Influenza disease burden in the Greater-Accra region of Ghana, 2013-2017

Michael Ntiri, Jazmin Duque, Meredith McMorrow, Talla Nzussouo, Elijah Paa Edu-Quansah,

Kwadwo Koram, William Ampofo

US Centers for Disease Control and Prevention (CDC), Co-Ag. No: U011P000607-05

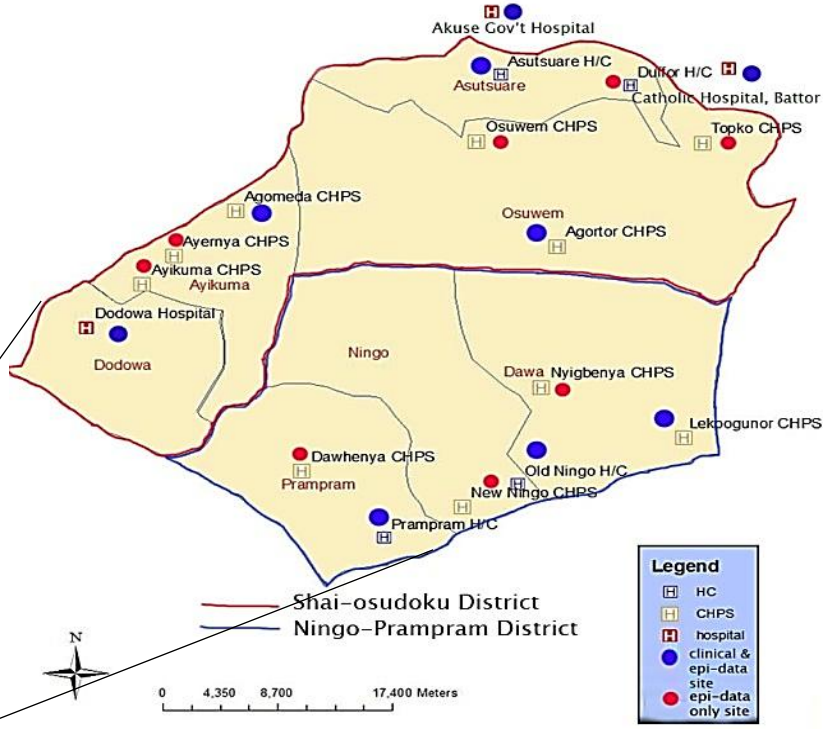
ANISE 2018, Antananarivo, Madagascar

Background

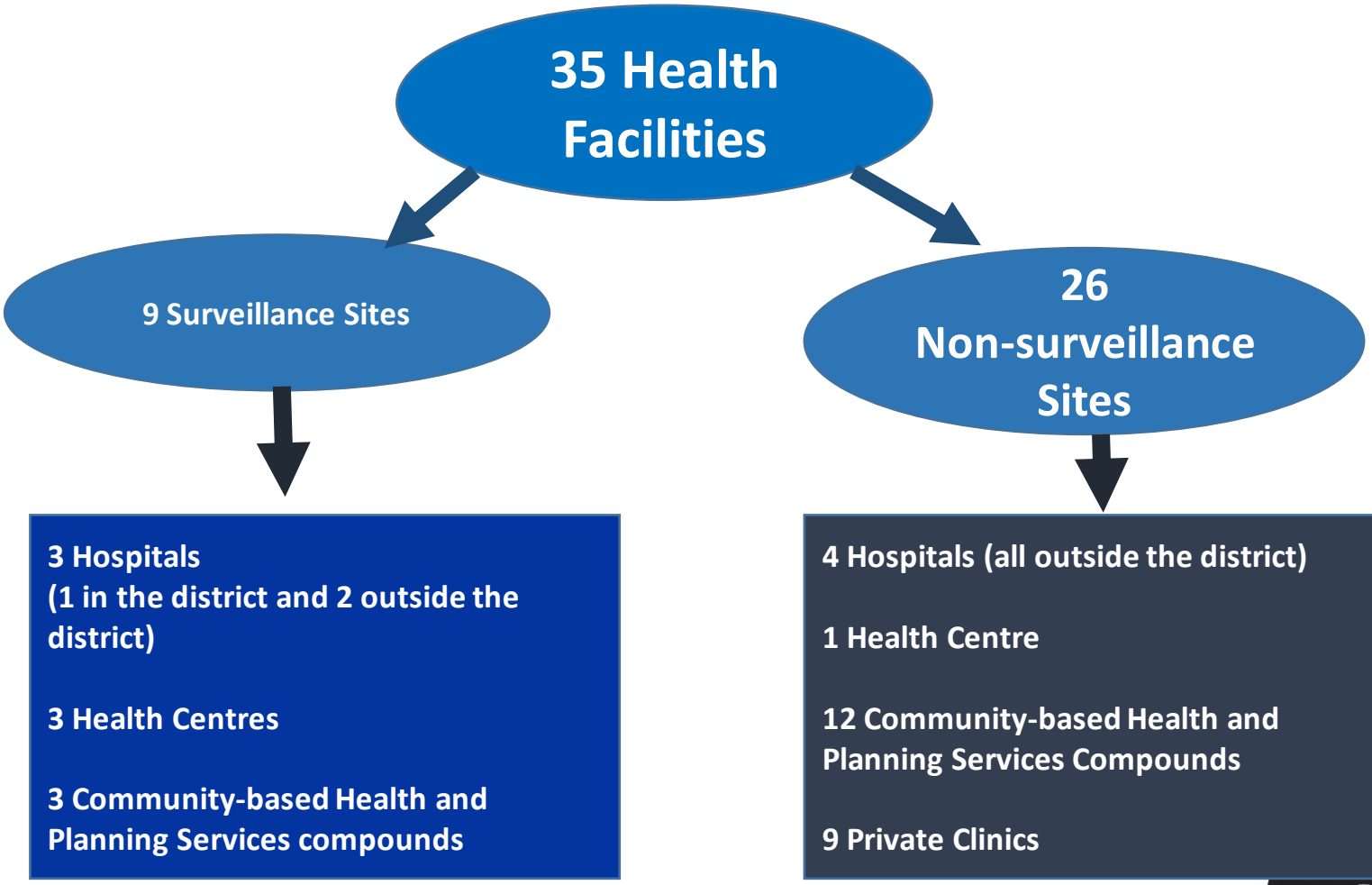
- Influenza virus infections contribute substantially to morbidity and mortality with a significant burden among children < 5 years and the elderly
- Influenza disease burden estimates inform decision making, resource allocation and appropriate immunization policies for high risk groups
- About a decade ago, the burden and economic impact of influenza was not well understood in Africa
- Recently influenza surveillance in Africa has increased substantially- South Africa, Kenya, Rwanda and Zambia have already provided burden estimates
- Ghana has no policy for influenza vaccination and the use of antivirals for case management hence burden estimates are needed for decision making
- A population based surveillance of influenza and other respiratory viruses among residents of Shai-Osudoku and Ningo-Prampram was established by the Ghana Health Service, Noguchi Memorial Institute for Medical Research (NMIMR) and the US Centres for Disease Control and Prevention (CDC)

