

Global Health Consortium (GHC)

International Global Health Conference “advances In Immunization In The Americas, Financing Of The National Immunization Programs”

2nd session: vulnerability of imunization programs
Yellow Fever: an unprecedented outbreak

Ministry of Health of Brazil
Health Surveillance Secretariat
Department of Epidemiological Surveillance
General Coordination of the National Immunization Program

Antonia Teixeira – technical assistance

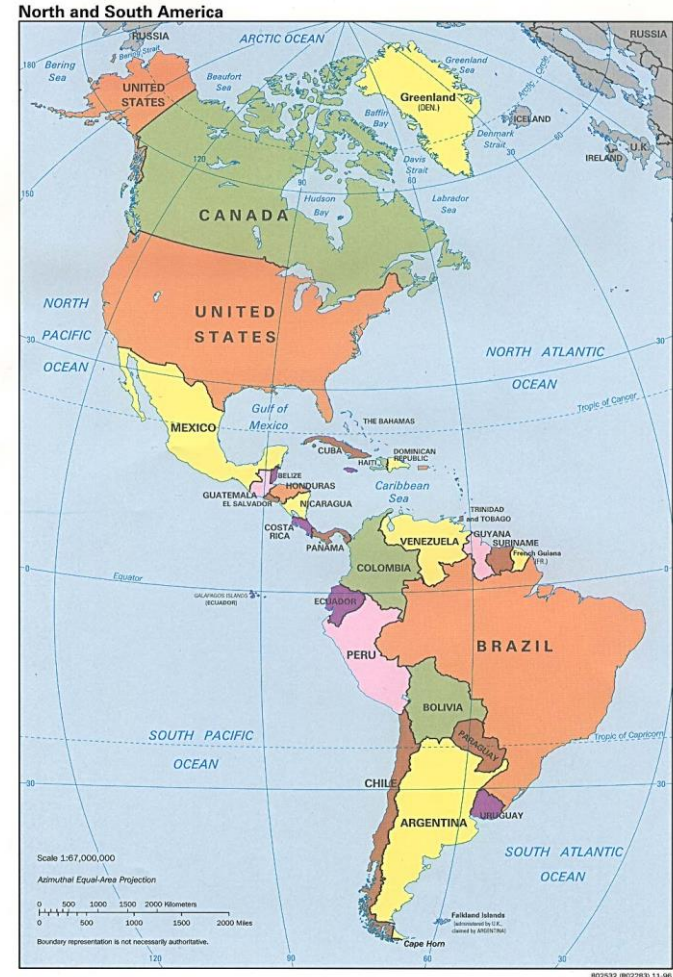


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SAÚDE

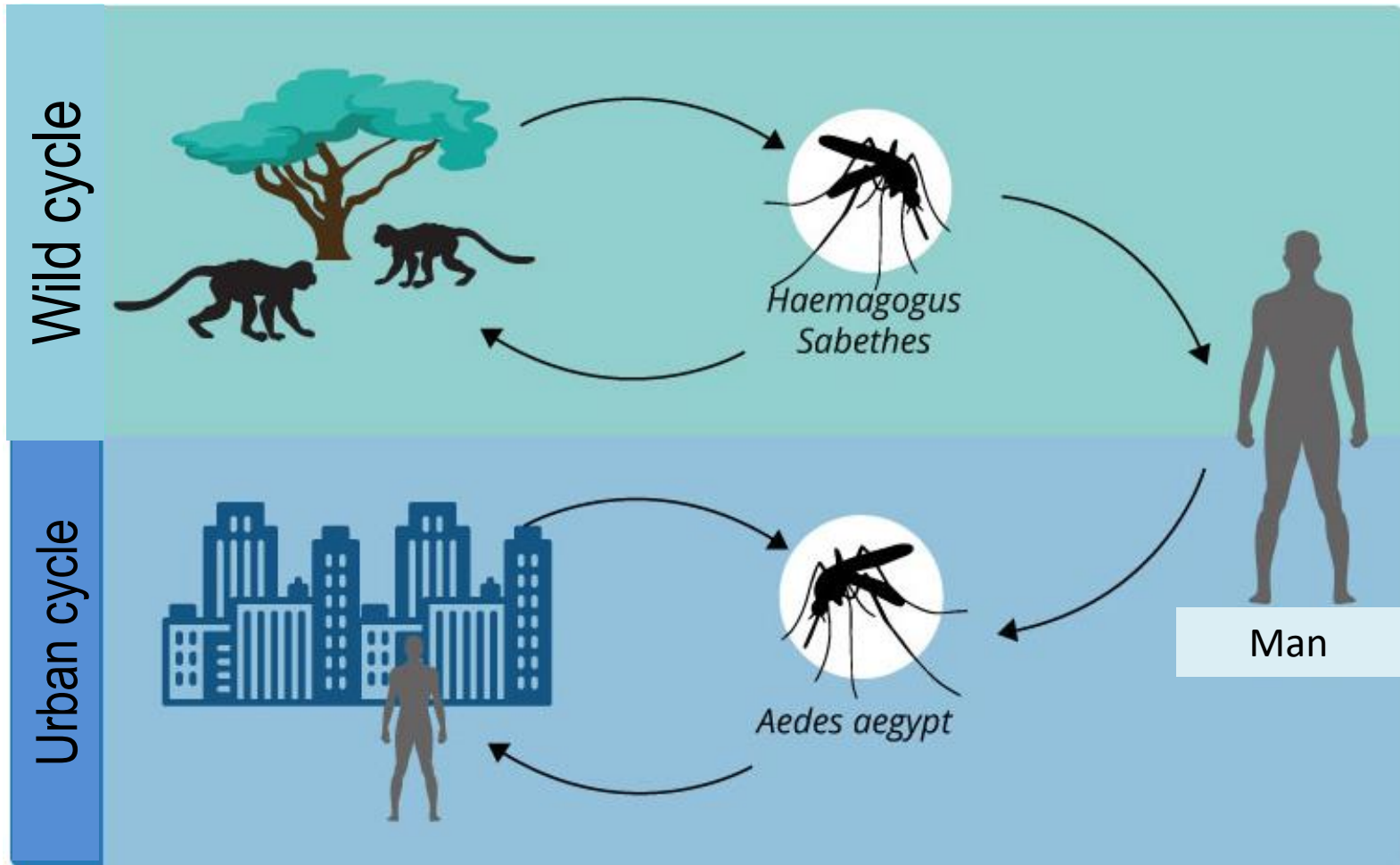


Brazil: administrative division and demographics

- ✓ **Federal Republic**
 - **5 regions, 27 federal units (UF) and 5,570 municipalities**
 - **Population: ~207 million inhabitants**
 - **2.9 million <1 year;**
 - **14 million <5 years**
 - **~ 20 million ≥ 60 years**
- ✓ **Borders with 10 countries of South America**
 - ✓ **2016: recommendation of vaccination against Yellow Fever in 3.529 municipalities (88 millions inhabitants)**
 - ✓ **2018: 4.266 municipalities (152 millions)**



