National Burden of Hospitalized & Non-Hospitalized Influenza-Associated Severe Acute Respiratory Illness in Kenya, 2012 - 2014

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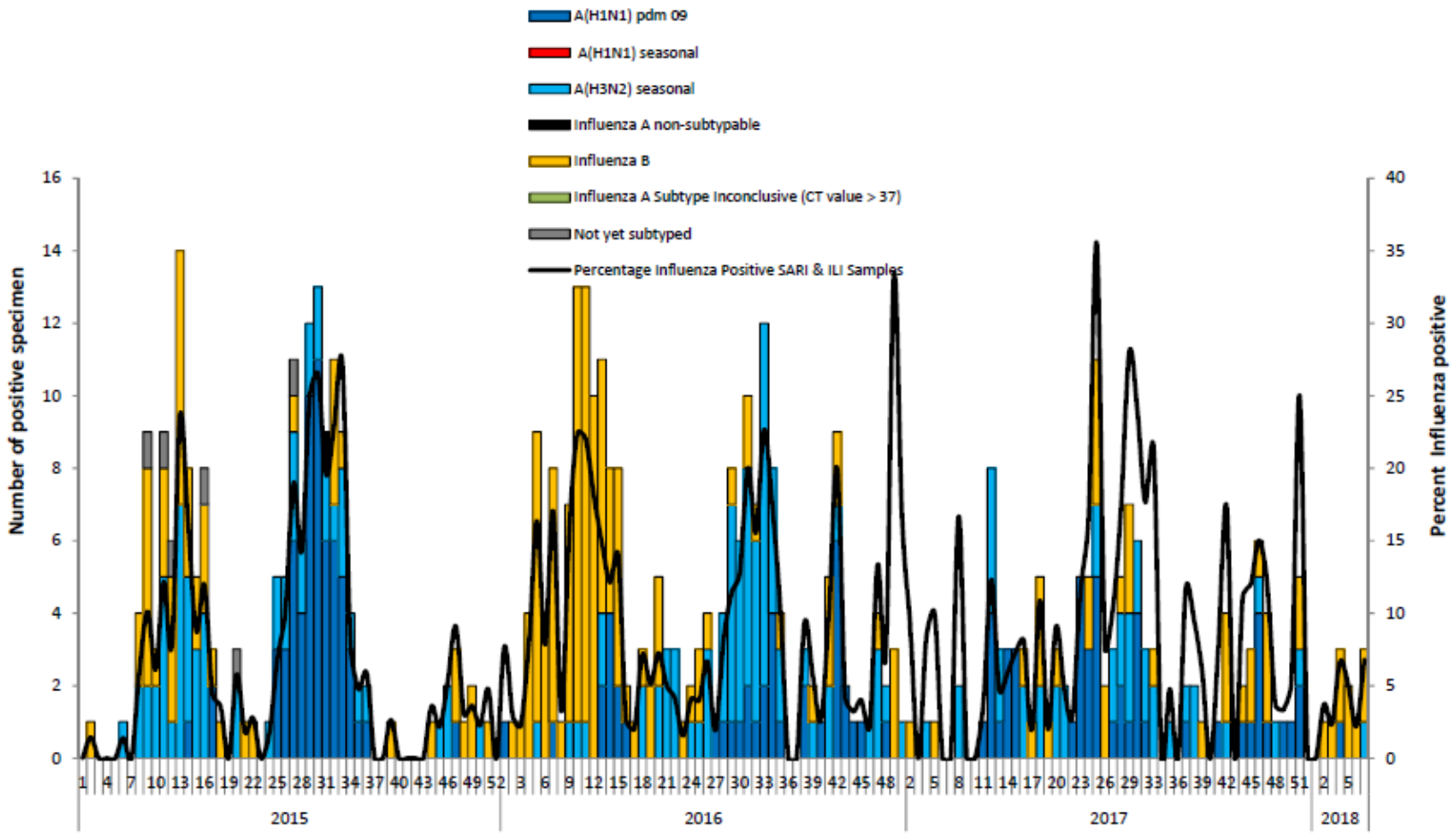
Background

- Data from Kenya show that influenza circulates year-round and causes substantial morbidity



