Supplemental Online Content

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

eAppendix 1. Sampling Strategy, 2017-2018 and 2018-2019 Seasons

Due to the high volume of influenza-associated hospitalizations among older-aged adults, some FluSurv-NET sites during the 2017–2018 and 2018–2019 seasons used a random stratified sampling scheme to abstract clinical data by age strata. Briefly, a random number was assigned to each case following FluSurv-NET database entry. At sites using random sampling, complete clinical data was abstracted for all patients who died within 30 days of hospitalization. Among patients who survived, stratification by age group was performed to select a representative sample among older-aged adults. During the 2017–2018 season, six sites abstracted 50% of cases among patients aged 50–64 years, and 25% among patients aged ≥65 years. One site during the 2017–2018 season and all seven sites that used random sampling during the 2018–2019 season abstracted clinical data for 50% of cases among patients aged ≥65 years. Complete clinical data was abstracted for patients in all other age groups.

eAppendix 2. Primary Outcomes Model Selection

A minimum sufficient set of primary outcome model covariates were derived based on a multi-step process:

1. A literature review was performed of factors associated with social vulnerability and influenza outcomes.
2. Tests were performed (chi-squared for categorical variables, t-tests for continuous variables) for evidence of crude association ($p<0.05$) between each covariate, outcome, and exposure.
3. An assessment for multilinearity of covariates was then performed to identify highly correlated covariates, with additional investigation of any variables with a tolerance level <0.1, variance inflation factor >10, and condition number >15.[1] For any variables identified as collinear, a priori selection was used to decide which variable to include in the model.
4. To eliminate variables from the model that represent statistical noise, forward model selection using Akaike Information Criterion (AIC) values was performed.[2]

Final primary models for ICU admission and IMV/ECMO were adjusted for age group (18–49, 50–64, and ≥65 years), number of categories of medical conditions (0, 1, 2, 3, ≥4 of the following categories: asthma, chronic lung disease, chronic metabolic disease, blood disorders/hemoglobinopathy, cardiovascular disease, neuromuscular disorders, neurologic disorders, history of Guillain-Barré Syndrome, immunocompromising conditions, renal disease, and liver disease), influenza season, female sex, and category of race and ethnicity. Models for death were adjusted for age group, number of categories of medical conditions, type of residence (e.g., private home, group quarters, assisted living), influenza season, female sex, and category of race and ethnicity.

Notably, the inclusion of categories of race and ethnicity as model covariates reflect social constructs that are informed by structural discrimination, and not driven by biological or cultural differences.[3,4] Area-level social vulnerability based on minority status (i.e., all persons except Non-Hispanic White populations) as well as factors associated with structural racism and discrimination (socioeconomic status, housing, education) were also examined in the primary outcome models.[5]

1. *Ender P. Applied Categorical & Nonnormal Data Analysis: Collinearity Issues. [accessed 2023 July 27]; Available from: http://www.philender.com/courses/categorical/notes2/collin.html*
2. *Schonlau M. Model Selection with AIC. 2021 Canadian Stata Conference; 2021; Virtual: StataCorp LLC; 2021.*
3. *Smedley A, Smedley BD. Race as biology is fiction, racism as a social problem is real: Anthropological and historical perspectives on the social construction of race. Am Psychol 2005; 60: 16-26.*
4. *Bailey ZD, Krieger N, Agénor M, Graves J, Linos N, Bassett MT. Structural racism and health inequities in the USA: evidence and interventions. Lancet 2017; 389: 1453-63.*
5. *Adkins-Jackson PB, Chantarat T, Bailey ZD, Ponce NA. Measuring Structural Racism: A Guide for Epidemiologists and Other Health Researchers. Am J Epidemiol 2022; 191: 539-47.*

eTable 1. FluSurv-NET Counties, 2014-2015 to 2018-2019 Influenza Seasons

Site	Number of participating counties[a,b]	% state population represented
Total	80	--
California[a]	3	9%
Colorado	5	49%
Connecticut	2	29%
Georgia[a]	8	39%
Maryland	6	46%
Michigan	5	13%
Minnesota[a]	7	55%
New Mexico[a]	7	61%
New York	15	11%
Albany[a]	*8*	
Rochester	*7*	
Ohio[a]	10	18%
Oregon[a]	3	44%
Tennessee	8	26%
Utah	1	36%

