

### 65th Annual Meeting

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and outside epidemic periods: Insights from Data Mining Nicolas Baurin<sup>1</sup>; David Morley<sup>2</sup>; Leon Ochiai<sup>1</sup>; Mariana Guergova-Kuras<sup>2</sup>; Mohammad Afshar<sup>2</sup>; Laurent Coudeville<sup>1</sup> <sup>1</sup>Sanofi Pasteur, Lyon, France; <sup>2</sup>Ariana Pharmaceuticals, Paris, France

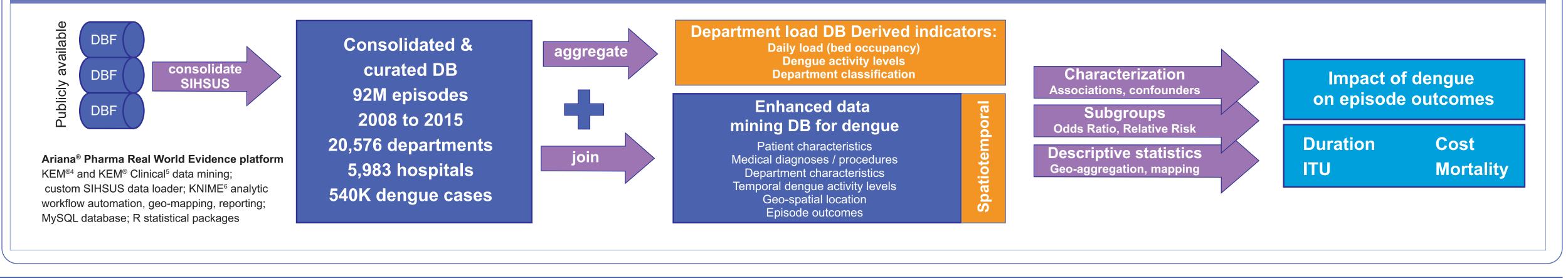
Management of dengue hospitalizations in Brazil during

## BACKGROUND & OBJECTIVES

- Brazil reported 1.5 million dengue cases in 2015, more than any other country. All publicly funded hospitalizations are registered in a publicly available database (SIH/SUS)<sup>1</sup>.
- Over 2008-2015, the SIH/SUS database describes 92 million admissions managed by 20,576 departments of 5,983 hospitals, of which 540k are admissions associated to a dengue diagnostic.
- Data mining of hospital databases provides insights on the impact of diseases on the healthcare infrastructure<sup>2,3</sup>, and contributes to document the disease burden on public health.
- We present here the consequences of the seasonal aspect of dengue on the management of dengue hospitalization in Brazil and some implications for dengue-related mortality.

# METHODS

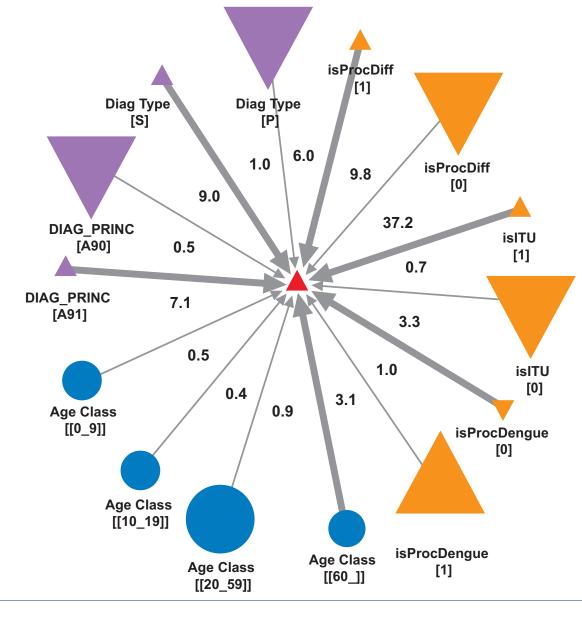
Ariana<sup>®</sup> Pharma Real World Evidence process - data consolidation, spatiotemporal exploration and data mining





