in one subject of 10 years of age, convulsion (reported as “seizures not specified”) in one subject of 11 years of age, and acute disseminated encephalomyelitis (ADEM) in one subject aged 8 years of age. These events were isolated and therefore not listed in the tabulated list of adverse reactions above. These three isolated events were outside the age indication.

#### Hospitalized and/or clinically severe dengue fever in long-term safety follow-up data

In an exploratory analysis of up to 6 years of follow up from the first dose in three efficacy studies, an increased risk of hospitalization for dengue including clinically severe dengue (predominantly Dengue Hemorrhagic Fever grade 1 or 2 [WHO 1997]) has been observed in vaccinees with no previous dengue infection. In subjects 9-16 years of age, it was estimated that during a 5 year follow-up about 5 additional hospitalized dengue cases or 2 additional severe dengue cases per 1000 vaccinees with no previous dengue infection could occur following vaccination. Estimates from the long-term analysis suggest the onset of increased risk was mainly during the 3rd year following the first dose.

This increased risk was not observed in individuals who have been previously infected by dengue virus, where it was estimated that 15 hospitalized dengue cases or 4 severe dengue cases could be prevented per 1000 vaccinees with previous dengue infection during 5 years of follow up from the first dose.

In subjects 12-16 years of age, it was estimated that during a 5 year follow-up about 5 hospitalized dengue cases could be prevented per 10,000 vaccinees with no previous dengue infection; however 1 additional severe dengue case per 1000 vaccinees with no previous dengue infection could occur following vaccination. In the same age range, it was estimated that 11 hospitalized dengue cases or 4 severe dengue cases could be prevented per 1000 vaccinees with previous dengue infection during 5 years of follow up from the first dose. For severe dengue, the results are not meaningful due to low number of subjects combined with low disease incidence.

#### Paediatric data in subjects below 12 years of age, i.e., outside the age indication

In subjects 2 through 11 years of age, i.e., outside the age indication, long-term safety follow-up data showed an increased risk of dengue disease requiring hospitalization including clinically severe dengue in vaccinees with no previous dengue infection.

#### **Reporting of suspected adverse reactions**

Reporting suspected adverse reactions after authorisation of the medicinal product is important. It allows continued monitoring of the benefit/risk balance of the medicinal product. Healthcare professionals are asked to report any suspected adverse reactions to the Health Sciences Agency of Singapore via the ADR online reporting tool at [www.hsa.gov.sg](http://www.hsa.gov.sg) or to Sanofi Singapore Pharmacovigilance at [PV.SIN@sanofi.com](mailto:PV.SIN@sanofi.com).

#### **4.9 Overdose**

No cases of overdose have been reported in clinical studies with Dengvaxia.

### **5 PHARMACOLOGICAL PROPERTIES**

## 5.1 Pharmacodynamic properties

Pharmacotherapeutic group: Viral vaccines

ATC code: J07BX

J (ANTIINFECTIVES FOR SYSTEMIC USE) 07 (VACCINES) B (VIRAL VACCINES) X (Other viral vaccines)

### Mechanism of action

Dengvaxia contains live attenuated viruses. Following administration, the viruses replicate locally and elicit neutralizing antibodies and cell-mediated immune responses against the four dengue virus serotypes.

### Immunogenicity

Immunogenicity data were collected in a total of approximately 1800 subjects 12 through 45 years of age from endemic areas who received at least one dose of the final formulation of Dengvaxia according to the claimed vaccination schedule in 7 randomized, observer-blinded, placebo-controlled Phase II to Phase III clinical studies. Most of the subjects were 12 through 16 years of age (n= 1492).

The immunogenicity data presented correspond to the neutralizing antibody titers for each serotype as measured with the plaque reduction neutralization test (PRNT). The results are presented as geometric mean titers (GMTs), expressed in reciprocal dilutions (1/dil), measured at baseline and 28 days after the third dose of Dengvaxia.