[a] For the 2017–2018 season, sites from California, Georgia, New Mexico, Ohio, Oregon, and Albany, New York used a 50% random sample strategy to abstract clinical data from medical records for cases among patients aged 50–64 years and 25% for cases among patients aged ≥65 years. Minnesota conducted random sampling for 50% of cases among patients aged ≥65 years. For the 2018–2019 season, these sites used a 50% random sample strategy to abstract clinical data from medical records for cases among patients aged ≥65 years.
[b] All contributing counties remained the same throughout the five influenza seasons, except for the addition of one Michigan county starting in the 2017–2018 season.

eTable 2. Missingness Among Key Analytic Variables

Variable	Use	No. (col %) missing N=57,964	Notes
Hospital admission date	Secondary outcomes	0 (0%)	All FluSurv-NET patients were required to have a date of hospital admission
Transferred from another hospital	Descriptive results	1 (0%)	Recoded as unknown
State	Descriptive results	0 (0%)	
County	Descriptive results	0 (0%)	
Age	Descriptive results, primary and secondary outcomes	0 (0%)	As age ≥18 years was an eligibility criterion, included patients were required to have a documented age.
Sex	Descriptive results, primary outcomes	0 (0%)	
Race	Descriptive results, primary outcomes	1 (0%)	Recoded not specified
Ethnicity	Descriptive results, primary outcomes	2 (0%)	Recoded as not specified
Insurance status	Descriptive results	883/26,729 (3.3%)	Recoded as unknown. Insurance status only collected by FluSurv-NET for the 2017–2018 and 2018–2019 influenza seasons.
Residence type	Descriptive results, primary outcomes	0 (0%)	Missing residential type were excluded under criterion of not having an address type that was residential.
Influenza type	Descriptive results	0 (0%)	
Symptom onset date		5,482 (9.5%)	Due to the high number of patients missing symptom onset date, this variable was not considered in the selection of secondary outcomes.
Respiratory signs/symptoms at admission	Descriptive results	0 (0%)	≥1 respiratory sign or symptom was an eligibility criterion, so included patients were required to have these documented.
Body mass index (BMI)	Descriptive results	3,218 (5.6%)	Missingness for BMI due to patients missing weight (n=283) or height (n=2,089) or both (n=846). Coded as unknown for BMI category.
Smoker	Descriptive results	0 (0%)	
Alcohol use	Descriptive results	1 (0%)	Recoded as no/unknown
Pre-existing medical conditions	Descriptive results, primary outcomes	0 (0%)	
Intensive care unit admission	Descriptive results, primary outcomes	0 (0%)	
Invasive mechanical ventilation	Descriptive results, primary outcomes	2 (0%)	Recoded as unknown

ECMO	Descriptive results, primary outcomes	2 (0%)	Recoded as unknown
Death	Descriptive results, primary outcomes	0 (0%)	All included patients were required to have final outcome (alive/deceased).
Received antiviral treatment	Descriptive results, primary outcomes, secondary outcomes	76 (0.1%)	Recoded as unknown
Antiviral start date	Descriptive results, primary outcomes, secondary outcomes	0/52,585 (0%)	Denominator is among patients receiving influenza antivirals.
Received current season influenza vaccine	Descriptive results, primary outcomes, secondary outcomes	1 (0%)	Recoded as unknown
Date of seasonal influenza vaccination	Secondary outcomes	0/28,643 (0%)	Denominator is among patients receiving a seasonal influenza vaccination.

eTable 3. Secondary Study Outcomes

Outcome	Numerator	Denominator
A. Vaccination		
Proportion receiving seasonal influenza vaccine[a]	Number receiving seasonal influenza vaccine during the influenza season[b] that the hospitalization occurred	Number with known influenza vaccination history
Proportion vaccinated by the date considered ideal for most people to be vaccinated	Number receiving seasonal influenza vaccine by October 31st of the influenza season that the hospitalization occurred	Number receiving seasonal influenza vaccine during the influenza season that the hospitalization occurred and who have a documented date of vaccination
B. Treatment		
Proportion initiated on recommended in-hospital antivirals[c]	Number receiving recommended antivirals upon or following hospital admission	Number with known influenza treatment history who were not initiated on antivirals prior to hospitalization
Proportion with early initiation of recommended in-hospital antivirals	Number receiving recommended in-hospital antivirals within one day following hospital admission	Number receiving recommended in-hospital antivirals
Proportion initiated on antivirals prior to hospital admission	Number receiving recommended antivirals prior to hospital admission	Number receiving recommended antivirals