#### CHARACTERIZATION OF DENGUE EPISODES AND DEATHS

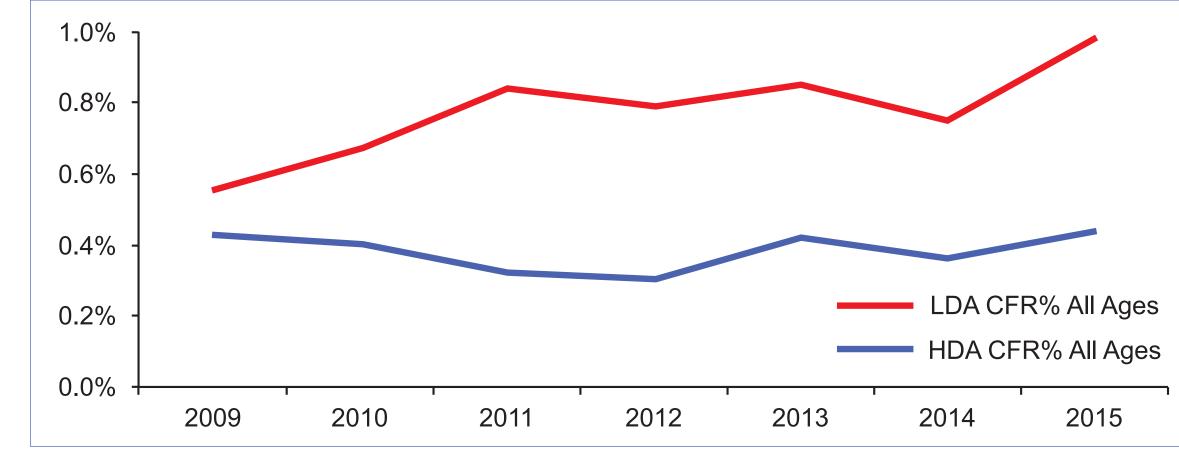
Characterization confirms higher Case Fatality Rate (CFR) for older adults (60+) and for more severe dengue cases



Variable / Subgroup	Cases	Deaths	CFR%	Lift*
Reference	461481	2828	0.6%	1.0
All dengue cases (2009-2015)				
PATIEI	NT CHARACT	ERISTICS		
AgeClass				
Age 0-9	67436	186	0.3%	0.5
Age 10-19	95088	239	0.3%	0.4
Age 20-59	240285	1297	0.5%	0.9
Age 60+	58672	1106	1.9%	3.1
M	EDICAL DIAGN	OSIS		
DIAG_PRINC				
A90: classic dengue principal diagnosis	429950	1374	0.3%	0.5
A91: severe dengue principal diagnosis	19613	856	4.4%	7.1
DiagType				
P: dengue (A90/A91) principal diagnosis	458881	2685	0.6%	1.0
S: dengue (A90/A91) secondary diagnosis	2600	143	5.5%	9.0
HOSPITAL	SERVICES / PF	ROCEDURES		
isProcDengue				
0: dengue procedure not performed	8373	171	2.0%	3.3
1: dengue procedure is performed	453108	2657	0.6%	1.0
sProcDiff				
0: procedure performed as proposed	446836	2292	0.5%	0.8
1: different procedure to proposed	14645	536	3.7%	6.0
isITU				
0: episode does not require ITU	457100	1830	0.4%	0.7
1: episode requires ITU	4381	998	22.8%	37.2
* Lift = ratio of subgroup CFR to overall de	ngue CFR: node	e size proportiona	I to #Cases: arr	ow densit

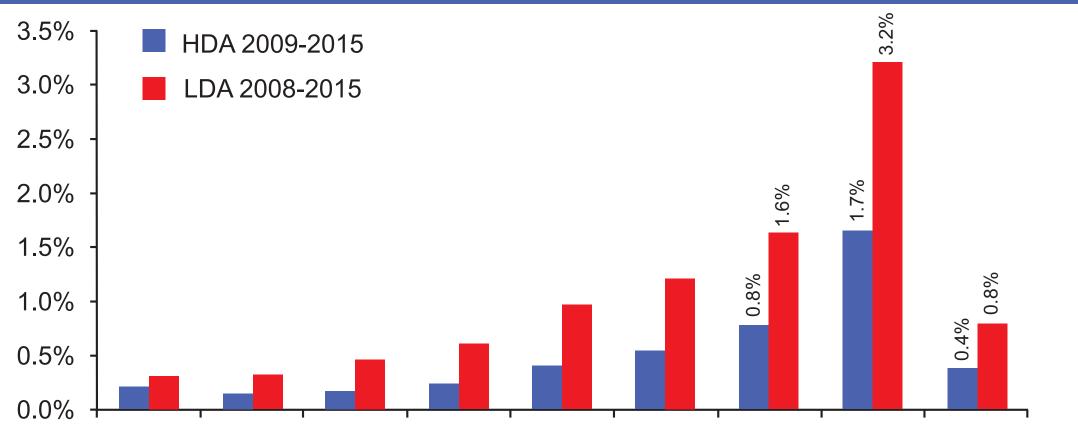
#### **COMPARISON OF HDA vs LDA departments**