GMT data on subjects 17 through 25 and 26 through 45 years of age included in Phase II safety and immunogenicity studies conducted in endemic areas (CYD22, CYD28 and CYD47) and on subjects 12 through 16 years of age included in the 2 large-scale Phase III efficacy studies, CYD14 and CYD15, and in CYD28 conducted in Singapore are presented by study and region in [Table 2](#).

**Table 2: Dengue immunogenicity data pre-dose 1 and 28 days post-dose 3 - GMTs of antibodies against each serotype (1/dil) - Dengue PRNT – Subjects 12 through 45 years of age in endemic areas**

Age group	Region	Study	Serotype 1			Serotype 2			Serotype 3			Serotype 4		
			N	Pre-dose 1 GM (95% CI)	Post-dose 3 GM (95% CI)	N	Pre-dose 1 GM (95% CI)	Post-dose 3 GM (95% CI)	N	Pre-dose 1 GM (95% CI)	Post-dose 3 GM (95% CI)	N	Pre-dose 1 GM (95% CI)	Post-dose 3 GM (95% CI)
Subjects 26 through 45 years of age	Asia Pacific	CYD22	10	467 (229; 955)	681 (257; 1808)	10	393 (191; 811)	578 (341; 980)	10	245 (142; 422)	461 (313; 678)	10	105 (34.4; 318)	323 (179; 582)
		CYD28	91	22.5 (14.9; 34.1)	58.6 (36.5; 94.2)	91	22.4 (14.9; 33.7)	76.3 (50.8; 115)	91	19.3 (13.4; 27.8)	114 (85.1; 153)	91	11.5 (8.41; 15.8)	126 (95.5; 167)
		CYD47	82	222 (143; 345)	557 (389; 798)	82	248 (159; 387)	510 (370; 704)	82	292 (192; 443)	880 (642; 1206)	82	75.0 (52.5; 107)	376 (286; 494)
Subjects 17 through 25 years of age	Asia Pacific	CYD22	10	229 (47.6; 1102)	710 (189; 2666)	10	311 (72.3; 1337)	1178 (454; 3051)	10	104 (33.6; 322)	390 (177; 858)	10	53.7 (15.8; 183)	436 (223; 850)
		CYD28	75	8.51 (6.00; 12.1)	38.7 (23.6; 63.3)	75	10.2 (6.75; 15.5)	56.6 (35.3; 90.6)	75	8.39 (6.44; 10.9)	60.0 (41.3; 87.3)	75	7.57 (5.88; 9.73)	107 (73.5; 155)
		CYD47	44	131 (65.3; 262)	328 (187; 576)	44	141 (73.8; 271)	442 (268; 727)	44	127 (66.5; 244)	481 (321; 718)	44	31.6 (19.6; 50.9)	275 (193; 391)
Subjects 12 through 16 years of age	Asia Pacific	CYD14	400	93.1 (73.5; 118)	305 (249; 372)	400	152 (121; 190)	592 (506; 692)	400	84.2 (67.6; 105)	309 (261; 367)	400	51.2 (42.4; 61.8)	213 (185; 245)
		CYD28	123	6.36 (5.21; 7.76)	26.3 (19.5; 35.6)	123	7.24 (5.75; 9.10)	46.7 (35.0; 62.2)	123	6.87 (5.77; 8.19)	71.8 (55.5; 92.9)	123	5.79 (5.11; 6.56)	78.5 (62.8; 98.1)
	Latin America	CYD15	658	163 (137; 194)	466 (399; 545)	658	179 (152; 211)	684 (605; 772)	658	146 (124; 171)	554 (488; 628)	658	50.4 (44.0; 57.7)	277 (252; 305)

The lower limit of quantification for dengue neutralizing antibodies is 10 (1/dil).

Endemic areas are defined as areas where the disease has been continuously present in the native population with documented outbreaks or epidemics.