Study Area

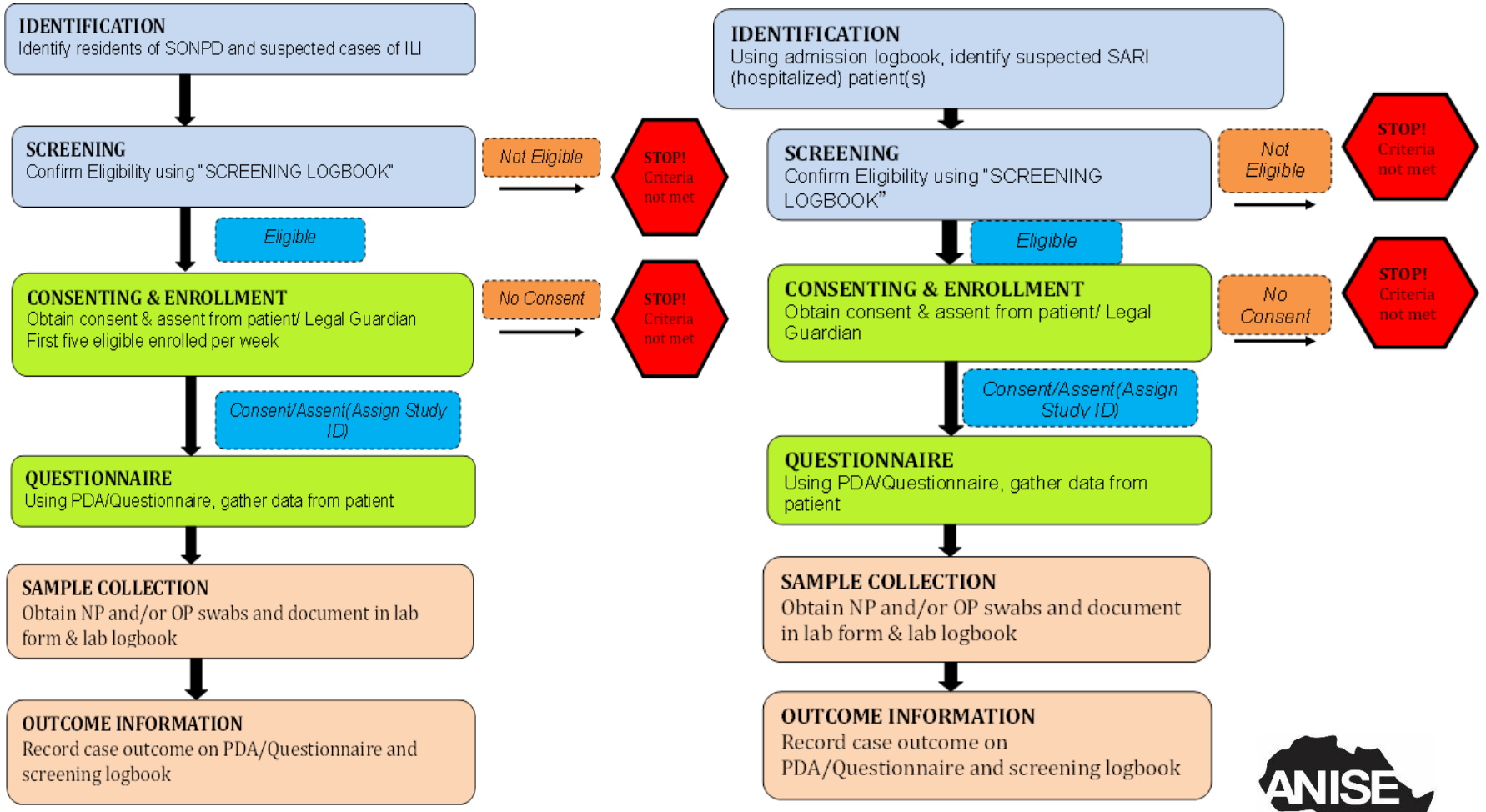

BURKINA FASO
Bolgatanga
BENIN
White Volta
Tamale
Black Volta
TOGO
CÔTE D'IVOIRE
Sunyani
Lake Volta
Mount Afadjato
Kumasi
Ho
Tano
Obuasi
Volta
Koforidua
ACCRA
Ankobra
Tema
Cape Coast
Takoradi
Gulf of Guinea
0 50 100 km
0 50 100 mi


Akuse Gov't Hospital
Asutsuare H/C
Asutsuare
Duffor H/C
Catholic Hospital, Battor
Osuwem CHPS
Topko CHPS
Agomeda CHPS
Osuwem
Agortor CHPS
Ayernya CHPS
Ayikuma CHPS
Ayikuma
Dodowa Hospital
Dodowa
Ningo
Dawa Nyigbenya CHPS
Lekpogunor CHPS
Dawhenya CHPS
Prampram
Old Ningo H/C
New Ningo CHPS
Prampram H/C
Shai-osudoku District
Ningo-Prampram District
N
0 4,350 8,700 17,400 Meters
Legend
HC
CHPS
hospital
clinical & epi-data site
epi-data only site

Study Design



Prospective ILI/SARI surveillance



Case definitions

Influenza-like Illness (ILI)