#### Higher dengue case fatality rates in LDA departments: on the rise over the years ("All ages")



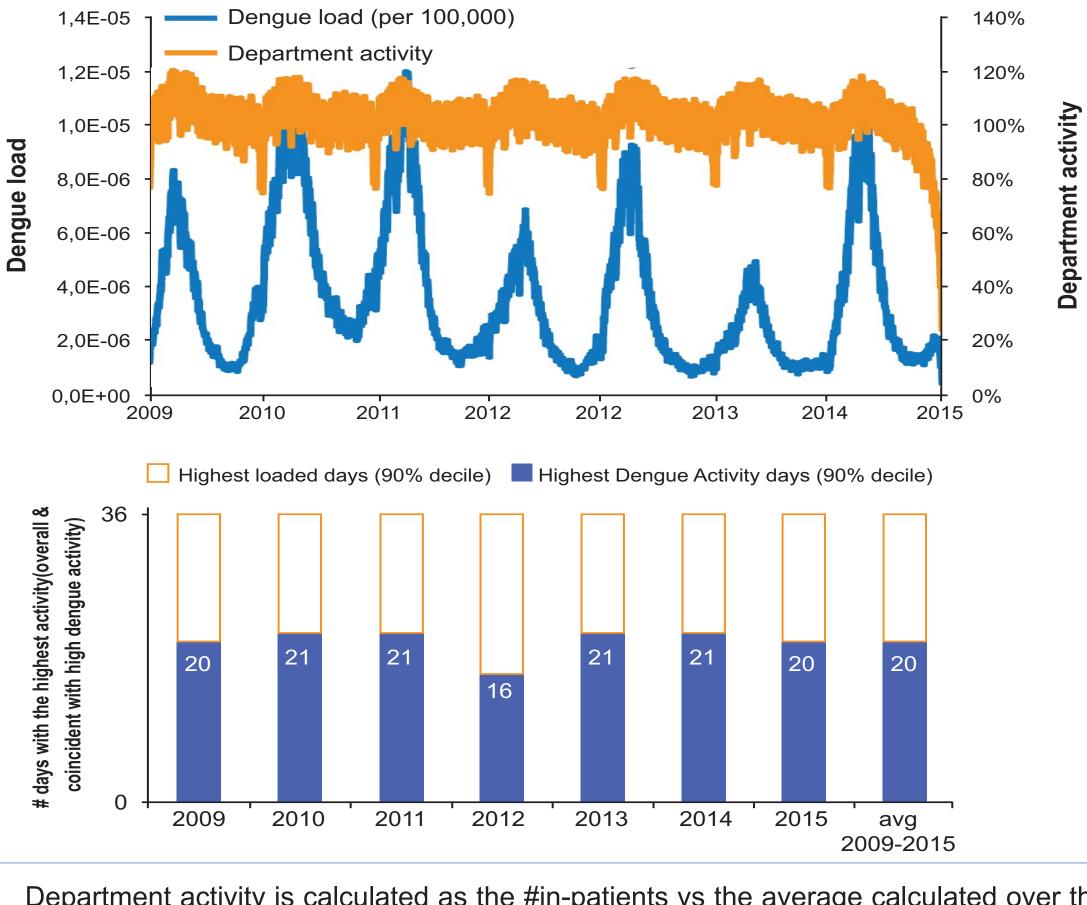
• **75% increase** of CFR in LDA departments (.56% in 2009 to .98% in 2015)