Source: Kenya Weekly Influenza Activity Report as of epi week 7, 2018

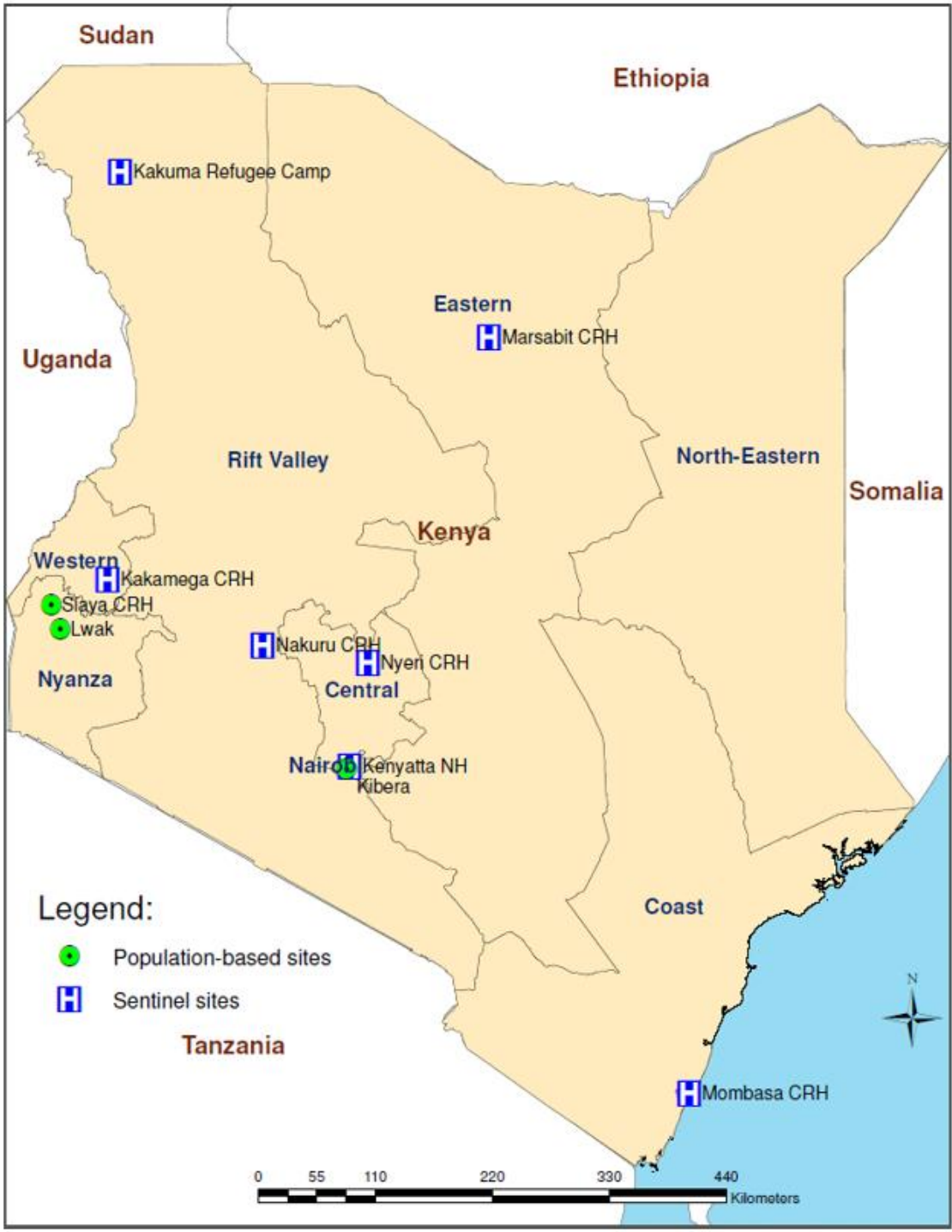
Background

- 10-20% of influenza-associated cases of pneumonia are admitted[1]

- Only national estimates of influenza-associated severe acute respiratory illness (SARI) were from 2009 – 2011[2]
  - Data collected during and shortly after the 2009 influenza pandemic
  - Estimated rates for two broad age groups: <5 years vs. ≥5 years

[1] Katz *et al*. Epidemiology, seasonality, and burden of influenza and influenza-like illness in urban and rural Kenya, 2007-2010. 2012

[2] Fuller *et al*. Estimation of the national disease burden of influenza-associated severe acute respiratory illness in Kenya and Guatemala: a novel methodology. 2013


Sudan
Ethiopia
Kakuma Refugee Camp
Eastern
Marsabit CRH
Uganda
Rift Valley
North-Eastern
Somalia
Kenya
Western
Kakamega CRH
Siaya CRH
Lwak
Nakuru CRH
Nyeri CRH
Nyanza
Central
Nairobi
Kenyatta NH
Kibera
Coast
Legend:
Population-based sites
Sentinel sites
Tanzania
Mombasa CRH
N
0
55
110
220
330
440
Kilometers

Objectives

- To **update national** estimates of the burden of hospitalized and non-hospitalized influenza-associated SARI (2012 – 2014)

- To describe the incidence of influenza-associated SARI by narrow age categories (including individuals <6 months, <2 years & ≥ 65 years of age)

Definitions

Hospitalized SARI was defined as acute respiratory infection (onset within 14 days) with**:**