[a] A FluSurv-NET case is a patient considered to have received the current season influenza vaccine if one or more doses were administered ≥14 days prior to or after an influenza-associated hospitalization.
[b] An influenza vaccine was considered to have been administered during the current influenza season if received starting on July 1st.
[c] Includes neuraminidase inhibitors (NAIs) (Oseltamivir/Tamiflu, Peramivir/Rapivab, and Zanamivir/Relenza) and Baloxavir marboxil (Xofluza) received following hospital admission.

eTable 4. US Centers for Disease Control and Prevention and Agency for Toxic Substances and Disease Registry Social Vulnerability Index 2018 Variables and Source Census Tables

SVI theme	SVI individual variables	Description	Source ACS table
Theme 1: Socioeconomic status	Below poverty	Percentage of persons below poverty estimate	S0601: Selected Characteristics of the Total and Native Populations in the United States
	Unemployed	Percentage of civilian (age 16+) unemployed estimate	DP03: Selected Economic Characteristics
	Income	Per capita income estimate, 2014–2018 ACS	B19301: Per Capita Income
	No high school diploma	Percentage of persons with no high school diploma (age 25+) estimate	S0601: Selected Characteristics of the Total and Native Populations in the United States
Theme 2: Household composition & disability	Aged 65 or older	Percentage of persons aged 65 and older estimate	S0101: Age and Sex
	Aged 17 or younger	Percentage of persons aged 17 and younger estimate	B09001: Population Under 18 Years by Age
	Civilian with a disability	Percentage of civilian Noninstitutionalized population with a disability estimate, 2014–2018 ACS	DP02: Selected Social Characteristics in the United States
	Single-parent households	Percentage of single parent households with children under 18 estimate, 2014–2018 ACS	DP02: Selected Social Characteristics in the United States
Theme 3: Minority status & language	Minority	Percentage minority (all persons except white, non-Hispanic) estimate, 2014–2018 ACS	B01001H: Sex by Age (White Alone, Not Hispanic or Latino)
	Speaks English “Less than well”	Percentage of persons (age 5+) who speak English “less than well” estimate, 2014–2018 ACS	B16005: Nativity by Language Spoken at Home by Ability to Speak English for the Population 5 Years and Over
Theme 4: Housing type & transportation	Multi-unit structures	Percentage of housing in structures with 10 or more units estimate	DP04: Selected Housing Characteristics
	Mobile homes	Percentage of mobile homes estimate	DP04: Selected Housing Characteristics
	Crowding	Percentage of occupied housing units with more people than rooms estimate	DP04: Selected Housing Characteristics
	No vehicle	Percentage of households with no vehicle available estimate	DP04: Selected Housing Characteristics
	Group quarters	Percentage of persons in group quarters estimate, 2014–2018 ACS	B26001: Group Quarters Population

Abbreviations: ACS = American Community Survey ; SVI = Social Vulnerability Index

eTable 5. Mediation Analysis of Significant Associations Found in Primary Analysis, 2014-2015 to 2018-2019 Influenza Seasons, FluSurv-NET