Yellow Fever cycles

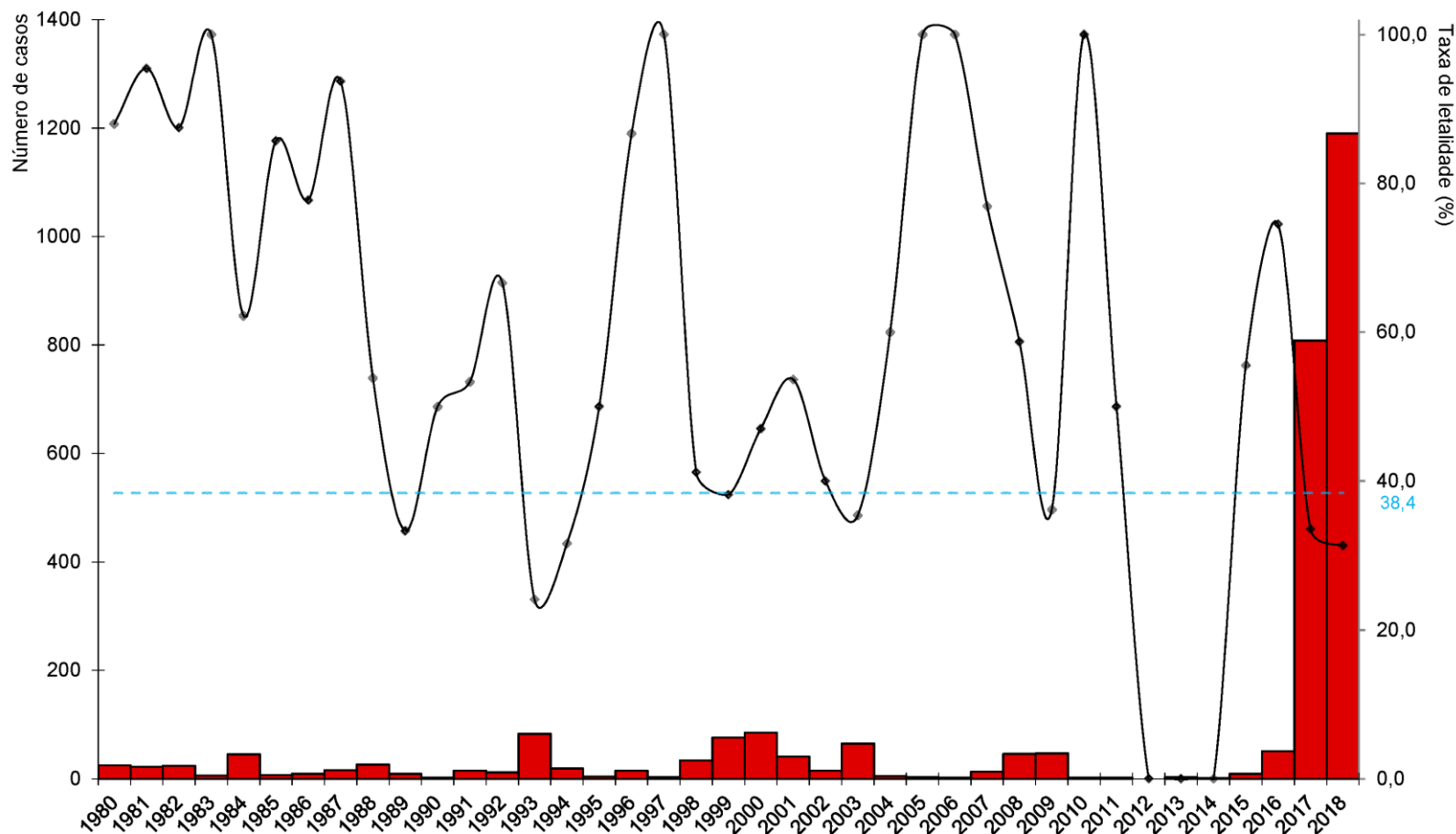


Fonte: <http://portalms.saude.gov.br/saude-de-a-z/febre-amarela-sintomas-transmissao-e-prevencao>

Considerations on Yellow Fever in Brazil

- 1942: last cases of urban yellow fever (UYF) in Brazil
- Historical case series shows irregular pattern of annual incidence;
- Expected epidemic peaks (seasonality)
- High lethality rate (mean – 38,4%)
- 2007 to 2010: expansion of viral circulation (south/southeast of the country)
- Epidemiological importance
 - ✓ Potential for dissemination
 - ✓ Risk of occurrence of cases of urban yellow fever
 - ✓ Severity / lethality

Confirmed human cases of sylvatic yellow fever and lethality, Brazil, 1980 to May 2018



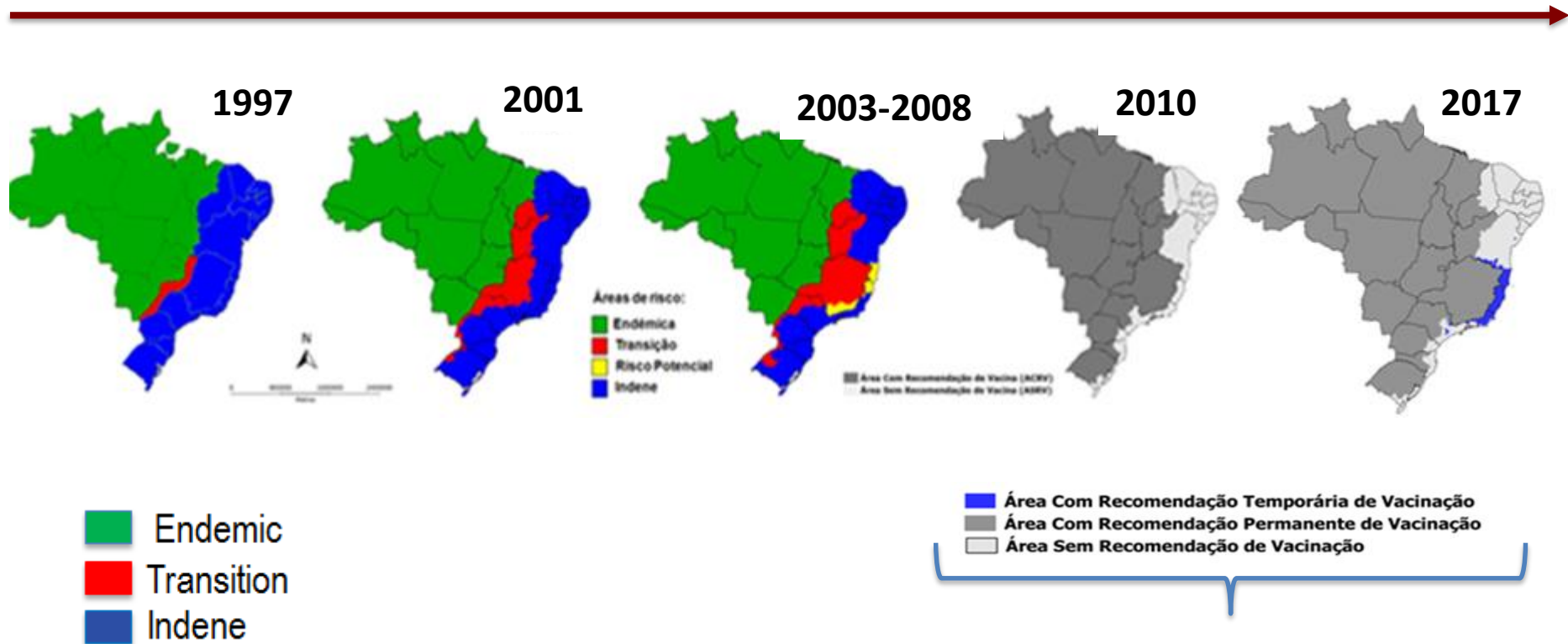
Fonte: Sinan; GT-Arbo/CGDT/DEVIT/SVS/MS; COES-FA

*Dados atualizados até a SE-19/2018

■ Casos humanos de FA —● Taxa de letalidade (%) - - - Taxa de letalidade média (%)

Brazil

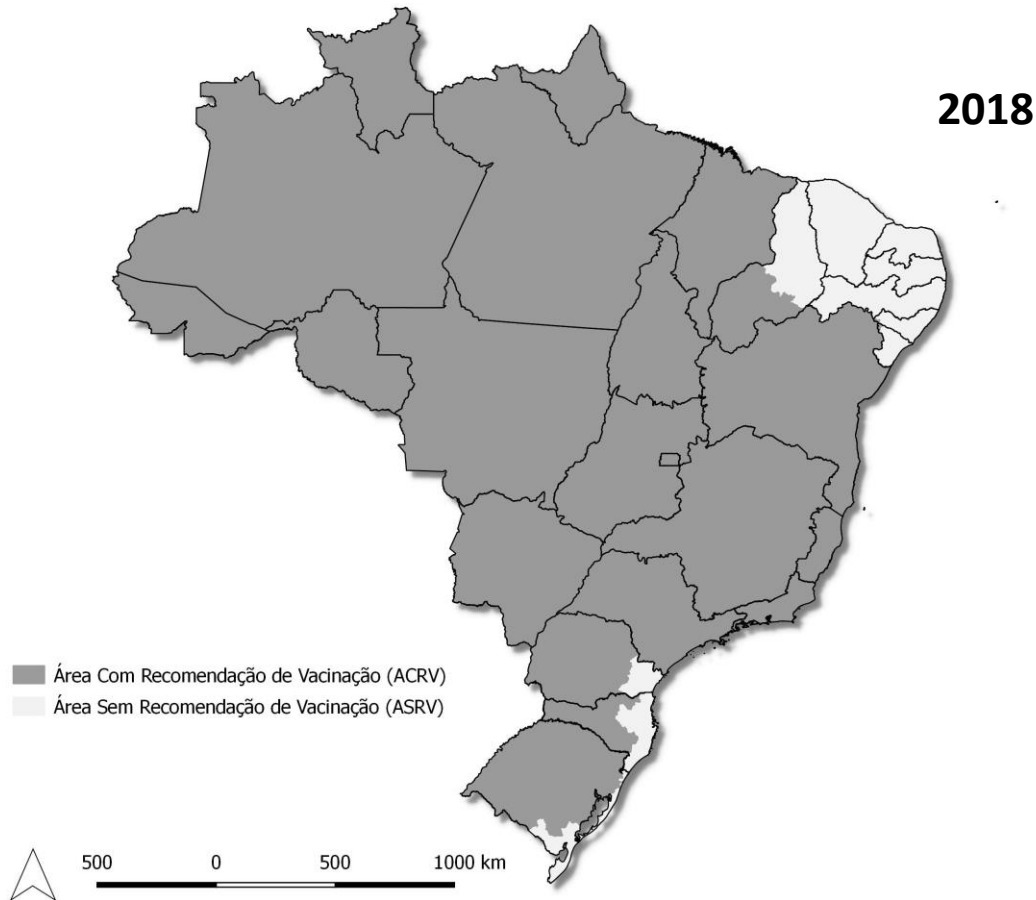
Yellow fever: expansion beyond the endemic area (Amazon region)