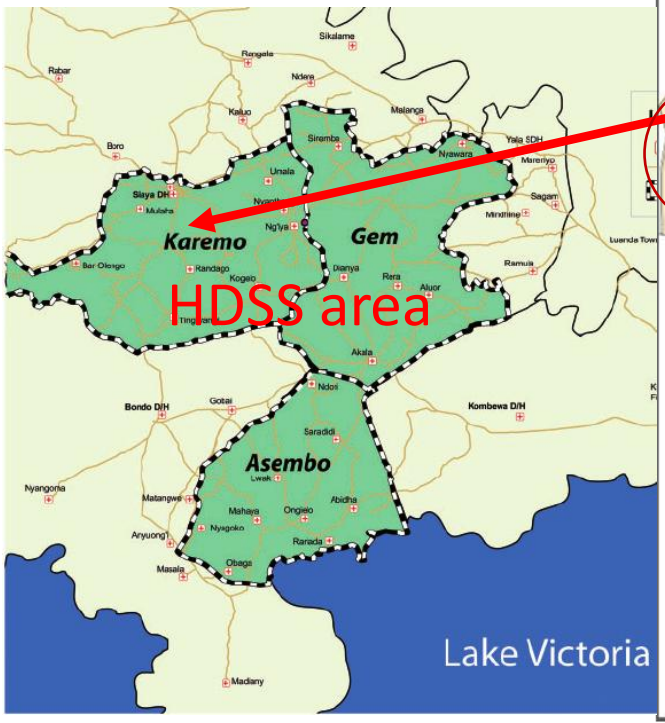
- History of fever or measured fever of ≥ 38 C°;
- Cough;
- And requiring hospitalization

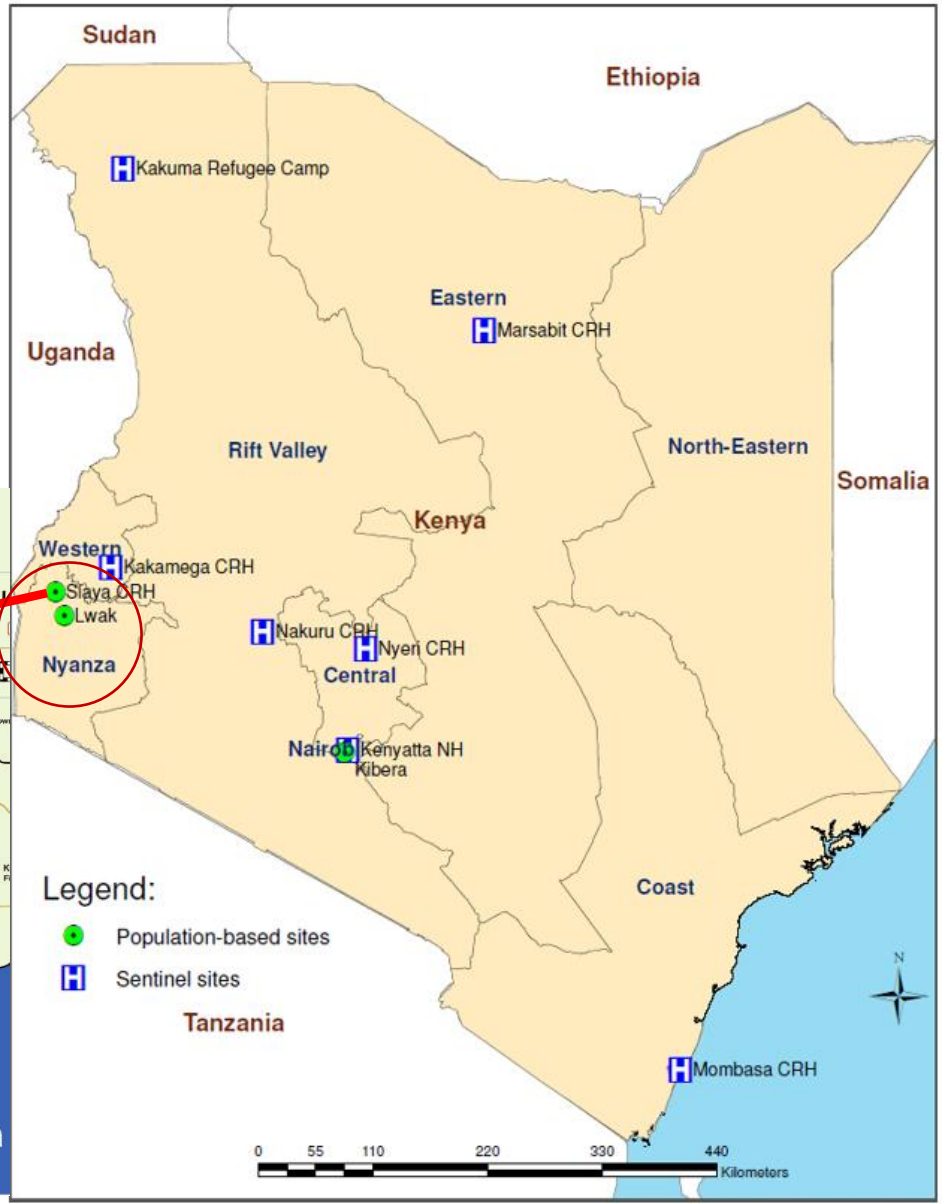
Non-hospitalized SARI considered as severe respiratory illness in the community for which healthcare was not sought

