An Approach to Estimate the National Burden of RSV-Associated Respiratory Illness Hospitalization Using Sentinel Surveillance Data

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Background

1. **Obtaining the National Burden (rates and numbers) of RSV-associated severe illness is important for informed decisions on interventions.**

2. **A rapid assessment methodology of the national burden of influenza-associated severe respiratory illness using sentinel surveillance data has been developed.**
    - Fuller JA, et al. Estimation of the national burden of influenza-associated severe acute respiratory illness in Kenya and Guatemala: a novel methodology. PLoS One. 2013;8(2):e56882. doi: 10.1371/journal.pone.0056882.
    - Murray J, et al. Determining the provincial and national burden of influenza-associated severe acute respiratory illness in South Africa using a rapid assessment methodology. PLoS One. 2015;10(7):e0132078. doi: 10.1371/journal.pone.0132078.
    - Theo A, et al. The national burden of influenza-associated severe acute respiratory illness hospitalization in Zambia, 2011-2014. Influenza Other Respiratory Viruses. 2017;1-8; doi: 10.1111/irv.12492.

3. **Such methodology can be adapted to estimate the national burden of RSV-associated severe respiratory illness.**

Data Needs

- **RSV proportion positive:** from one or more sentinel hospitals where laboratory-confirmed RSV surveillance is conducted by pre-specified age groups.

- **Rates of SARI/LRTI:** from one or more sentinel hospitals or Province/administrative division within pre-specified age groups.

- **Mid-year population estimates:** from projection of census data by:
  - Pre-specified age groups.
  - Province/administrative division.
  - Year (for the study period – usually 3-5 years are included).

Data Needs

- **Demographic and Health Survey (DHS):** ideally conducted in years close to the study period.

- **Healthcare Utilization Survey (HUS):** conducted in the area were SARI/LRTI rates are estimated. This is needed only for the estimation of non-medically-attended illness.

Estimation Approach – Step 1

Estimate SARI/LRTI at sentinel hospital(s) or Province/administrative division (Base Province).
(see also WHO Manual on Estimation of Influenza Disease Burden)

If rates are obtained from a sentinel hospital use that rate as proxy for the Province/administrative division.

Output: SARI/LRTI hospitalization rates in the Base Province/Administrative Division

Estimation Approach – Step 2.1

Adjust SARI/LRTI rates from the base province/administrative division to those of other Provinces/administrative divisions based on differential prevalence of known risk factors for pneumonia from DHS (usually measured):

- Malnutrition (children only)
- Low birth weight (children only)
- Non-exclusive breastfeeding (children only)
- Indoor air pollution (children and adults)
- Crowding (children and adults)
- HIV infection (children and adults)

Estimation Approach – Step 2.2

Adjust SARI/LRTI rates from the base province/administrative division to those of other provinces/administrative division based on differential healthcare seeking behavior for Acute Respiratory Illness (ARI) from DHS (usually measured)

Output: SARI/LRTI hospitalization rates in the Other Province/Administrative Divisions

Estimation Approach – Step 3

Multiply Provincial/administrative division SARI/LRTI rates by the RSV proportion positive from laboratory confirmed RSV surveillance conducted at sentinel hospitals.

Output: RSV-associated SARI/LRTI hospitalization rates by Province/Administrative Division

Estimation Approach – Step 4

Multiply Provincial/administrative division RSV-associated SARI/LRTI rates by the provincial/administrative division mid-year population estimates.

Output: Number of RSV-associated SARI/LRTI hospitalizations by Province/Administrative Division

Estimation Approach

- **If HUS data on non-medically-attended illness for SARI/LRTI are available non-medically-attended RSV-associated severe respiratory illness can be obtained using the same approach (Steps 1 to 3).**

Influenza Example from Zambia

TABLE 1 Estimated mean annual numbers and rates of severe acute respiratory illness and influenza-associated severe acute respiratory illness hospitalizations, Zambia, 2011-2014

	SARI hospitalizations		Influenza-associated SARI hospitalizations	
Age-group (in years)	Number (95% CI)	Rate (95% CI)[a]	Number (95% CI)	Rate (95% CI)[a]
<1	57,449 (34,642-80,256)	11,548.3 (6,963.6-16,133)	2,494 (1,504-3,484)	484.4 (292.3-680.5)
1-4	37,775 (22,136-53,414)	1,898.4 (1,112.5-2,684.3)	2,175 (1,275-3,075)	109.3 (64.0-154.6)
5-24	6,525 (4,626-8,424)	95.2 (67.5-122.9)	406 (288-524)	5.9 (4.2-7.6)
25-44	9,708 (6,737-12,679)	297.8 (206.7-388.9)	610 (423-797)	18.7 (13-24.4)
45-64	4,211 (3,045-5,377)	385.8 (278.9-492.7)	283 (205-361)	25.9 (18.7-33.1)
≥65	3,000 (2,106-3,894)	794.3 (557.6-1,031.0)	214 (150-278)	56.5 (39.7-73.3)
<5	95,223 (67,037-123,409)	3,828.4 (2,695.2-4,961.6)	4,669 (3,287-6,051)	187.7 (132.1-243.3)
≥5	23,444 (16,083-30,805)	202.5 (138.9-266.1)	1,512 (1,037-1,987)	13.1 (9.0-17.2)
All	118,668 (82,948-154,386)	843.6 (589.7-1,097.5)	6,181 (4,321-8,041)	43.9 (30.7-57.1)
Province				
Central	10,148 (7,215-13,081)	727.8 (517.5-938.1)	529 (376-682)	38.1 (27.3-49.2)
Copperbelt	20,450 (13,988-26,912)	981.6 (671.4-1,291.8)	1,066 (729-1,403)	51.2 (35.0-67.4)
Eastern	15,328 (10,837-19,819)	902.2 (637.9-1,166.5)	800 (566-1,034)	47.1 (33.3-60.9)
Luapula	7,725 (5,098-10,352)	731.9 (483.1-980.7)	402 (265-539)	38.1 (25.1-51.1)
Lusaka	21,843 (15,421-28,265)	889.7 (628.1-1,151.3)	1,132 (799-1,465)	46.1 (32.5-59.7)
Muchinga	5,949 (4,123-7,775)	774 (536.4-1,011.6)	310 (215-405)	40.4 (28.0-52.8)
North Western	7,439 (5,334-9,544)	968.7 (694.6-1,242.8)	388 (278-498)	50.6 (36.3-64.9)
Northern	8,296 (5,674-10,918)	692.9 (473.9-911.9)	432 (295-569)	36.1 (24.7-47.5)
Southern	13,709 (9,624-17,794)	804.3 (564.6-1,044)	715 (502-928)	42.0 (29.5-54.5)
Western	7,781 (5,602-9,960)	826 (594.7-1,057.3)	407 (293-521)	43.2 (31.1-55.3)

SARI, severe acute respiratory illness; CI, confidence intervals.

[a]Rates expressed per 100,000 population.

Thank you!!!

(Questions?)