CYD22: Vietnam; CYD28: Singapore; CYD47: India; CYD14: Indonesia, Malaysia, the Philippines, Thailand, Vietnam; CYD15: Brazil, Colombia, Honduras, Mexico, Puerto Rico.

In all age groups in all studies, an increase in GMTs was observed for each of the 4 serotypes 28 days after the third dose of Dengvaxia as compared to baseline, regardless of the region, i.e., Asia Pacific or Latin America.

*Differences in GMTs 28 days after the third dose were observed depending on dengue immune status<sup>a</sup> before the first dose, the age and the region. Overall:*

- The higher the GMTs before the first dose, the higher the GMTs 28 days after the third dose;
- Dengue immune status before the first dose is a confounding factor of age: the older the subject, the higher the GMTs before the first dose and the higher the GMTs 28 days after the third dose.

*Singaporean Population (data from CYD28 study):*

In CYD28, a clinical immunogenicity and safety study conducted in Singapore in individuals from 2 to 45 years of age, an immune response to the vaccine was observed in all age groups, with an increase of GMTs for each serotype 28 days after the third dose. Post-dose 3 GMTs in CYD28 study were lower than in the other studies conducted in highly endemic countries (see [Table 2](#)). Clinical efficacy studies have not been conducted in the Singaporean population.

*Singaporean population with unknown previous history of dengue*

[Table 3](#) presents the immune response in CYD28 study, conducted in Singapore, by baseline dengue immune status. An increase in GMTs was observed 28 days after the third dose as compared to baseline in both dengue immune and non-immune subjects at baseline. GMTs 28 days after the third dose were higher in subjects who were dengue immune at baseline, as observed in the other clinical studies. Low GMTs were observed in dengue non-immune subjects at baseline. Post-dose 3 GMTs were also low in the out-of-indication 2- to 5-year-old subjects included in the CYD14 Phase III study, for which the cumulative relative risk of hospitalized dengue illness was 2.108 95% CI (1.14; 4.21) within the 3 years of long-term follow-up that includes both hospital phase and partial surveillance expansion phase data (from 1 to 4 years after the third dose) and 1.360 95% CI (0.86; 2.22) within the first five years after the first dose.

In an exploratory analysis of up to 6 years of follow up from the first dose in three efficacy studies, an increased risk of hospitalization for dengue including clinically severe dengue (predominantly Dengue Hemorrhagic Fever grade 1 or 2 [WHO 1997]) has been observed in vaccinees with no previous dengue infection (see Section 4.4 and 4.8). In Singapore, for individuals with unknown history of prior dengue exposure, serostatus testing if available may provide some additional information to inform the benefit/risk considerations following vaccination with Dengvaxia in these individuals.

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<sup>a</sup> Dengue immune status at baseline (i.e. before the first dose) measured by PRNT is defined as:

- Subjects with quantified ( $\geq 10$  [1/dil], the lower limit of quantitation) neutralizing antibodies against at least one dengue serotype in the baseline sample,
- Subjects without quantified ( $<$  the lower limit of quantitation) neutralizing antibodies against any of the 4 dengue serotypes in the baseline sample.

The terms “immune and non-immune” are used to describe the presence or not of antibodies at baseline. Immune is not used to imply that subjects are protected from dengue infection.

**Table 3: Dengue immunogenicity data pre-dose 1 and 28 days post-dose 3 in CYD28 study conducted in Singapore - by baseline dengue immune status and age group - GMTs of antibodies against each serotype (1/dil) - Dengue PRNT - Subjects 12 through 45 years of age**