- An acute respiratory infection with:
  - history of fever or measured fever of ≥ 37.5°C (axillary)
  - and cough
  - with onset within the last 10 days

Severe Acute Respiratory Infection (SARI)

- An acute respiratory infection with:
  - history of fever or measured fever of ≥ 37.5°C (axillary)
  - and cough
  - with onset within the last 10
  - and **requires hospitalization**

Laboratory testing

Viral ribonucleic acid (RNA) was extracted using the QIAamp® Viral RNA Mini Kit (Qiagen, Hilden, Germany) according to manufacturer's recommendations

Influenza detection using standardized real-time reverse-transcription polymerase chain reaction (rRT-PCR) protocols from the CDC in Atlanta, Georgia, USA

rRT-PCR assays performed with AgPath One-Step rRT-PCR kit on Applied Bios systems 7500 fast rRT-PCR instrument

Additional data sources

- HUS from 2012 showed that SONPD residents frequented 26 other health facilities in addition to the 9 surveillance sites
- Epidemiological data **only** collection

  -prospective surveillance of medically attended ILI from 8 health facilities

  -May 2013 to April 2017
- Retrospective record review and statistical extrapolation

  -retrospective data review in 18 health facilities covering April 2013 to May 2015

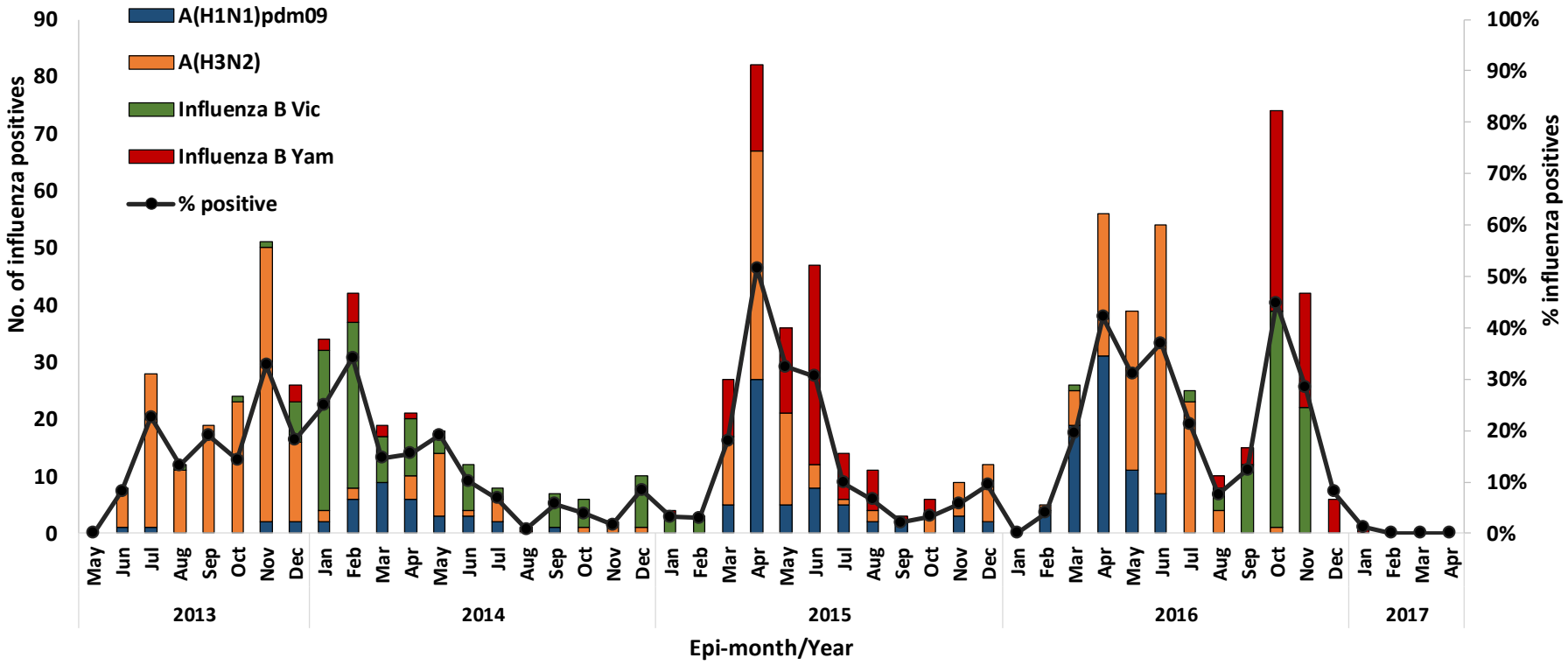
  -records of medically attended ILI/SARI