Burden estimation

Step 1: Calculate the base rate of SARI

- Hospitalized SARI data from Siaya County Referral Hospital (SCRH)





Burden estimation

Step 2: Extrapolate base-rate of SARI to other regions

- Based on adjustment for region-specific prevalence of risk factors for SARI

Children <5 years

- Malnutrition (weight for age Z-score ≤-2) – RR=1.8
- Low birth weight (<2500 g) – RR=1.4
- Non-exclusive breastfeeding (during the first 4 months of life) – RR=1.9

Persons ≥5 years

- Household pollution (as indicated by use of solid fuels for cooking) – RR=1.8
- Crowding (≥5 persons in a household) – RR=1.4
- HIV prevalence – RR=7.2 (<14 years), RR=5.6 (≥14years)

- And, the ratio of healthcare seeking for acute respiratory illness (ARI) in each of the regions to the base province

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Calculating adjustment factors

$$Adj_Y = \left(1 + \sum_i \left(P_{i,Y} - P_{i,B}\right) \times \left(RR_i - 1\right)\right) \times \frac{DHS_Y}{DHS_B}$$

Where:

- Adj_Y is the adjustment factor for region ***Y***
- $P_{i,Y}$ is the prevalence[1] of risk factor ***i*** in region ***Y***
- $P_{i,B}$ is the prevalence[1] of risk factor ***i*** in base region ***(Nyanza)***
- RR_i is the published relative risk[2] of SARI due to risk factor ***i***
- DHS_Y is the proportion[1] of ARI cases seeking care in region ***Y***
- DHS_B is the proportion[1] of ARI cases seeking care in the base region[4]

[1] Kenya National Bureau of Statistics. Kenya Demographic and Health Survey. 2014

[2] Rudan *et al*. Epidemiology and etiology of childhood pneumonia. 2008

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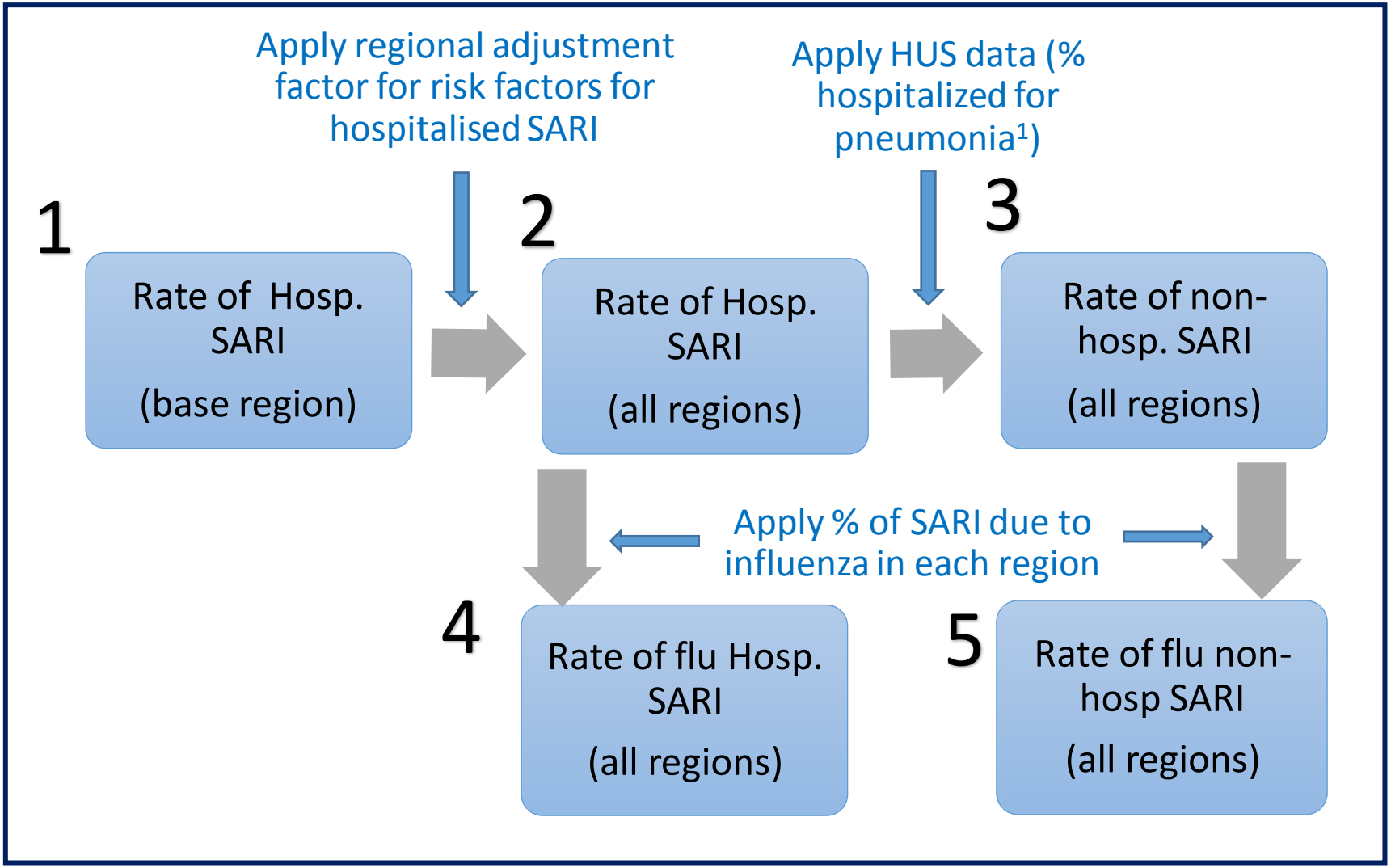
Steps followed to calculate rates