Other classification

Brazil

Yellow fever: expansion beyond the endemic area (Amazon region)



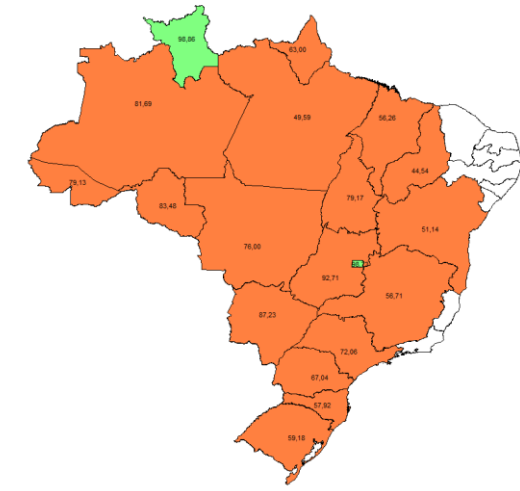
Fonte: <http://portalms.saude.gov.br/saude-de-a-z/febre-amarela-sintomas-transmissao-e-prevencao>

Yellow Fever: an unprecedented outbreak **Causes, consequences and control strategies**

Scenario in December 2016

Vaccine coverage of the YF vaccine (D1 + Reinforcement),
Areas with vaccination recommendation, by federated units, Brazil, 2007 to 2016

Unidade Federada	Nº Municípios ACRV	População (IBGE -2012)	Doses acumuladas (2007 a 2016)	Cob.(%)
Rondônia	52 / 52	1.590.011	1.327.311	83,48
Acre	22 / 22	758.786	600.404	79,13
Amazonas	62 / 62	3.590.985	2.933.344	81,69
Roraima	15 / 15	469.524	464.153	98,86
Pará	144 / 144	7.822.205	3.879.047	49,59
Amapá	16 / 16	698.602	440.106	63,00
Tocantins	139 / 139	1.417.694	1.122.385	79,17
Maranhão	217 / 217	6.714.314	3.777.758	56,26
Piauí	224 / 224	454.697	202.538	44,54
Bahia	45 / 417	1.192.593	609.941	51,14
Minas Gerais	853 / 853	19.855.332	11.259.368	56,71
São Paulo	452 / 645	10.498.677	7.565.081	72,06
Paraná	363 / 399	7.022.046	4.707.346	67,04
Santa Catarina	162 / 295	1.985.907	1.150.154	57,92
Rio Grande do Sul	463 / 497	9.810.480	5.806.169	59,18
Mato Grosso do Sul	79 / 79	2.505.088	2.185.156	87,23
Mato Grosso	141 / 141	3.115.336	2.367.576	76,00
Goiás	246 / 246	6.154.996	5.706.561	92,71
Distrito Federal	1	2.648.532	2.614.942	98,73
Total	3.529 / 5.570	88.305.805	58.719.340	66,50



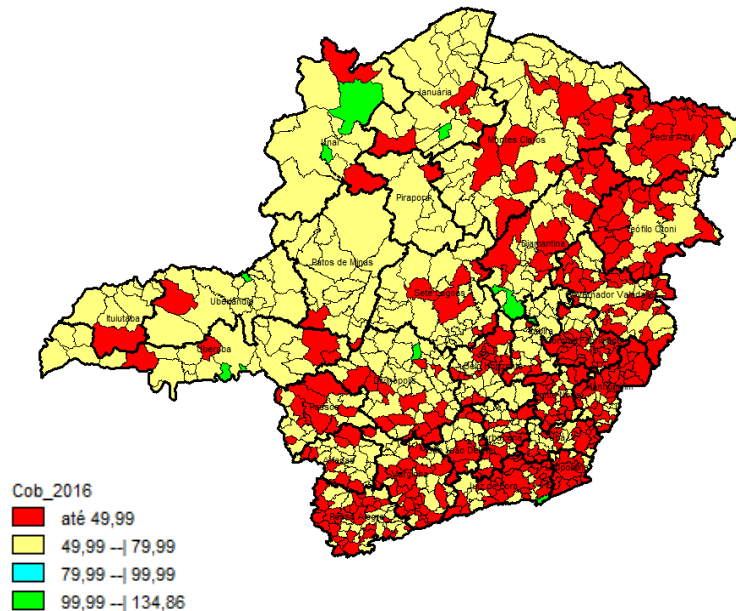
Cob.(%)
■ até 94,99
■ 94,99 –| 98,86
 Out of vaccination criteria

CV estabelecida até 2016 (100%), a partir de 2017 (95%)

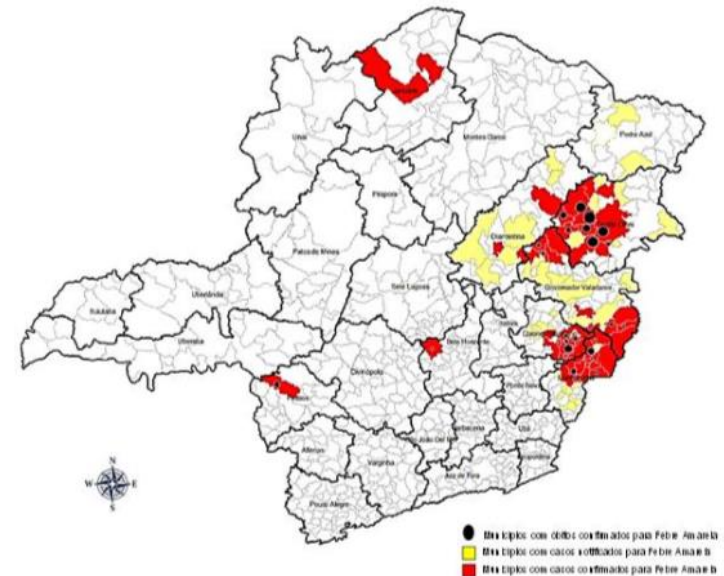
Fonte: <http://pni.datasus.gov.br> Destaque em vermelho para UF onde a recomendação de vacinação em 2016 não cobria 100% dos municípios.