Age group	Baseline dengue immune status	Serotype 1			Serotype 2			Serotype 3			Serotype 4		
		N	Pre-dose 1 GM (95% CI)	Post-dose 3 GM (95% CI)	N	Pre-dose 1 GM (95% CI)	Post-dose 3 GM (95% CI)	N	Pre-dose 1 GM (95% CI)	Post-dose 3 GM (95% CI)	N	Pre-dose 1 GM (95% CI)	Post-dose 3 GM (95% CI)
Subjects 26 through 45 years of age	Non Immune	37	5.00 (NC)	13.8 (9.82; 19.3)	37	5.00 (NC)	28.1 (17.8; 44.4)	37	5.00 (NC)	47.1 (35.4; 62.7)	37	5.00 (NC)	73.6 (47.4; 114)
	Immune	49	74.6 (43.1; 129)	255 (141; 463)	49	71.8 (42.4; 122)	226 (138; 372)	49	55.2 (34.6; 88.0)	261 (179; 380)	49	21.7 (13.3; 35.4)	202 (143; 287)
Subjects 17 through 25 years of age	Non Immune	52	5.00 (NC)	19.3 (13.1; 28.6)	52	5.00 (NC)	29.8 (20.5; 43.5)	52	5.00 (NC)	34.5 (25.1; 47.5)	52	5.00 (NC)	80.1 (50.4; 127)
	Immune	20	33.9 (11.4; 101)	215 (64.0; 723)	20	66.0 (19.7; 221)	282 (88.1; 905)	20	32.2 (16.4; 63.1)	233 (101; 534)	20	22.2 (10.5; 47.2)	240 (134; 431)
Subjects 12 through 16 years of age	Non Immune	106	5.00 (NC)	19.6 (15.3; 25.1)	106	5.00 (NC)	36.3 (28.1; 47.0)	106	5.00 (NC)	56.7 (44.6; 72.1)	106	5.00 (NC)	68.9 (54.3; 87.4)
	Immune	16	31.7 (7.74; 130)	195 (49.1; 779)	16	85.7 (23.5; 313)	265 (80.6; 870)	16	56.5 (25.4; 126)	347 (138; 874)	16	15.3 (6.34; 37.1)	204 (128; 327)

The lower limit of quantification for dengue neutralizing antibodies is 10 (1/dil).

*Adult Population from 46 to 60 years of age*

A study was conducted in adult subjects aged 18 to 60 years in Australia in non-endemic areas. This study included 241 subjects aged 46 through 60 years of age. A similar immune response was observed in 18 to 45 and 46 to 60-year-old subjects included in the trial against the 4 serotypes: in subjects aged 46 to 60 years, GMTs post-dose 3 were of 17.6 (1/dil) for serotype 1, 54.2 (1/dil) for serotype 2, 83.3 (1/dil) for serotype 3 and 144 (1/dil) for serotype 4.

*Data on long-term persistence of antibodies*

GMT data up to 4 years after the last dose are presented by age group and by study in [Table 4](#) for serotype 1 and 2 and [Table 5](#) for serotype 3 and 4.

Overall, in subjects 12 years of age and older in endemic areas, a decrease in the GMTs against all 4 serotypes was observed one year after the third dose and then a trend toward stabilization was observed in the subsequent years. The decrease in GMTs was variable depending on age and the dengue immune status of subjects before the first dose. Long-term GMTs for each serotype remained higher than GMTs before the first dose.

**Table 4: Dengue immunogenicity data up to 4 years after the last dose for serotype 1 and 2 - GMTs of antibodies against each serotype (1/dil) - Dengue PRNT - Subjects 12 through 45 years of age**