~2-fold higher dengue case fatality rate in LDA vs HDA departments: for all ages, up to 3% for elderly



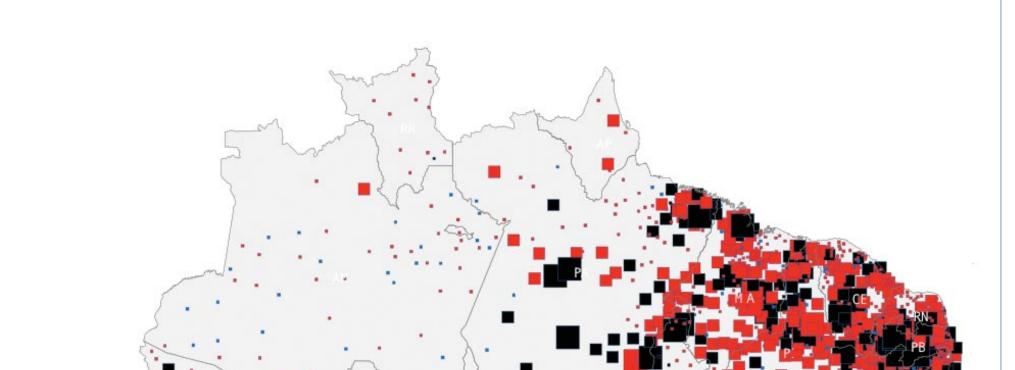
#### **IMPACT OF DENGUE ON HOSPITAL ACTIVITY**

Seasonality of hospital activity is dominated by dengue")



- Department activity is calculated as the #in-patients vs the average calculated over the past 6 months
- Department dengue load is calculated as the #in-patients with a dengue diagnostic vs the average calculated over the past 6 months

#### Dengue cases are managed by 40% of hospital departments throughout Brazil



HDA departments LDA departments ZDA departments

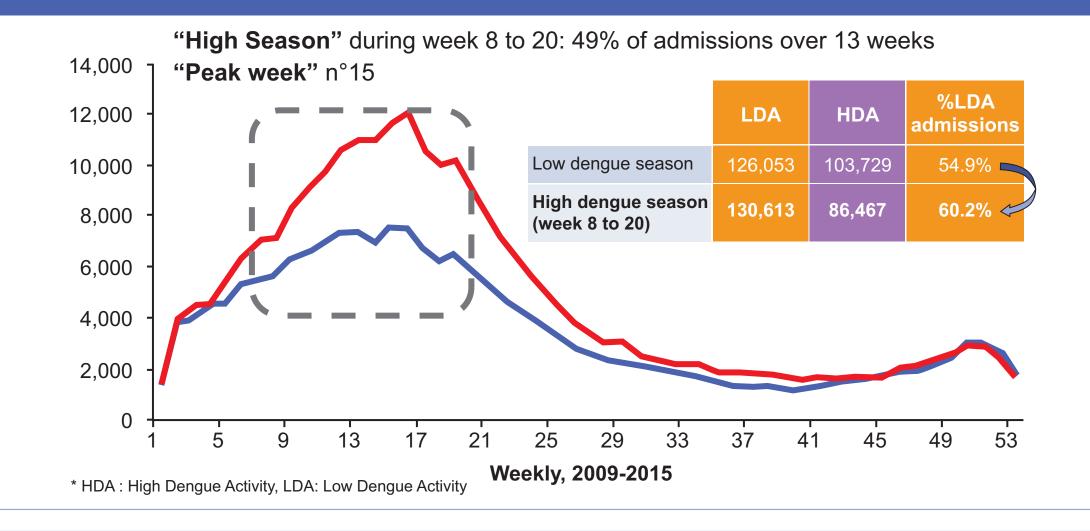
• 469 High Dengue Activity Departments (HDA) have treated at least 200 dengue patients between 2009-2015 AND have a peak dengue load rate of at least 20% of estimated capacity

• 6,113 Low Dengue Activity Departments (LDA) have treated < 200 dengue patients between 2009-2015 OR have a peak dengue load rate of < 20% of estimated capacity