[1] Burton *et al*. Healthcare-seeking behaviour for common infectious disease-related illnesses in rural Kenya: a community-based house-to-house survey. 2011.

Confidence intervals (CIs)

- Confidence intervals on the rates were estimated by:
  - **Step 1:** running 1,000 iterations of each of the risk factors for hospitalized SARI (allowing reported prevalence to vary within its 95% CI) while keeping all the other risk factors constant
  - **Step 2:** obtaining the 95% CI as 2.5^{th} and 97.5^{th} percentile on the estimates generated from all the iterations

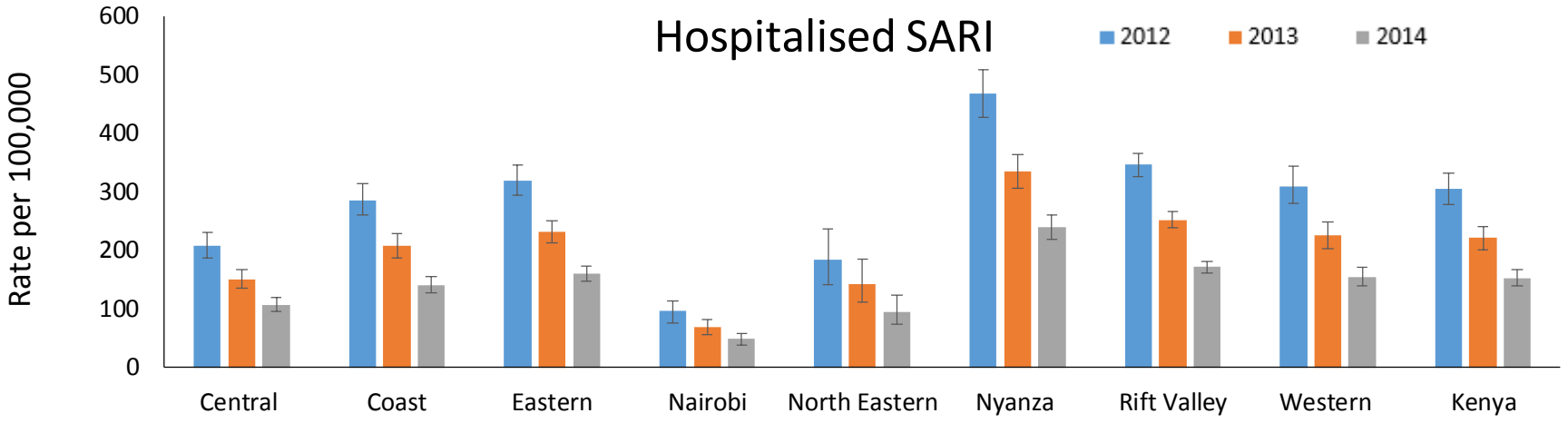
Key assumptions

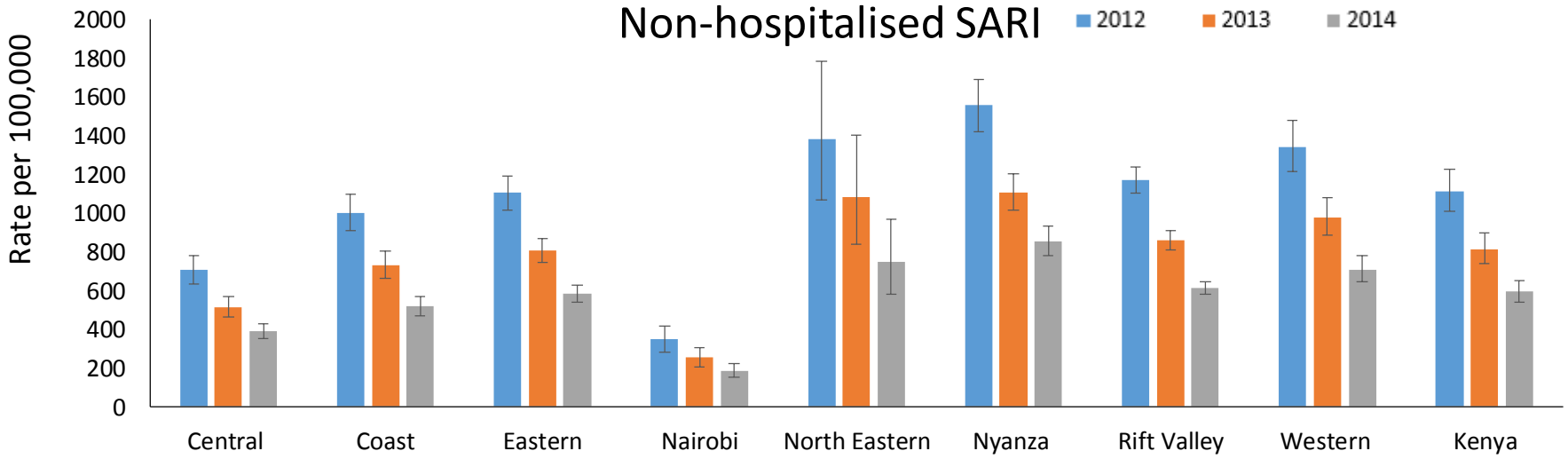
- Rates of SARI in Nyanza region were the same as those in Karemo, Siaya

- Proportion of non-hospitalized SARI in the community was assumed to be the same as the proportion of non-hospitalized pneumonia
  - using data from HUS conducted in 2000 in Siaya (Nyanza region)

- Influenza positivity among non-hospitalized severe respiratory cases was the same in the hospitalized SARI cases