  -statistical extrapolation of 2-year data to cover 4 years

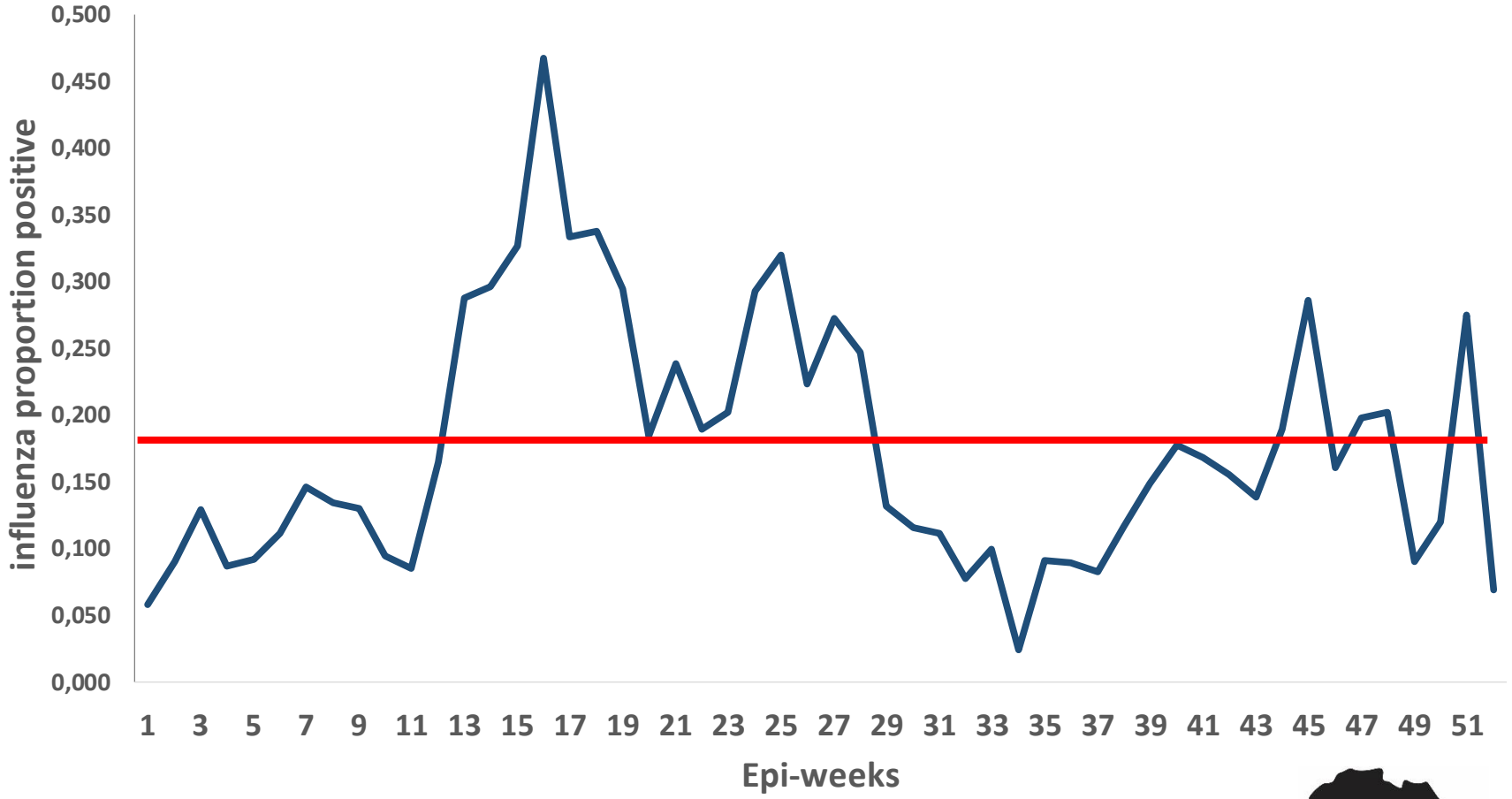
ILI and SARI cases in SONPD by age groups, May 2013 – April 2017