Vaccine coverage and outbreak in Minas Gerais (southeast Brazil)

Vaccination coverage of the Yellow Fever vaccine; Minas Gerais, 2007 to 2016 *



Cases and deaths of Yellow Fever, Minas Gerais, 2017 *

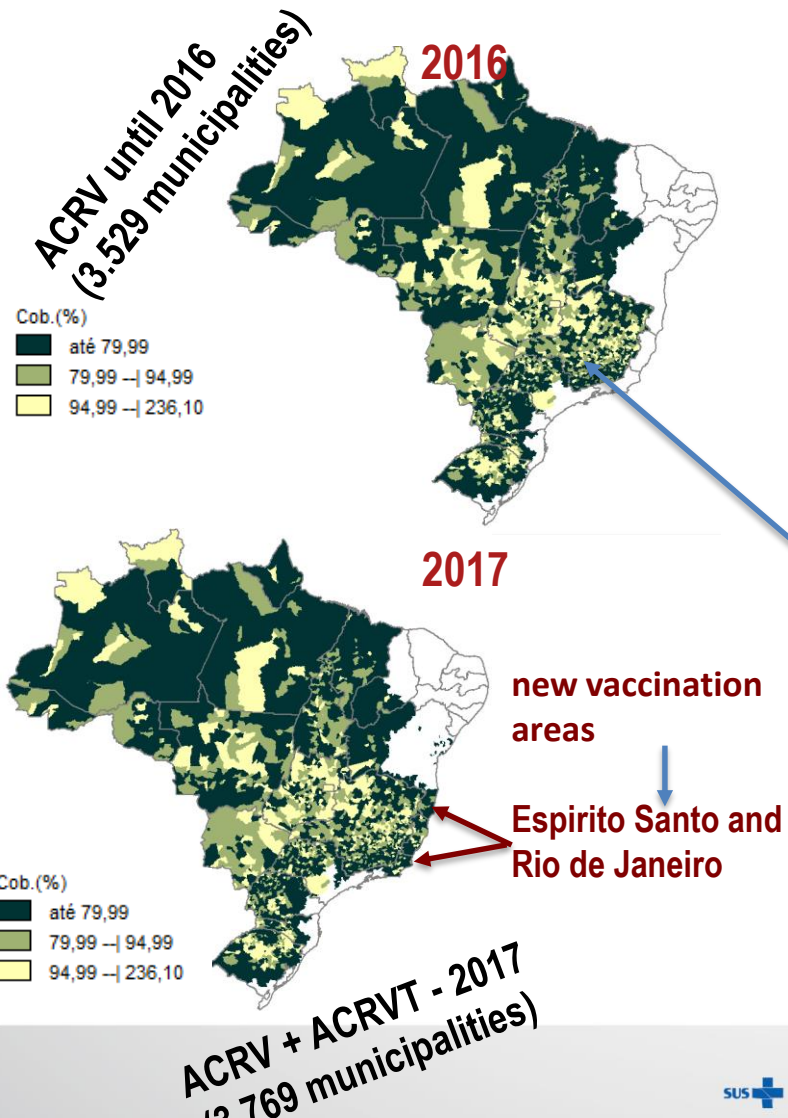


Source: National Immunization Program - Brazil and State Health Secretariat – MG * 07/03/2017

The importance of numbers: a tool for decision
Low vaccine coverage signaled the risk of YF in eastern MG

Scenery in May 2017

Vaccine coverage of the YF vaccine (D1 + Reinforcement),
Areas with vaccination recommendation, by federated units, Brazil, 2008 to 2017*



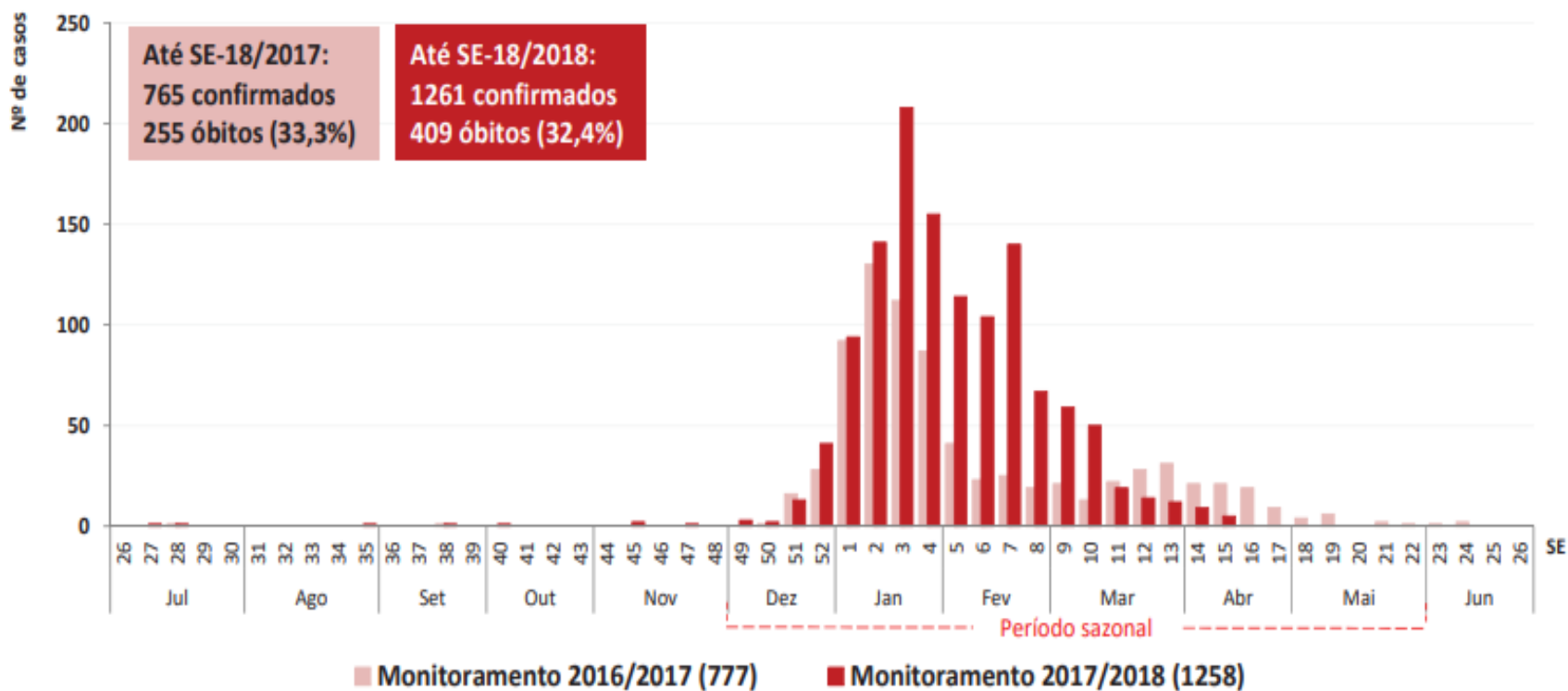
Unid Federadas	Nº Municípios ACRV	População (IBGE -2012)	Cobertura vacinal em 2017*		Estimativa de não vacinados em 2017*
			Doses acumuladas	Cob.(%)	
Rondônia	52	1.590.011	1.264.785	79,55	325.226
Acre	22	758.786	564.565	74,40	194.221
Amazonas	62	3.590.985	2.832.163	78,87	758.822
Roraima	15	469.524	444.925	94,76	24.599
Pará	144	7.822.205	3.944.347	50,43	3.877.858
Amapá	16	698.602	431.779	61,81	266.823
Tocantins	139	1.417.694	1.159.597	81,79	258.097
Maranhão	217	6.714.314	3.696.890	55,06	3.017.424
Piauí	57	454.697	195.170	42,92	259.527
Bahia	95	6.408.021	3.020.332	47,13	3.387.689
Minas Gerais	853	19.855.332	15.230.122	76,71	4.625.210
Espírito Santo	78	3.578.067	2.106.824	58,88	1.471.243
Rio de Janeiro	68	5.504.177	2.579.644	46,87	2.924.533
São Paulo	496	14.980.648	8.553.255	57,10	6.427.393
Paraná	363	7.022.046	4.942.466	70,38	2.079.580
Santa Catarina	162	1.985.907	1.235.050	62,19	750.857
Rio Grande do Sul	463	9.810.480	6.069.556	61,87	3.740.924
Mato Grosso do Sul	79	2.505.088	2.166.812	86,50	338.276
Mato Grosso	141	3.115.336	2.374.994	76,24	740.342
Goiás	246	6.154.996	5.528.417	89,82	626.579
Distrito Federal	1	2.648.532	2.666.798	100,69	NA
Total	3.769	107.085.448	71.008.491	66,31	36.076.957

Affected municipalities with confirmed human cases; number of cases, resident population and incidence of YF: monitoring periods July to June 2016/2017 and July to June 2017/2018*

	Municípios com casos humanos	População residente	% populacional	Número de casos	Incidência por 100.000 hab.
2016/2017					
ASRV	51	5.004.840	42,2	279	5,57
ACRV	92	6.845.883	57,8	483	7,06
Total	143	→ 11.850.723	100,0	762	→ 6,43
2017/2018					
ASRV	53	22.186.156	58,3	418	1,88
ACRV	169	15.861.841	41,7	831	5,24
Total	222	→ 38.047.997	100,0	1.249	→ 3,28