	Generalized structural equation modeling[a]							
	Vaccination status		Any antiviral receipt		Number of categories of underlying medical conditions[b]		Number of respiratory symptoms[c]	
	Coefficient (95% CI)	p-value	Coefficient (95% CI)	p-value	Coefficient (95% CI)	p-value	Coefficient (95% CI)	p-value
ICU admission								
Overall SVI								
Q2 vs. Q1								
Direct effect	-0.01 (-0.27–0.24)	0.93	-0.01 (-0.27–0.24)	0.93	-0.01 (-0.27–0.24)	0.93	0.00 (-0.26–0.25)	0.97
Indirect effect	0.00 (0.00–0.00)	0.51	0.00 (0.00–0.00)	0.78	0.00 (0.00–0.01)	0.17	0.00 (0.00–0.00)	0.74
Total effect	-0.01 (-0.27–0.24)	0.93	-0.01 (-0.27–0.24)	0.93	-0.01 (-0.26–0.25)	0.95	0.00 (-0.26–0.25)	0.97
Q3 vs. Q1								
Direct effect	0.04 (-0.23–0.30)	0.80	0.04 (-0.23–0.30)	0.80	0.04 (-0.23–0.30)	0.80	0.05 (-0.22–0.32)	0.74
Indirect effect	0.00 (0.00–0.00)	0.88	0.00 (0.00–0.00)	0.84	0.01 (0.00–0.01)	0.17	0.00 (0.00–0.00)	0.78
Total effect	0.04 (-0.23–0.30)	0.80	0.04 (-0.23–0.30)	0.80	0.04 (-0.23–0.31)	0.77	0.05 (-0.22–0.32)	0.74
Q4 vs. Q1								
Direct effect	-0.04 (-0.28–0.21)	0.77	-0.04 (-0.28–0.20)	0.77	-0.04 (-0.28–0.20)	0.77	-0.01 (-0.25–0.24)	0.96
Indirect effect	0.00 (0.00–0.00)	0.93	0.00 (0.00–0.00)	0.65	0.01 (0.00–0.02)	0.15	0.00 (-0.01–0.00)	0.04
Total effect	-0.04 (-0.28–0.21)	0.77	-0.04 (-0.28–0.20)	0.77	-0.03 (-0.27–0.21)	0.83	-0.01 (-0.25–0.24)	0.94
Theme 1: SES								
Q2 vs. Q1								
Direct effect	-0.06 (-0.30–0.18)	0.64	-0.06 (-0.30–0.18)	0.64	-0.06 (-0.30–0.18)	0.64	-0.05 (-0.29–0.19)	0.68
Indirect effect	0.00 (0.00–0.00)	0.75	0.00 (0.00–0.00)	0.96	0.00 (0.00–0.01)	0.10	0.00 (0.00–0.00)	0.86
Total effect	-0.06 (-0.30–0.18)	0.64	-0.06 (-0.30–0.18)	0.64	-0.05 (-0.30–0.19)	0.66	-0.05 (-0.29–0.19)	0.68
Q3 vs. Q1								
Direct effect	0.03 (-0.22–0.28)	0.81	0.03 (-0.22–0.28)	0.81	0.03 (-0.22–0.28)	0.81	0.05 (-0.20–0.30)	0.71
Indirect effect	0.00 (0.00–0.00)	0.89	0.00 (0.00–0.00)	0.83	0.01 (0.00–0.01)	0.24	0.00 (-0.01–0.00)	0.17
Total effect	0.03 (-0.22–0.28)	0.81	0.03 (-0.22–0.28)	0.81	0.036 (-0.22–0.29)	0.78	0.05 (-0.21–0.30)	0.72
Q4 vs. Q1								
Direct effect	0.01 (-0.25–0.28)	0.93	0.01 (-0.25–0.27)	0.94	0.01 (-0.25–0.27)	0.94	0.05 (-0.23–0.32)	0.74
Indirect effect	0.00 (0.00–0.00)	0.56	0.00 (0.00–0.00)	0.67	0.01 (0.00–0.02)	0.08	0.00 (0.00–0.00)	0.09
Total effect	0.01 (-0.25–0.28)	0.93	0.01 (-0.25–0.27)	0.94	0.02 (-0.24–0.29)	0.87	0.04 (-0.23–0.31)	0.76