• 8,660 Zero Dengue Activity Departments (ZDA) have treated no dengue patients between 2009-2015 Age 0–9 Age 10–19 Age 20–29 Age 30–39 Age 40–49 Age 50–59 Age 60–69 Age 70–79

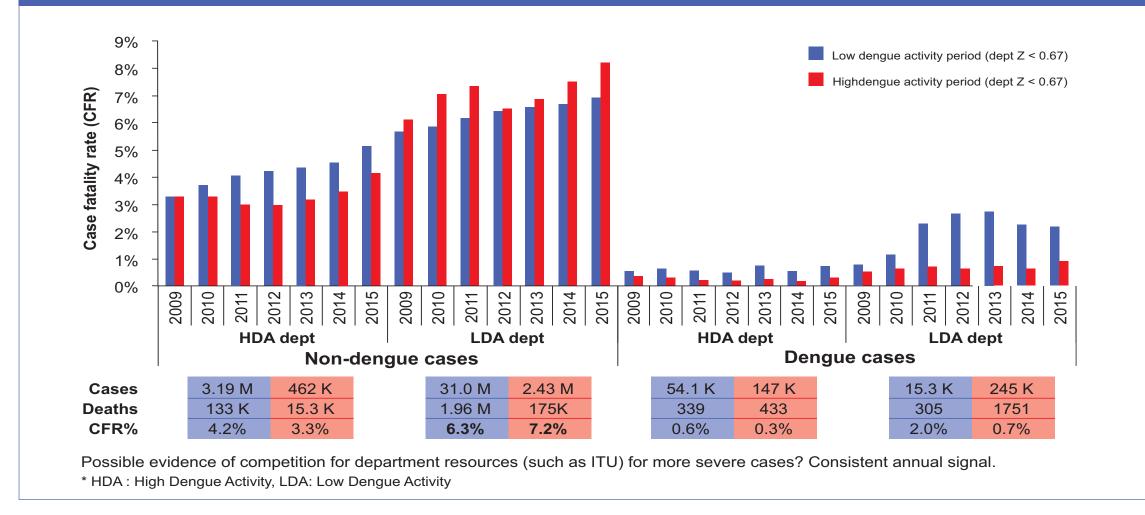
\* HDA : High Dengue Activity, LDA: Low Dengue Activity

The proportion of LDA-managed dengue admissions increases during the high dengue season



### **IMPACT OF DENGUE ON NON-DENGUE DEATHS**

#### Non-dengue mortality increases in LDA departments during periods of high dengue activity



### REFERENCES

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- 6. KNIME, The {K}onstanz {I}nformation {M}iner. M. R. Berthold et al. Studies in Classification, Data Analysis, and Knowledge Organization. 2007

## DISCLOSURES

This study was funded by Sanofi Pasteur

## STRENGTHS & LIMITATIONS

- Main findings are supported by a robust database
- 99% of admissions have clean records
- ~20 indicators for each admission (ICD diagnostic, Length of Stay, costs, Hospital identifier, Geolocalization ...
- Temporality: SIHSUS database documents 8 years of hospital activity
- Big Data analytics platform enables exploration of these massive databases
- Data mining identifies actionable insights into Public Health infrastructure
- Current findings are not final, role of confounding factors remain to be fully investigated
- Interpretation of data supported findings/trends must be confirmed, fine-tuned by local experts (hospital) management, physicians ...)
- SIHSUS database does not capture the activity of all hospitals in Brazil, notably the private sector (25%) of the population enrolled)

## CONCLUSIONS

The characteristics of dengue hospitalized admissions in Brazil (heterogeneity, seasonality, mortality, high activity load) confirm the significant burden imposed by dengue on the population

- Dengue case fatality rate is 2-fold higher in the LDA departments (.8% overall, consistent for all ages, up to 3.1% for 70+) vs HDA departments (.4%). This could be due to a combination of the ability of departments to manage dengue, and also characteristics of patients admitted
- The proportion of dengue admissions managed by LDA departments (compared to HDA) is higher during periods of high dengue activity
- Seasonality of hospital activity is dominated by dengue : 56% of the most overloaded hospital days coincide with days with high dengue related activity (20/36 days at the national level in 2015)
- Non-dengue mortality increases in LDA departments during periods of high dengue activity