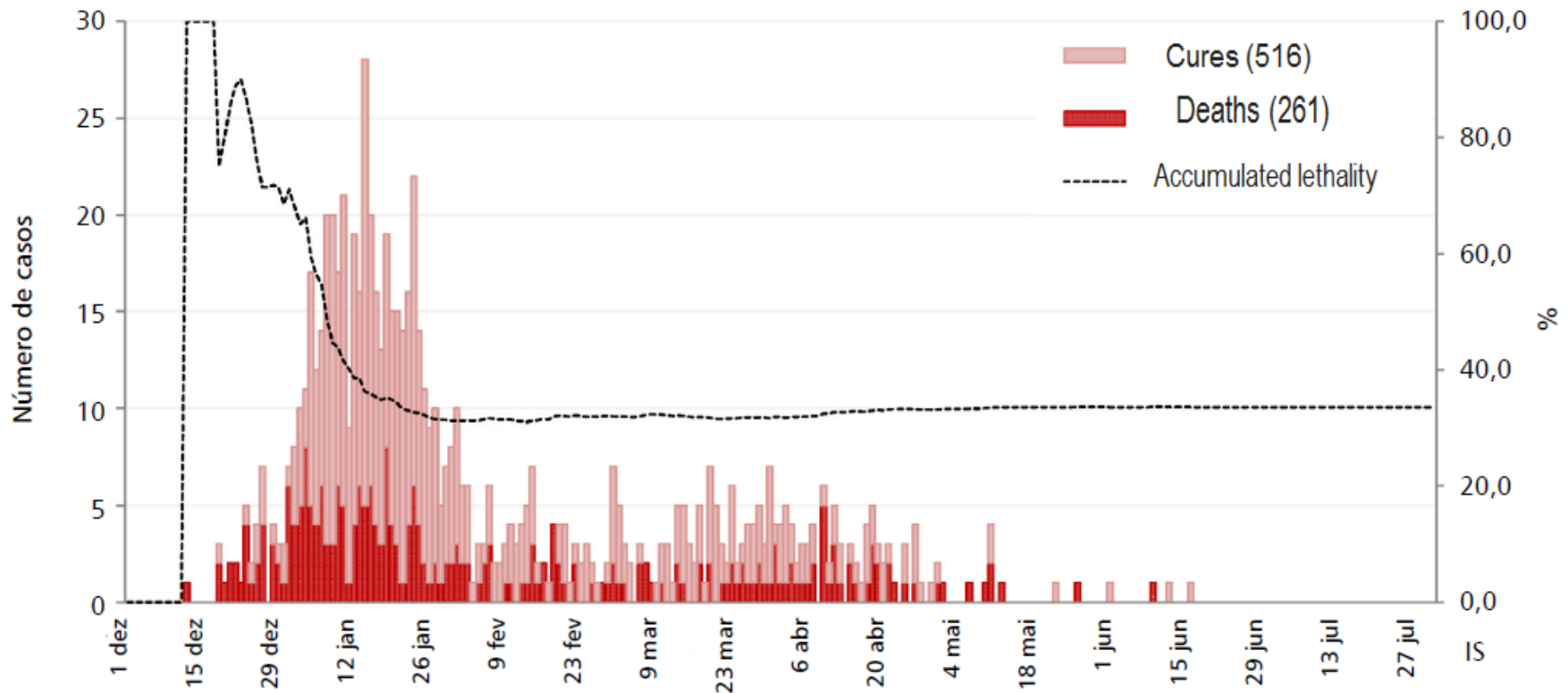
Fonte: CGDT/DEVIT/SVS/MS. Foram excluídos os casos que não tinham todas as informações necessárias para compor a análise (2016/2017: um caso; 2017/2018: nove casos). *Dados até 08/05/2018

Distribution of confirmed cases per epidemiological week, in the monitoring periods; July to June 2016/2017 and July to June 2017/2018*



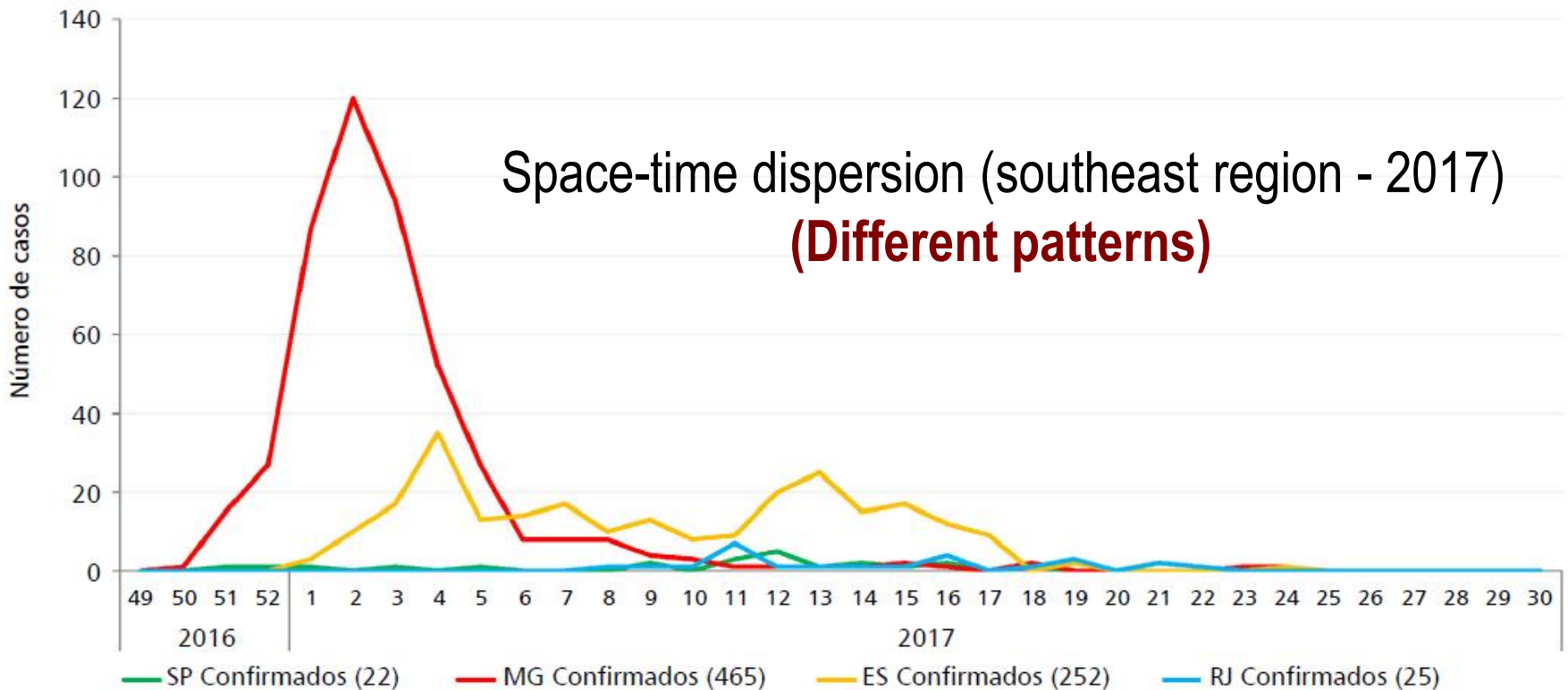
Fonte: CGDT/DEVIT/SVS/MS. *Dados preliminares e sujeitos à revisão. *Dados até 08/05/2018

Distribution of yellow fever cases at the onset of symptoms, evolution and cumulative lethality rate, Brazil, from December 1, 2016 to July 31, 2017



*Dados atualizados em 01/08/2017, sujeitos a alterações.

Temporal distribution of confirmed yellow fever cases reported per epidemiological week, December 1, 2016 to July 31, 2017



*Dados atualizados em 01/08/2017, sujeitos a alterações.

