

Supplementary Online Content

Kytömaa S, Hegde S, Claggett B, et al. Association of influenza-like illness activity with hospitalizations for heart failure: the Atherosclerosis Risk in Communities Study. *JAMA Cardiol*. Published online March 27, 2019. doi:10.1001/jamacardio.2019.0549

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eMethods

This supplementary material has been provided by the authors to give readers additional information about their work.

eTable 1. Demographics of ARIC Surveillance Communities based on the 2010 U.S Census

	Forsyth Co, NC			Jackson, MS			Minneapolis, MN			Washington Co, MD		
Age Group	N	%Female	% White	N	%Female	% White	N	%Female	% White	N	%Female	% White
35-44	41,201	52	69.2	19,659	55	16.7	27,941	50	79.3	19,873	47	87.2
44-54	48,076	53	72.5	22,405	54	19.8	34,697	51	86.6	22,388	48	90.6
55-64	40,286	54	75.4	17,774	55	27.6	27,468	52	91.4	17,504	50	94.8
65-74	23,800	55	79.1	9,230	58	34.1	14,706	55	94.0	10,802	53	96.8
75-84	15,143	61	83.8	5,480	63	47.1	10,038	59	96.7	70,11	58	98.2
85+	5,878	68	85.3	2,408	71	52.6	4,759	67	98.1	30,61	69	98.8
Total	174,384	54	74.7	76,956	56	25.5	119,609	53	88.2	80,639	51	92.5

eTable 2. Stations measuring monthly average temperatures

Region	Station Name	Elevation
Washington County, MD	Hagerstown Washington Co Regional Airport	214.9 m
Forsyth Co, NC	King Station	268.2 m
Minneapolis, MN	Minneapolis St. Paul International Airport	265.8 m
Jackson, MS	Jackson International Airport	100.6 m

eTable 3. Median weighted monthly number of heart failure hospitalization by region and demographic strata						
Demographic Strata			Forsyth Co, NC	Jackson, MS	Minneapolis, MN	Washington Co, MD
Age	Gender	Race	Median event count (max, min)	Median event count (max, min)	Median event count (max, min)	Median event count (max, min)
55-74	Female	Black	15 (3-45)	15 (0-45)	0 (0-11)	0 (0-6)
		White	13 (0-26)	2 (0-10)	5 (0-27)	6 (0-24)
	Male	Black	16 (6-39)	16 (6-35)	0 (0-15)	0 (0-12)
		White	15 (0-35)	4 (0-10)	11(0-23)	9 (0-25)
75-84	Female	Black	5 (0-21)	7 (0-31)	0 (0-8)	0 (0-5)
		White	10 (0-27)	3 (0-11)	11 (0-27)	6 (0-15)
	Male	Black	4 (0-11)	4 (0-11)	0 (0-8)	0 (0-5)
		White	15 (0-30)	4 (0-10)	8 (0-30)	6 (0-18)
85+	Female	Black	5 (0-13)	6 (0-31)	0 (0-8)	0 (0-5)
		White	12 (0-34)	3 (0-19)	15 (0-38)	9 (0-25)
	Male	Black	2 (0-6)	3 (0-12)	0 (0-0)	0 (0-5)
		White	9 (0-27)	2 (0-8)	8 (0-38)	5 (0-16)

eTable 4. Median weighted monthly number of myocardial infarction hospitalization by region and demographic strata

Demographic Strata			Forsyth Co, NC	Jackson, MS	Minneapolis, MN	Washington Co, MD
Age	Gender	Race	Median event count (max, min)	Median event count (max, min)	Median event count (max, min)	Median event count (max, min)
55-74	Female	Black	13 (0-31)	15 (4-35)	4 (0, 25)	0 (0,8)
		White	27 (0-83)	3 (0-14)	17 (0,31)	12 (3, 26)
	Male	Black	20 (8-60)	19 (0-35)	4 (0,28)	0 (0,9)
		White	31 (9-77)	6 (0-19)	28 (8,67)	22 (7, 52)
75-85	Female	Black	3 (0-11)	3 (0-12)	0 (0-15)	0 (0-13)
		White	12 (0-33)	2 (0-12)	9 (0-31)	16 (0-42)
	Male	Black	2 (0-11)	2 (0-19)	0 (0-2)	0 (0-2)
		White	6 (0-38)	3 (0-9)	9 (0-33)	11 (0-26)

eTable 5: Association between monthly influenza activity and hospitalizations for heart failure per 5% increase in influenza activity by age, region, ejection fraction and history of heart failure hospitalizations			
	Subgroup	IRR	P-value for Interaction
Age Category	55-74	1.15 (1.00-1.33)	0.09
	75-85	1.36 (1.13-1.65)	
	85+	1.12 (0.88-1.41)	
Region	Maryland	1.00 (0.70-1.41)	0.41
	Minnesota	1.38 (0.83-2.00)	
	Mississippi	1.22 (1.06-1.40)	
	North Carolina	1.20 (0.96-1.48)	
Ejection Fraction (LVEF)*	Preserved (LVEF \geq 50)	1.31 (1.09-1.59)	0.51
	Reduced (LVEF <50)	1.24 (1.05-1.47)	
History of Heart Failure	First Heart Failure Hospitalization	1.05 (0.88-1.26)	0.13
	Recurrent Heart Failure Hospitalization	1.21 (1.05-1.39)	

* Ejection fraction was not reported for over 26% of adjudicated heart failure hospitalizations.

eMethods

Outcome: The outcome of interest was definite or probable hospitalizations, aggregated by month/age/sex/race/site from Oct 2010 to Sep 2014. Specifically, the age categories used were 55-74, 75-84, and 85+ years of age for HF events and 35-74 and 75-85 for MI events, based on age at the time of hospitalization. Because of small numbers, blacks in Minneapolis and Washington County and persons reported to be neither black nor white were excluded from these analyses.

Exposure: The primary exposure was influenza-like illness (ILI) activity, as measured by % of visits in community for influenza-like illness. ILI activity was defined at the month/site level, and assumed constant across age/sex/race within month/site

Additional Covariates: Additional covariates included in our model were prior month's event count, age category, sex, race, region, and season. Prior month's event counts were defined at the age/sex/race/site level. Influenza seasons were defined twelve-month periods from October, when influenza activity often begins to increase, to the following September.

Regression Analysis:

We used a Poisson model with the weighted total population at risk as an offset variable, defined as the total population within the specific demographic groups divided by sampling weight. Specifically, the population totals were defined at year/site/age/sex/race level and assumed constant across months within a given calendar year. The sampling weights were inverse probability weights, defined for individual events previously. Within each month/age/sex/race/age/site unit, there were either 0, 1, or 2+ sampling weights associated with them. We defined unit-specific sampling weight as follows.

- i. If exactly 1 sampling weight present: we used that weight
- ii. If 2+ sampling weights present:
 1. Multiplied each sampling weight by the associated event count to produce 2+ "weighted counts" within the unit
 2. summed the "weighted counts" within the unit
 3. summed the unweighted event counts within the unit
 4. defined unit-specific sampling weight =
$$\frac{\text{sum of unweighted event counts}}{\text{sum of weighted events counts}}$$
- iii. If 0 sampling weights present: we averaged the sampling weights from the month immediately before and/or after the month in question to interpolate the presumed sampling weight.