		Serotype 1							Serotype 2						
Age group	Study	N	Pre-dose 1 GM (95% CI)	Post-dose 3 GM (95% CI)	Year 1 GM (95% CI)	Year 2 GM (95% CI)	Year 3 GM (95% CI)	Year 4 GM (95% CI)	N	Pre-dose 1 GM (95% CI)	Post-dose 3 GM (95% CI)	Year 1 GM (95% CI)	Year 2 GM (95% CI)	Year 3 GM (95% CI)	Year 4 GM (95% CI)
26-45 years	CYD22	10	467 (229; 955)	681 (257; 1808)	351 (151; 819)	407 (177; 938)	434 (193; 979)	309 (141; 674)	10	393 (191; 811)	578 (341; 980)	724 (374; 1402)	634 (304; 1323)	366 (197; 682)	540 (324; 900)
	CYD28	91	22.5 (14.9; 34.1)	58.6 (36.5; 94.2)	36.3 (22.2; 59.3)	33.2 (20.4; 54.0)	30.2 (18.0; 50.7)	28.9 (17.5; 47.9)	91	22.4 (14.9; 33.7)	76.3 (50.8; 115)	65.3 (41.1; 104)	90.0 (52.9; 153)	47.8 (29.7; 77.0)	42.9 (27.1; 68.0)
17-25 years	CYD22	10	229 (47.6; 1102)	710 (189; 2666)	300 (68.6; 1312)	212 (42.2; 1068)	203 (39.1; 1051)	201 (38.4; 1053)	10	311 (72.3; 1337)	1178 (454; 3051)	588 (125; 2754)	558 (183; 1706)	422 (101; 1772)	398 (96.1; 1650)
	CYD28	75	8.51 (6.00; 12.1)	38.7 (23.6; 63.3)	14.1 (8.51; 23.5)	16.1 (9.06; 28.7)	14.2 (7.97; 25.4)	15.3 (7.69; 30.5)	75	10.2 (6.75; 15.5)	56.6 (35.3; 90.6)	27.6 (16.2; 47.0)	33.3 (19.2; 57.7)	22.5 (12.5; 40.3)	18.7 (10.6; 33.0)
12-16 years	CYD14	400	93.1 (73.5; 118)	305 (249; 372)	247 (198; 308)	217 (173; 271)	No data*	No data*	400	152 (121; 190)	592 (506; 692)	425 (357; 505)	324 (272; 386)	No data*	No data*
	CYD22	20	59.9 (17.7; 203)	192 (68.6; 536)	128 (43.3; 377)	113 (37.1; 346)	124 (36.0; 427)	110 (34.2; 354)	20	83.2 (29.5; 235)	334 (132; 845)	324 (103; 1023)	493 (166; 1465)	120 (43.5; 332)	165 (57.0; 479)
	CYD28	123	6.36 (5.21; 7.76)	26.3 (19.5; 35.6)	9.28 (7.23; 11.9)	7.65 (6.18; 9.47)	7.51 (5.98; 9.43)	6.61 (5.53; 7.89)	123	7.24 (5.75; 9.10)	46.7 (35.0; 62.2)	16.1 (11.9; 21.9)	17.8 (13.3; 23.9)	12.7 (9.53; 16.9)	13.3 (9.82; 18.0)
	CYD15	658	163 (137; 194)	466 (399; 545)	343 (289; 409)	254 (214; 301)	No data*	No data*	658	179 (152; 211)	684 (605; 772)	472 (410; 542)	415 (364; 475)	No data*	No data*

\*Study ongoing. No data available

The lower limit of quantification for dengue neutralizing antibodies is 10 (1/dil).

CYD22: Vietnam; CYD28: Singapore; CYD14: Indonesia, Malaysia, the Philippines, Thailand, Vietnam; CYD15: Brazil, Colombia, Honduras, Mexico, Puerto Rico.

**Table 5: Dengue immunogenicity data up to 4 years after the last dose for serotype 3 and 4 - GMTs of antibodies against each serotype (1/dil) - Dengue PRNT - Subjects 12 through 45 years of age**