SARI Rates by region





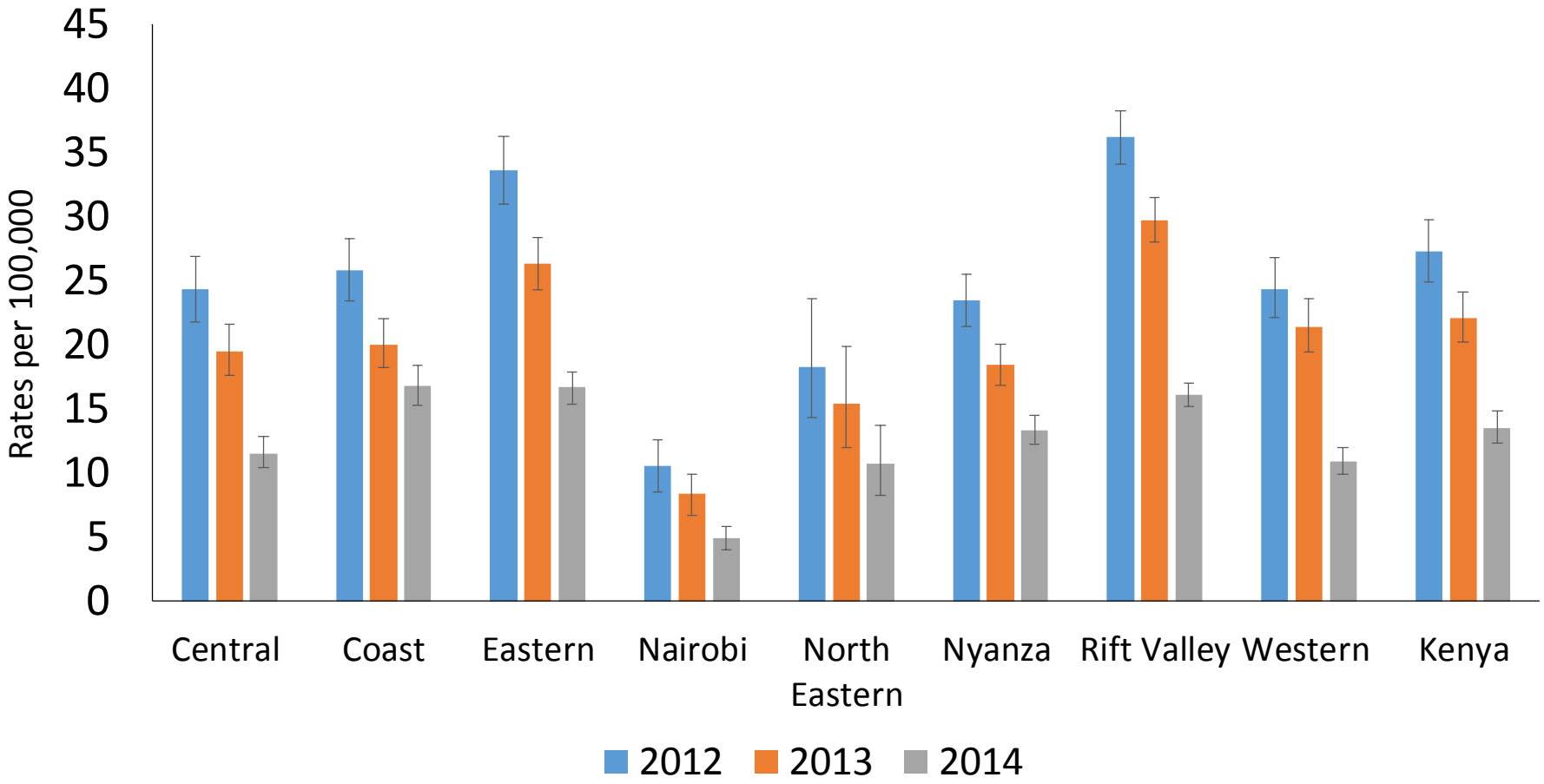
Influenza activity

- Average influenza positivity ranged between 8-13% among SARI cases tested over the period 2012-2014
  - 8-9% among children <5 years
  - 10-13% among persons ≥5 years

Table 1: Circulating influenza sub-types by year, 2012-2014

Year	2012		2013		2014	
Influenza subtype	Number	Percent	Number	Percent	Number	Percent
Influenza B	59	29.4	77	35.0	21	7.8
Pandemic influenza A(H1N1)	7	3.5	32	14.6	129	48.1
Seasonal influenza A(H3N2)	97	48.3	70	31.8	80	29.9
Not subtyped	38	18.9	41	18.6	38	14.2
Total	201	100.0	220	100.0	268	100.00