Explanations for an unprecedented outbreak

➤ **Little known, is attributed to multicausality**

- Expansion of virus circulation to the area without vaccination recommendation (Espírito Santo, Rio de Janeiro and São Paulo)
- Urban segment entering the rural segment of cities
- Fragility in the monitoring of vaccine coverage in vaccination recommendation areas
- Fragility in surveillance of epizootics in NHP
- Environmental factors (not yet explained)

Additional costs with the outbreak, not assessed

- Direct costs with hospitalizations (cases): overload
- Years of life lost (deaths)
- Unexpected expenses with health workers (additional hours of work, displacement)
- Other services interrupted to meet YF
- Relocation of resources by affected municipalities to guarantee structure in controlling the outbreak
- Hiring of extra hospital beds
- Extra federal financial transfers: R\$ 33 million (14,35 million dollars)

Estimate of Direct Costs (US\$)

Estimated hospitalization costs (US \$) for Yellow Fever from 2016 to 2018

Monitoring periods		V_m (US\$)	N_H	C_{FA} (US\$) $V_m \times N_H$
1st period:	July 2016 to June 2017	320.53	1,237	396,495.00
2st period	July 2017 to April 2018	338.25	2,113	714,715.09
Total				1,111,210.09

*1º Período de Monitoramento – julho de 2016 a junho de 2017

2º Período de Monitoramento – julho de 2017 a julho de 2018

Potential years of life lost (PYLL) by Yellow Fever in the Monitoring Period from July 2016 to June 2017.

age groups (year)	Female			Male			Total		
	n	PYLL	Mean	n	PYLL	Mean	N	PYLL	Mean
< 1 ano	3	238,2	79,4	-	-	-	3	238,2	79,4
1 a 4	-	-	-	1	72,3	72,3	1	72,3	72,3
5 a 9	-	-	-	-	-	-	-	-	-
10 a 14	-	-	-	2	126,1	63,1	2	126,1	63,1
15 a 19	2	125,5	62,7	2	110,9	55,5	4	236,4	59,1
20 a 29	2	111,9	56,0	13	649,3	49,9	15	761,2	50,7
30 a 39	2	100,4	50,2	50	2.058,1	41,2	52	2.158,5	41,5
40 a 49	6	215,7	36,0	61	2.013,3	33,0	67	2.229,1	33,3
50 a 59	8	235,7	29,5	56	1.387,5	24,8	64	1.623,2	25,4
60 a 69	6	121,1	20,2	38	680,6	17,9	44	801,7	18,2
70 ou mais anos	-	-	-	10	105,0	10,5	10	105,0	10,5
Total	29	1.148,5	39,6	233	7.203,1	30,9	262	8.351,7	31,9

Source: COES-FA / CGDT / DEVIT / SVS / MS

Potential years of life lost (PYLL) by Yellow Fever in the Monitoring Period from July 2017 to May 2018.

age groups (year)	female			Male			Total		
	n	PYLL	Mean	n	PYLL	Mean	N	PYLL	Mean
< 1 ano	-	-	-	1	72,2	-	1	72,2	72,2
1 a 4	-	-	-	-	-	-	-	-	-
5 a 9	-	-	-	-	-	-	-	-	-
10 a 14	-	-	-	-	-	-	-	-	-
15 a 19	2	128,4	64,2	4	229,1	57,3	6	357,5	59,6
20 a 29	3	162,1	54,0	23	1.160,7	50,5	26	1.322,7	50,9
30 a 39	6	280,1	46,7	45	1.840,3	40,9	51	2.120,4	41,6
40 a 49	8	298,9	37,4	104	3.377,5	32,5	112	3.676,4	32,8
50 a 59	12	343,3	28,6	85	2.098,5	24,7	97	2.441,8	25,2
60 a 69	10	206,0	20,6	70	1.251,9	17,9	80	1.457,9	18,2
70 ou mais anos	8	101,8	12,7	28	301,4	10,8	36	301,4	8,4
Total	49	1.520,6	31,0	360	10.331,5	28,7	409	11.750,3	28,7

Source: COES-FA / CGDT / DEVIT / SVS / MS

Number of Yellow Fever vaccine received and costs, Brazil. 2017/2018

Ano	Number of doses	R\$	U\$
2017	68.944.850	239.698.405,12	74.210.032,54
2018	10.685.500	32.377.065,00	10.023.859,13
Total	79.630.350	272.075.470,12	84.233.891,67

Source: IPN/MS May 2018

Distribution of YF vaccines for routine actions and outbreak control. Brazil. 2017/2018

Year	Distribution / action	number of doses
2017	routine	12.148.215
	outbreak	32.874.420
2018	routine	7.918.000
	outbreak	20.396.000
2017/2018	routine	20.066.215
	outbreak	53.270.420
Total		73.336.635

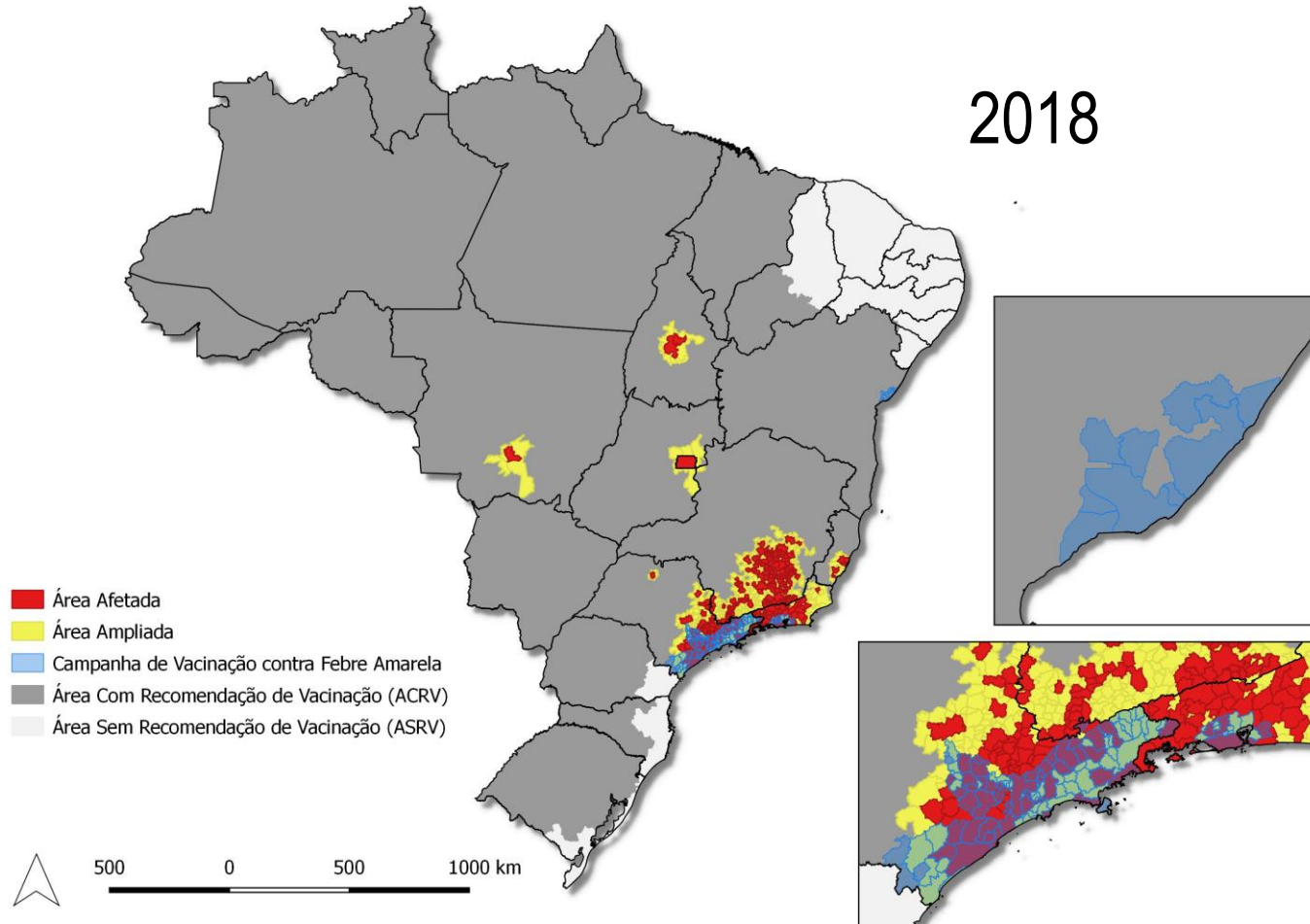
Source: IPN/MS May 2018

Strategies of intervention, prevention and control of Yellow Fever

- Disease monitoring (recommendations to intensify surveillance and immunization actions)
- Elaborated contingency plan for yellow fever
 - ✓ Epidemiological, entomological and epizootics in non-human primates (NHP) surveillance
 - ✓ Immunizations
 - ✓ Laboratory
 - ✓ Communication, information, and social mobilization (weekly epidemiological report , instructional material, written and spoken media, myths and truths, opinion research...)
- Intensification of vaccination (criteria established)
- Center for Emergency Operations in Public Health (CEOPH)
- Technical and operational support: Ministry of Health (states and municipalities)
- Definition of priority areas for vaccination based on ecological corridors (São Paulo)