Age group	Study	Serotype 3							Serotype 4						
		N	Pre-dose 1 GM (95% CI)	Post-dose 3 GM (95% CI)	Year 1 GM (95% CI)	Year 2 GM (95% CI)	Year 3 GM (95% CI)	Year 4 GM (95% CI)	N	Pre-dose 1 GM (95% CI)	Post-dose 3 GM (95% CI)	Year 1 GM (95% CI)	Year 2 GM (95% CI)	Year 3 GM (95% CI)	Year 4 GM (95% CI)
26-45 years	CYD22	10	245 (142; 422)	461 (313; 678)	860 (562; 1316)	360 (227; 571)	230 (138; 385)	205 (160; 264)	10	105 (34.4; 318)	323 (179; 582)	283 (130; 618)	128 (69.3; 237)	144 (73.8; 282)	109 (67.3; 178)
	CYD28	91	19.3 (13.4; 27.8)	114 (85.1; 153)	60.7 (39.9; 92.4)	88.0 (59.9; 129)	58.9 (37.0; 93.6)	31.9 (20.7; 49.1)	91	11.5 (8.41; 15.8)	126 (95.5; 167)	86.0 (63.3; 117)	57.5 (41.6; 79.4)	53.2 (39.1; 72.3)	36.6 (26.9; 49.7)
17-25 years	CYD22	10	104 (33.6; 322)	390 (177; 858)	571 (215; 1518)	208 (61.3; 703)	149 (44.6; 495)	106 (30.8; 365)	10	53.7 (15.8; 183)	436 (223; 850)	254 (104; 624)	163 (43.9; 608)	110 (36.7; 327)	84.8 (25.4; 283)
	CYD28	75	8.39 (6.44; 10.9)	60.0 (41.3; 87.3)	25.8 (16.4; 40.6)	31.4 (18.9; 52.2)	26.6 (15.5; 45.6)	20.0 (12.1; 33.1)	75	7.57 (5.88; 9.73)	107 (73.5; 155)	41.5 (27.2; 63.3)	38.9 (24.7; 61.2)	28.4 (18.7; 43.0)	22.3 (14.6; 34.2)
12-16 years	CYD14	400	84.2 (67.6; 105)	309 (261; 367)	350 (290; 422)	224 (185; 272)	No data*	No data*	400	51.2 (42.4; 61.8)	213 (185; 245)	146 (127; 169)	132 (115; 153)	No data*	No data*
	CYD22	20	36.3 (17.1; 76.9)	135 (66.9; 274)	323 (131; 795)	155 (73.5; 327)	56.9 (26.2; 123)	56.5 (26.2; 122)	20	26.9 (12.2; 59.2)	183 (87.0; 385)	166 (73.1; 377)	127 (69.4; 233)	57.3 (31.1; 105)	36.5 (19.0; 70.1)
	CYD28	123	6.87 (5.77; 8.19)	71.8 (55.5; 92.9)	18.9 (14.3; 25.1)	20.3 (15.3; 26.9)	14.9 (11.4; 19.5)	13.5 (10.5; 17.5)	123	5.79 (5.11; 6.56)	78.5 (62.8; 98.1)	31.2 (24.2; 40.3)	34.2 (25.8; 45.2)	24.1 (18.7; 31.1)	21.3 (16.5; 27.6)
	CYD15	658	146 (124; 171)	554 (488; 628)	356 (309; 411)	348 (304; 397)	No data*	No data*	658	50.4 (44.0; 57.7)	277 (252; 305)	214 (193; 237)	157 (141; 174)	No data*	No data*

\*Study ongoing. No data available

The lower limit of quantification for dengue neutralizing antibodies is 10 (1/dil).

CYD22: Vietnam; CYD28: Singapore; CYD14: Indonesia, Malaysia, the Philippines, Thailand, Vietnam; CYD15: Brazil, Colombia, Honduras, Mexico, Puerto Rico.

Efficacy:

The efficacy of Dengvaxia was assessed in 2 pivotal large-scale, randomized, observer-blinded, placebo-controlled Phase III efficacy studies conducted in 5 countries each, CYD14 in Asia and CYD15 in Latin America.

In the 2 pivotal Phase III studies, efficacy was assessed in a total of 13,732 subjects 12 through 16 years of age who received at least one dose of the vaccine: 2329 subjects 12 through 14 years of age in CYD14 and the 11,400 subjects 12 through 16 years of age in CYD15. A time window of +/- 20 days was applied for the second and third dose. More than 70% of subjects were dengue immune at baseline.