	ILI			SARI		
All age groups-years	**Tested (N= 4836)**	**Not Tested (N=20088)**	**Influenza Positive**	**Tested (N= 1197)**	**Not Tested (N=661)**	**Influenza Positive**
0 to 4	2655 (55)	10113 (50)	383 (14)	679 (57)	130 (20)	53 (8)
5 to 14	826 (17)	3865 (19)	216 (26)	207 (17)	54 (8)	23 (11)
15 to 24	359 (7)	1491 (7)	81 (23)	62 (5)	45 (7)	10 (16)
25 to 44	537 (11)	2276 (11)	95 (18)	120 (10)	91 (14)	7 (6)
45 to 64	307 (6)	1351 (7)	51 (17)	81 (7)	113 (17)	10 (12)
≥ 65	152 (3)	992 (5)	17 (11)	48 (4)	228 (34)	9 (19)
Influenza Positivity (n,%)	843 (17)			112 (9)		
Year						
May 2013 - April 2014	1185 (25)		255 (22)	293 (24)		29 (10)
May 2014 - April 2015	1162 (24)		149 (13)	337 (28)		31 (9)
May 2015 - April 2016	1371 (28)		205 (15)	321 (27)		20 (6)
May 2016 - April 2017	1118 (23)		234 (21)	246 (21)		32 (13)

Distribution of influenza virus types and subtypes among ILI and SARI patients, May 2013 – April 2017



Influenza seasonality



ANISE

Influenza burden estimation

- Annual incidence rates were calculated using the methods described in WHO's manual for estimating disease burden associated with seasonal influenza

- Using population denominators obtained from the HDSS , we determined rates of influenza-associated ILI and SARI by applying the proportion positive among those tested to those who were not tested, adjusting by month and age-group

Incidence of influenza-associated ILI and SARI at 95% confidence interval

Characteristics	Number of influenza virus cases per 100,000 persons		
	ILI	SARI	Population denominator
Overall (Age)	3136 (3029 - 3248)	125 (105 - 149)	138,527
Age groups			
0 to 4 years	9881 (9688 - 10078)	339 (305 - 377)	18641
5 - 14 years	3163 (3055 - 3275)	75 (60 - 94)	38781
15 - 24 years	1308 (1239 - 1381)	54 (41 - 71)	31903
25 - 44 years	2137 (2049 - 2230)	53 (40 - 69)	23282
45 - 64 years	1775 (1694 - 1859)	154 (132 - 181)	15518
≥ 65 years	1230 (1163 - 1301)	497 (456 - 543)	10402
Year of study			
May 2013 - April 2014	1080 (707 - 1367)	28 (10 - 87)	
May 2014 - April 2015	608 (296 - 831)	32 (16 – 81)	
May 2015 - April 2016	765 (461 - 994)	21 (8 - 66)	
May 2016 - April 2017	975 (768 - 1205)	39 (19 - 84)	
Districts			
Ningo-Prampram	2424 (2329 – 2522)		
Shai-Osudoku	4088 (3965 – 4216)		

Discussion

- The incidence of influenza-associated hospitalizations and outpatient visits was highest among children aged 0 to 4 years in the Greater-Accra region from May 2013 to April 2017
- Consistent with recent influenza burden publications from Kenya, Rwanda and Zambia
- During the study period, the dominant circulating flu subtype in the region was influenza A(H3N2)
- GISRS also reported influenza A(H3N2) as the predominant subtype circulating in West Africa based upon data received from Ghana and other West African countries over the same period
- Influenza circulated year-round in the region during the study period though 2 distinct epidemic periods can be seen