Brazil

Yellow fever: expansion beyond the endemic area (Amazon region)



Fonte: <http://portalms.saude.gov.br/saude-de-a-z/febre-amarela-sintomas-transmissao-e-prevencao>

Changes in vaccination schedule with yellow fever vaccine

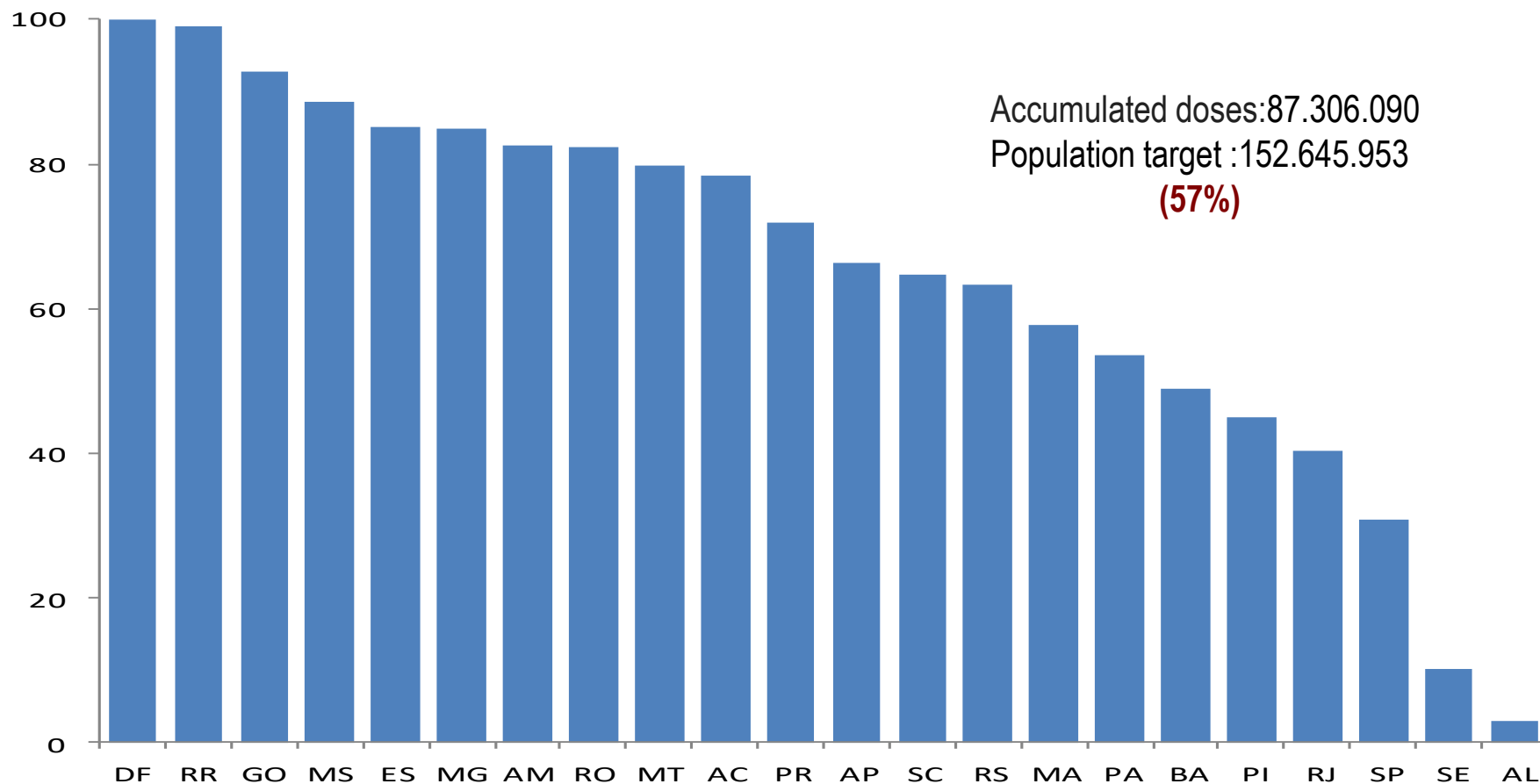
- ✓ **Until 2016:** 1st dose at 9 months old and reinforcement every 10 years (3,529 municipalities)
- ✓ **2016:** 1st dose at 9 months old ; 2nd dose at 4 years old (<5 years old)
 - ✓ **< 5 years old not vaccinated:** 1 dose and schedule 2nd dose (30 days between doses)
- ✓ **≥5 years old not vaccinated:** 1st dose and booster at 10 years old
- ✓ **2017:** adopts recommendation OPS – 1 dose: 9 months old
- ✓ **2018:** adopts fractional dose (**campaign municipalities of 3 states**): second dose expectancy after 8 years of 1st dose

Changes in the calculation of vaccine coverage

- ✓ **Until May 2017:** coverage vaccination estimated with first doses + booster doses accumulated every 10 years
- ✓ **After May 2017:** coverage vaccination estimated with cumulative doses of available data since 1994.
 - ✓ The information system collects aggregated data and per occurrence of vaccination
 - ✓ Does not identify outputs by death or mobility of the population, or duplication of doses.
 - ✓ High vaccine coverage not matching reality

This is a question: Who is vaccinated?

Vaccine coverage for Yellow Fever with first doses and cumulative reinforcement, Brazil, 2017 *



Source: NIP/MH * Accumulate doses 2008 /2017

Vaccination campaign in municipalities of selected federated units. Brazil, 2018*

Federated Units	Nº municipalities	Target population	Doses Aplicadas			
			campaing		Total accumulated	%
			Pattern (0,5ml)	Fractional(0,1ml)		
Bahia	8	3.362.802	4.370	46.023	1.850.393	55,0
São Paulo	107	24.726.783	626.402	6.070.263	13260550	53,6
Rio Janeiro	15	11.735.582	77.951	1.532.486	6.535.230	55,7
TOTAL	130	39.825.167	708.723	7.648.772	21.646.173	54,4

Source: State Secretary of Health

Fractionated dose: nominal register to identify the individual for revaccination after eight years if necessary

Concluding

- ✓ The expansion of the area of viral circulation and of the risk areas for the occurrence of yellow fever in Brazil is a fact (4.266 municipalities)
- ✓ The factors responsible for the expansion of risk areas are still not well explained (multifactorial)
- ✓ The monitoring of the disease reaffirms the seasonality and allows the establishment of timely prevention measures
 - ✓ **Immunization, surveillance and assistance**
- ✓ Vaccination will be gradually extended to all Brazilian municipalities until 2019

References

Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de Vigilância das Doenças Transmissíveis. Coordenação Geral de Doenças Transmissíveis. **Monitoramento do Período Sazonal da Febre Amarela Brasil – 2017/2018.** Informe nº 25 | 2017/2018. acesso 14/05/2018 <http://portalarquivos2.saude.gov.br/images/pdf/2018/maio/09/Informe-FA.pdf>

Brasil. Secretaria de Vigilância em Saúde. Emergência epidemiológica de febre amarela no Brasil, no período de dezembro de 2016 a julho de 2017. Boletim Epidemiológico. Vol 48. n 28. 2017 . Acesso em 14/05/2018
http://portalarquivos2.saude.gov.br/images/pdf/2017/setembro/06/2017_027.pdf

Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de Vigilância das Doenças Transmissíveis. Coordenação Geral de do Programa Nacional de Imunizações. Sistema de Informação do Programa Nacional de Imunizações. Doses aplicadas e Coberturas vacinais de Febre amarela. (Dados não publicados). 2008 a 2017