In subjects 12 through 16 years of age, the efficacy of the vaccine against symptomatic virologically confirmed dengue (VCD) cases due to any and each of the 4 serotypes was demonstrated in both studies, CYD14 and CYD15, and in the meta-analysis. The assessment period extended from the first dose to the end of the active phase, i.e. over the 25-month period after the first dose.

The efficacy of Dengvaxia against severe VCD cases and against hospitalized VCD cases (i.e., hospital admission due to dengue, whatever the severity) were also evaluated. For severe VCD cases, two types of endpoints were considered: clinically severe VCD cases and VCD cases that met WHO criteria for Dengue Hemorrhagic Fever (DHF). Vaccine efficacy was demonstrated for these three endpoints in both studies and in the meta-analysis.

The efficacy results in subjects 12 through 16 years of age are presented in [Table 6](#) for each of the two phase III efficacy studies and in the meta-analysis. *The results are presented for the entire active phase of 25 months.*

**Table 6: Vaccine efficacy (VE) estimates in subjects 12 through 16 years of age from a meta-analysis of phase III efficacy study data over the 25-month period after the first dose**

	<b>CYD14 VE % (95% CI)*</b>	<b>CYD15 VE % (95% CI)*</b>	<b>CYD14+CYD15 VE % (95% CI)*</b>
<b>Any serotype</b>	74.4 (59.2; 84.3)	67.6 (59.3; 74.3)	69.2 (62.4; 74.8)
<b>Serotype 1</b>	74.4 (48.1; 88.0)	54.4 (32.9; 69.1)	60.4 (45.4; 71.3)
<b>Serotype 2</b>	50.5 (-32.6; 81.5)	53.8 (26.4; 71.1)	53.2 (30.5; 68.4)
<b>Serotype 3</b>	78.7 (6.8; 96.5)	75.7 (57.5; 86.5)	76.2 (60.8; 85.5)
<b>Serotype 4</b>	93.0 (69.3; 99.2)	86.5 (74.8; 93.3)	88.0 (78.9; 93.2)
<b>Clinically severe VCD cases</b>	100.0 (-20.2; 100.0)	93.8 (53.4; 99.9)	95.5 (64.8; 99.4)
<b>DHF meeting any WHO criteria</b>	100.0 (-20.2; 100.0)	92.9 (44.5; 99.8)	95.0 (61.0; 99.4)
<b>Hospitalized VCD</b>	86.5 (48.9; 97.6)	78.6 (51.3; 91.4)	81.3 (63.8; 90.4)

\* The efficacy of the vaccine is considered as significant if the lower bound of the 95% CI is greater than 0.

CI: confidence interval.

Vaccine efficacy against VCD was demonstrated in dengue immune subjects at baseline (81.9%, 95% CI 67.2; 90.0) and dengue non-immune subjects at baseline (52.5%, 95% CI: 5.9; 76.1). This vaccine efficacy was measured over the 25-month period after the first dose and using PRNT 50 test in a subset of subjects aged 9 to 16 years.

### **Bridging of efficacy data to individuals 17 through 45 years of age in endemic areas**

The 2 pivotal efficacy studies showed that higher post-dose 3 GMTs were associated with higher protection.

Based on immunogenicity data from Phase II studies conducted in Asia (CYD22 conducted in Vietnam in 180 subjects 2 through 45 years of age including 30 adults, and CYD47, conducted in India in 189 subjects 18 through 45 years of age), similar or higher neutralizing antibody levels after the third dose of Dengvaxia are anticipated in adults from endemic areas, and thus a similar or higher level of protection after the third dose of the vaccine is expected in individuals 17 through 45 years of age in endemic areas compared to the vaccine efficacy observed in the CYD14 and CYD15 studies.