Hospitalized influenza-associated SARI



Non-hospitalized influenza-associated SARI

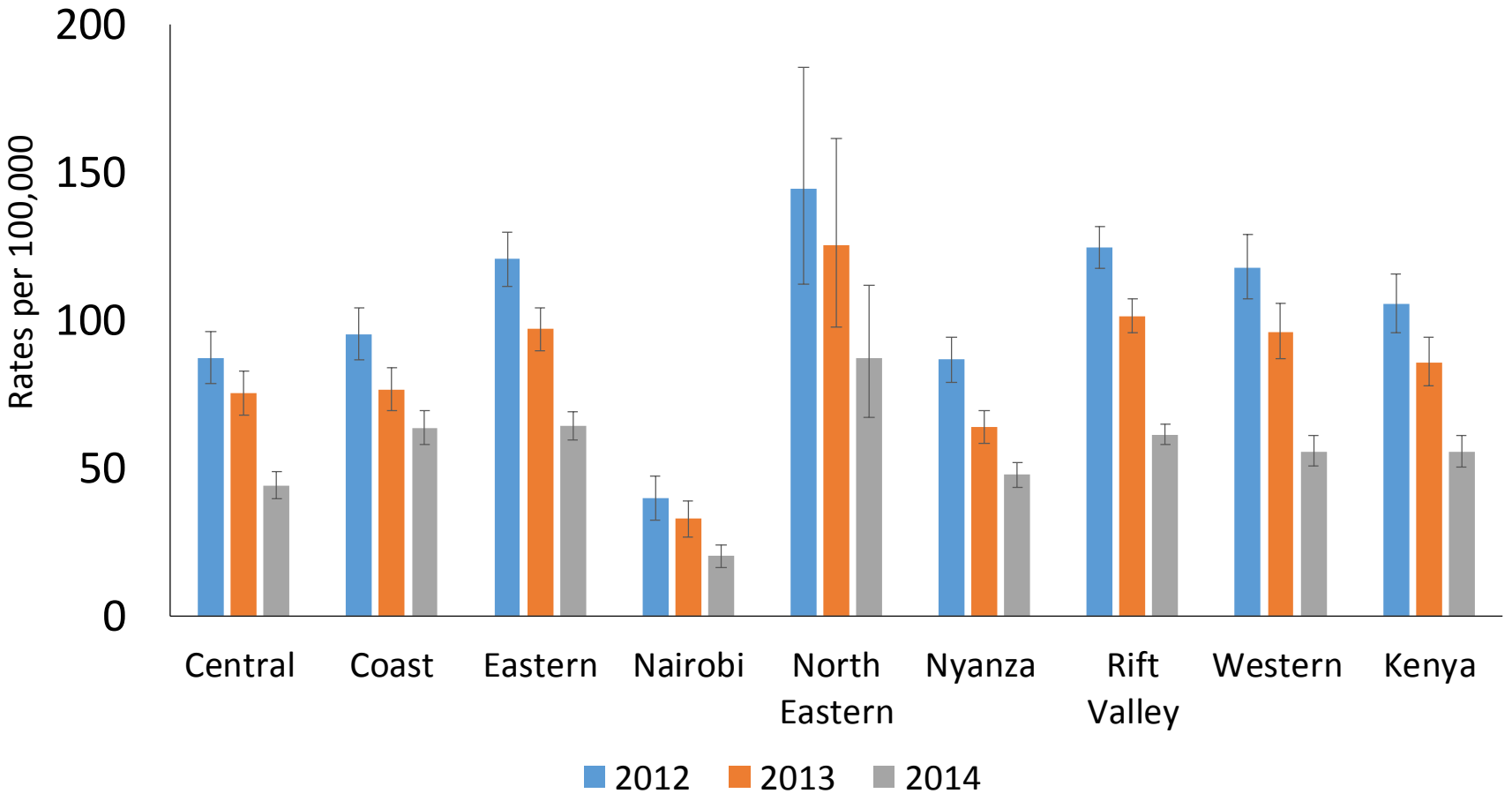


Table 2: National rate of hospitalized and non-hospitalized influenza-associated SARI among children <5 years in Kenya, 2012 to 2014

Age group	Hospitalized Rate per 100,000	Non-hospitalized Rate per 100,000
<5 years	**100.6 (91.7-110.3)**	**325.7 (294.7-360.3)**
0-5 months	112.2 (102.5-122.6)	358.7 (326.0-394.7)
6-11 months	169.7 (155.1-185.8)	542.6 (493.0-598.1)
12-23 months	152.7 (139.3-167.1)	489.2 (443.4-538.8)
2-4 years	72.0 (65.5-79.1)	236.5 (213.0-262.9)

Table 3: National rate of hospitalized and non-hospitalized influenza-associated SARI among persons aged ≥5 years in Kenya, 2012 to 2014

Age group	Hospitalized Rate per 100,000	Non-hospitalized Rate per 100,000
≥5 years	**6.3 (5.8-6.8)**	**37.3 (34.0-40.7)**
5-14 years	9.4 (8.7-10.1)	56.7 (51.6-61.8)
15-49 years	4.1 (3.8-4.5)	24.1 (21.9-26.3)
50-64 years	7.3 (6.7-8.0)	42.4 (39.1-46.7)
≥65 years	9.8 (8.9-10.5)	56.7 (51.6-61.0)

Table 4: National rates of hospitalized influenza-associated SARI in Kenya, 2009-2011 and 2012-2014

Age group	2009-2011[1]		2012-2014	
	Rate*	Cases	Rate*	Cases
<5 years	290-470	17,129-27,659	92-110	6,055-7,280
≥5 years	21-24	6,882-7,836	6-7	2,098-2,471
All ages	61-90	24,011-35,495	19-23	8,153-9,751

*Rate per 100,000 person

[1] Fuller *et al*. Estimation of the national disease burden of influenza-associated severe acute respiratory illness in Kenya and Guatemala: a novel methodology. 2013

Study limitations

- No current data on health care utilization at Siaya County Referral Hospital
  - Calculation of non-hospitalized SARI rates based on health care utilization survey conducted 10 years ago

- Estimates of non-hospitalized influenza-associated SARI may have included less severe cases

Discussion

- Rates of influenza-associated hospitalizations were higher during the influenza A(H1N1)pdm09 pandemic period

- Data show substantial disease burden among children aged <5 years
  - Burden particularly high among children aged <2 years
  - Rates similar to those reported in South Africa by Murray *et al*, 2015 (58-276 per 100,000 persons)

Discussion

- Rates in elderly (≥65 years) were much lower than rates reported in studies in the USA
  - Potentially underestimated because of low healthcare seeking behaviors in Kenya

Conclusion

- Influenza is associated with substantial disease burden, especially among children <2 years of age & in particular those 6-23 months of age, who should be prioritized for influenza prevention strategies

Acknowledgments

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Thank You