VACINAÇÃO EM DIA



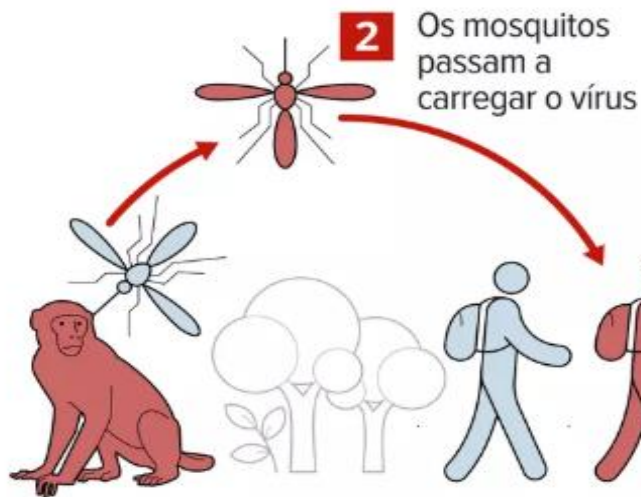
Thank you for attention!
Muchas gracias!
Obrigada!
antonia.teixeira@saude.gov.br

Febre amarela

Entenda como ocorre a infecção e quais são os sintomas

□ não infectados ■ infectados

Ciclo silvestre

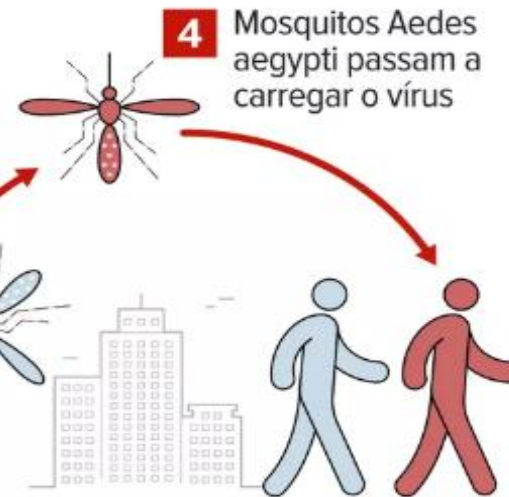


1 Macacos infectados pela doença são picados pelos mosquitos *Haemagogus* e o *Sabethes*

3 Uma pessoa é picada em área de mata e desenvolve a doença. Se for a uma cidade, pode dar início ao ciclo urbano

Ciclo urbano

Não ocorre no Brasil desde 1942



5 Pessoas em outros locais podem ser infectadas pela doença

Corrida aos postos de vacinação



 SP tem longas filas nos postos de vacinação contra a febre amarela (Foto: Reprodução/TV Globo)



São Paulo

Zona norte/Capital

Rotas da febre amarela em São Paulo

Vírus deve chegar neste ano à região de Sorocaba, ao litoral e ao Vale do Paraíba

MG

MS

ES

Vindo do Triângulo Mineiro, o vírus deslocou-se em média 0,9 quilômetro (km) por dia principalmente por meio de mosquitos, saguis e macacos-prego por matas próximas a rios

Vindo de Poços de Caldas, o vírus entrou na região de Campinas e começou a se deslocar até 2,7 km/dia, por meio principalmente de mosquitos e bugios, entre fragmentos de matas

São José do Rio Preto





Ribeirão Preto

Poços de Caldas

SP

Campinas

RJ

-  Rota efetiva até dezembro de 2017
-  Rota prevista em 2018
-  Área provável de expansão do vírus em 2018
-  Municípios com registros de morte de macacos

PR

Oceano Atlântico

FONTE: SUCEN / IAL / CVE-SES-SP

INFOGRÁFICO: ANA PAULA CAMPOS | ILUSTRAÇÃO: FÁBIO OTUBO



PRIORIDADES DE VACINAÇÃO EM GUARULHOS

As trajetórias efetivas e previstas do vírus definem as áreas prioritárias de vacinação



FONTE CVE-SES-SP

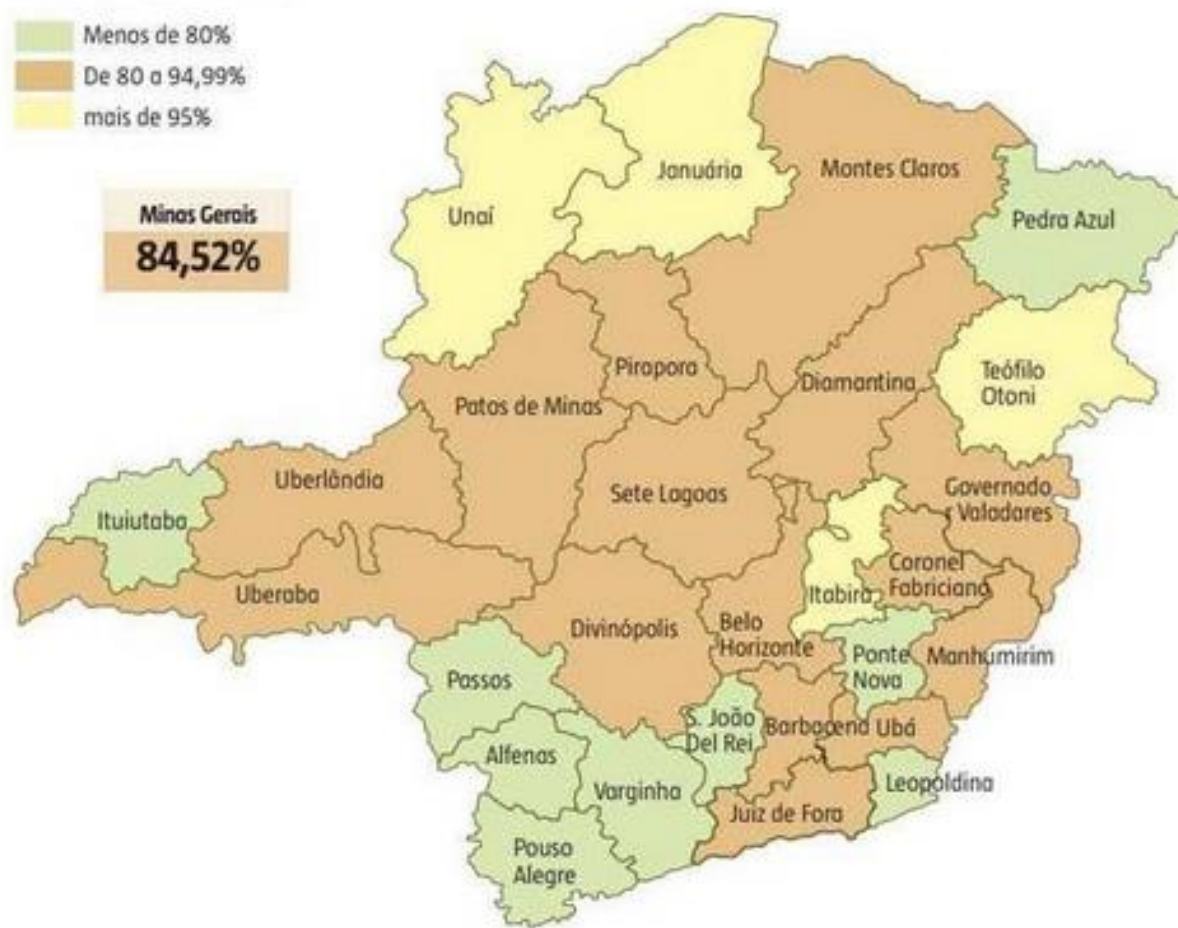
IMUNIZAÇÃO ACUMULADA

Cobertura vacinal nas 28 unidades regionais de saúde mineiras

(Por unidade regional de saúde)

- Menos de 80%
- De 80 a 94,99%
- mais de 95%

Minas Gerais
84,52%



Pouso Alegre	71,49%
Ponte Nova	75,33%
Pedra Azul	75,48%
Ituiutaba	75,81%
Passos	77,17%
Leopoldina	77,18%
Varginha	77,62%
São João del-Rei	77,77%
Alfenas	78,04%
Diamantina	80,24%
Ubá	81,16%
Sete Lagoas	81,92%
Barbacena	82,31%
Belo Horizonte	83,74%
Montes Claros	83,91%
Patos de Minas	86,83%
Juiz de Fora	87,01%
Divinópolis	87,12%
Governador Valadares	87,73%
Coronel Fabriciano	87,82%
Uberlândia	88,73%
Manhumirim	88,96%
Uberaba	89,44%
Pirapora	91,03%
Januária	95,90%
Itabira	97,18%
Unai	101,95%
Teófilo Otoni	103,25%