Conclusion

- Significant burden of influenza-associated respiratory disease in children <5 years of age in the Greater-Accra region
- Persons >65 years showed significant medically attended SARI
- We may have underestimated the true incidence of influenza-associated illness in these districts due to non-medically attended ILI or SARI
- This study fills some of the data gaps related to respiratory diseases in Ghana and West Africa needed for public health policies and action to lessen the impact of influenza on populations
- More data needed to adjust influenza disease burden estimates by healthcare seeking behaviour and in relation to specific high-risk groups, including pregnant women and HIV-infected individuals

Publication

Ntiri et al. BMC Infectious Diseases (2016) 16:257
DOI 10.1186/s12879-016-2078-x

BMC Infectious Diseases

RESEARCH ARTICLE Open Access

Incidence of medically attended influenza among residents of Shai-Osudoku and Ningo-Prampram Districts, Ghana, May 2013 – April 2015

Michael Preko Ntiri[1†], Jazmin Duque[2,3*†], Meredith L. McMorrow[3,4], Joseph Asamoah Frimpong[1], Prince Parbie[1], Edem Badji[1], Ndahwouh Talla Nzussouo[3,5], Eve-Marie Benson[1], Michael Adjabeng[6], Erica Dueger[3], Marc-Alain Widdowson[3], Fatimah S. Dawood[3,4], Kwadwo Koram[1] and William Ampofo[1]

Abstract

Background: Influenza vaccination is recommended by the World Health Organization for high risk groups, yet few data exist on influenza disease burden in West Africa.

Methods: We estimated medically attended influenza-associated illness rates among residents of Shai-Osudoku and Ningo Pram-Pram Districts (SONPD), Ghana. From May 2013 to April 2015, we conducted prospective surveillance for severe acute respiratory illness (SARI) and influenza-like illness (ILI) in 17 health facilities. In 2015, we conducted a retrospective assessment at an additional 18 health facilities to capture all SONPD SARI and ILI patients during the study period. We applied positivity rates to those not tested to estimate total influenza cases.

Results: Of 612 SARI patients tested, 58 (9%) were positive for influenza. The estimated incidence of influenza-associated SARI was 30 per 100,000 persons (95% CI: 13–84). Children aged 0 to 4 years had the highest influenza-associated SARI incidence (135 per 100,000 persons, 95% CI: 120–152) and adults aged 25 to 44 years had the lowest (3 per 100,000 persons, 95% CI: 1–7) ($p < 0.01$). Of 2,322 ILI patients tested, 407 (18%) were positive for influenza. The estimated incidence of influenza-associated ILI was 844 per 100,000 persons (95% CI: 501–1,099). The highest incidence of influenza-associated ILI was also among children aged 0 to 4 years (3,448 per 100,000 persons, 95% CI: 3,727 – 3,898). The predominant circulating subtype during May to December 2013 and January to April 2015 was influenza A(H3N2) virus, and during 2014 influenza B virus was the predominant circulating type.

Conclusions: Influenza accounted for 9% and 18% of medically attended SARI and ILI, respectively. Rates were substantive among young children and suggest the potential value of exploring the benefits of influenza vaccination in Ghana, particularly in this age group.

Keywords: Influenza, Respiratory, Burden, Rate, Children, Ghana, West Africa, Africa

* Correspondence: JDuque@cdc.gov
†Equal contributors
²Battelle Atlanta, Atlanta, Georgia, USA
³Influenza Division, National Center for Immunization and Respiratory Diseases, U.S. Centers for Disease Control and Prevention, 1600 Clifton Rd NE, MS-A32, Atlanta, GA 30329, USA
Full list of author information is available at the end of the article

ANISE

Acknowledgement

Jazmin Duque, Talla Nzussouo, Meredith McMorrow

Michael Ntiri, Elijah Paa Edu-Quansah, Anthony Twumasi Boateng, Wilma Appiah, Gloria Odame-Asiedu, Edem Badji, Kwadwo Koram, William Ampofo

Micheal Adjabeng, Kennedy Brightson, Beryl Karikari, Ahmed Tijani Sulemana, Gifty Ofori-Ansah, Afua Asante, Badu Sarkodie