#### *Long-term follow-up data from Phase III studies in subjects aged 12 to 16 years.*

In CYD14 and CYD15, during the first 2 years of long-term follow-up<sup>a</sup>, 20 hospitalized VCD cases were reported in 8463 vaccinees versus 27 hospitalized VCD cases reported in 4229 subjects in the control group (with a 2:1 randomization ratio).

Overall, over 5 years after the first injection, 32 hospitalized VCD cases were reported in 8699 vaccinees versus 58 hospitalized VCD cases reported in 4343 subjects in the control group (with a 2:1 randomization ratio). Long-term follow-up data according to the baseline dengue immune status are provided in Section 4.8 “Hospitalized and/or clinically severe dengue fever in long-term safety follow-up data”.

### **5.2 Pharmacokinetic properties**

No pharmacokinetic studies have been performed on Dengvaxia.

### **5.3 Preclinical safety data**

Non-clinical safety data revealed no special risks for humans based on a repeated-dose toxicity and local tolerance study, a distribution and shedding study, a neurovirulence study and a developmental and reproductive toxicology program.

## **6 PHARMACEUTICAL PARTICULARS**

### **6.1 List of excipients**

#### Powder:

Essential amino acids including L-Phenylalanine  
Non-essential amino acids  
L-Arginine hydrochloride  
Sucrose  
D-Trehalose dihydrate  
D-Sorbitol  
Trometamol

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<sup>a</sup> The long-term follow-up period started at the end of the Active Phase, i.e. 25 months after the first injection

Urea

Solvent for reconstitution:

Sodium chloride

Water for injections

## 6.2 Incompatibilities

In the absence of compatibility studies, Dengvaxia must not be mixed with any other injectable vaccine(s) or medicinal product(s).

## 6.3 Shelf-life

Shelf-life: 3 years (36 months).

After reconstitution with the solvent provided, Dengvaxia should be used immediately. However, in-use stability studies have shown that the reconstituted vaccine can be kept for up to 6 hours between 2°C and 8°C (i.e., in a refrigerator) and protected from light.

## 6.4 Special precautions for storage

Store in a refrigerator (2°C - 8°C).

Do not freeze.

Store in the outer carton in order to protect from light.

For storage conditions after reconstitution of Dengvaxia, see Section 6.3.

## 6.5 Nature and contents of container

- [Powder (1 dose) in vial + 0.5 mL of solvent in a pre-filled syringe with 2 separate needles] – pack size of 1 or 10.

Not all pack sizes may be marketed.

## 6.6 Special precautions for disposal and other handling

Contact with disinfectants is to be avoided since they may inactivate the vaccine viruses.

Separate syringes and needles, separate injection sites and preferably separate limbs must be used if any other vaccine(s) or medicinal product(s) is/are concomitantly administered.

Dengvaxia is reconstituted by transferring all of the solvent (0.4% sodium chloride solution) provided in the blue-labeled pre-filled syringe into the vial of freeze-dried powder with a yellowish green flip-off cap. The pre-filled syringe is fitted with a sterile needle for this transfer. The vial is then gently swirled. After

complete dissolution, a 0.5 mL dose of the reconstituted suspension is withdrawn into the same syringe. For injection, the syringe should be fitted with a new sterile needle.

The suspension should be visually inspected prior to administration. After reconstitution, Dengvaxia is a clear, colorless liquid with the possible presence of white to translucent particles (of endogenous nature).

After reconstitution with the solvent provided, Dengvaxia must be used immediately.

Any unused product or waste material should be disposed of, preferably by heat inactivation or incineration, in accordance with local regulations.

## **7     MARKETING AUTHORISATION HOLDER**

Sanofi-aventis Singapore Pte Ltd,  
38 Beach Road #18-11,  
South Beach Tower,  
Singapore 189767

## **8     DATE OF REVISION OF THE TEXT**

October 2022 (CCDS V6).