	Generalized structural equation modeling[a]							
	Vaccination status		Any antiviral receipt		Number of categories of underlying medical conditions[b]		Number of respiratory symptoms[c]	
	Coefficient (95% CI)	p-value	Coefficient (95% CI)	p-value	Coefficient (95% CI)	p-value	Coefficient (95% CI)	p-value
IMV/ECMO								
Overall SVI								
Q2 vs. Q1								
Direct effect	-0.03 (-0.13–0.06)	0.52	-0.03 (-0.13–0.07)	0.53	**-0.03 (-0.13–0.06)**	**0.53**	-0.02 (-0.11–0.08)	0.76
Indirect effect	0.00 (0.00–0.00)	0.28	0.00 (0.00–0.00)	0.76	**0.01 (0.00–0.01)**	**0.00**	0.00 (0.00–0.00)	0.61
Total effect	-0.03 (-0.13–0.06)	0.52	-0.03 (-0.13–0.07)	0.53	**-0.02 (-0.12–0.07)**	**0.62**	-0.02 (-0.11–0.09)	0.75
Q3 vs. Q1								
Direct effect	**0.05 (-0.04–0.15)**	**0.30**	0.06 (-0.04–0.15)	0.26	**0.06 (-0.04–0.15)**	**0.26**	0.07 (-0.02–0.17)	0.13
Indirect effect	**0.00 (0.00–0.00)**	**0.02**	0.00 (0.00–0.00)	0.84	**0.01 (0.00–0.01)**	**0.00**	0.00 (0.00–0.00)	0.69
Total effect	**0.05 (-0.04–0.15)**	**0.29**	0.06 (-0.04–0.15)	0.26	**0.06 (-0.03–0.16)**	**0.21**	0.07 (-0.02–0.17)	0.14
Q4 vs. Q1								
Direct effect	***0.15 (0.05–0.24)***	***0.00***	0.15 (0.06–0.25)	0.00	***0.15 (0.06–0.25)***	***0.00***	***0.19 (0.09–0.29)***	***0.00***
Indirect effect	***0.00 (0.00–0.00)***	***0.00***	0.00 (0.00–0.00)	0.86	***0.01 (0.01–0.02)***	***0.00***	***0.00 (-0.01–0.00)***	***0.00***
Total effect	***0.15 (0.05–0.24)***	***0.00***	0.15 (0.06–0.25)	0.00	***0.17 (0.07–0.26)***	***0.00***	***0.19 (0.09–0.29)***	***0.00***
Theme 1: SES								
Q2 vs. Q1								
Direct effect	0.03 (-0.06–0.12)	0.55	0.03 (-0.06–0.12)	0.54	**0.03 (-0.06–0.12)**	**0.54**	0.04 (-0.05–0.14)	0.35
Indirect effect	0.00 (0.00–0.00)	0.73	0.00 (0.00–0.00)	0.96	**0.01 (0.00–0.01)**	**0.00**	0.00 (0.00–0.00)	0.18
Total effect	0.03 (-0.06–0.12)	0.55	0.03 (-0.06–0.12)	0.54	**0.03 (-0.06–0.13)**	**0.46**	0.04 (-0.05–0.14)	0.36
Q3 vs. Q1								
Direct effect	0.15 (0.05–0.24)	0.00	0.15 (0.05–0.24)	0.00	***0.15 (0.05–0.24)***	***0.00***	***0.17 (0.08–0.27)***	***0.00***
Indirect effect	0.00 (0.00–0.00)	0.80	0.00 (0.00–0.00)	0.80	***0.01 (0.00–0.01)***	***0.00***	***0.00 (-0.01–0.00)***	***0.00***
Total effect	0.15 (0.05–0.24)	0.00	0.15 (0.05–0.24)	0.00	***0.15 (0.06–0.25)***	***0.00***	***0.17 (0.08–0.26)***	***0.00***
Q4 vs. Q1								
Direct effect	***0.19 (0.09–0.29)***	***0.00***	0.20 (0.10–0.30)	0.00	***0.20 (0.10–0.30)***	***0.00***	***0.24 (0.14–0.34)***	***0.00***
Indirect effect	***0.00 (0.00–0.00)***	***0.01***	0.00 (0.00–0.00)	0.47	***0.01 (0.01–0.02)***	***0.00***	***-0.01 (-0.01–0.00)***	***0.00***
Total effect	***0.19 (0.09–0.29)***	***0.00***	0.20 (0.10–0.30)	0.00	***0.21 (0.11–0.31)***	***0.00***	***0.24 (0.14–0.34)***	***0.00***
Theme 2: Household composition & disability								

	Generalized structural equation modeling[a]							
	Vaccination status		Any antiviral receipt		Number of categories of underlying medical conditions[b]		Number of respiratory symptoms[c]	
	Coefficient (95% CI)	p-value	Coefficient (95% CI)	p-value	Coefficient (95% CI)	p-value	Coefficient (95% CI)	p-value
Q2 vs. Q1								
Direct effect	0.03 (-0.06–0.12)	0.53	0.03 (-0.07–0.12)	0.54	**0.03 (-0.07–0.12)**	**0.55**	0.04 (-0.06–0.13)	0.43
Indirect effect	0.00 (0.00–0.00)	0.09	0.00 (0.00–0.00)	0.48	**0.00 (0.00–0.01)**	**0.00**	0.00 (0.00–0.00)	0.50
Total effect	0.03 (-0.06–0.12)	0.53	0.03 (-0.07–0.12)	0.54	**0.03 (-0.06–0.13)**	**0.51**	0.04 (-0.06–0.13)	0.44
Q3 vs. Q1								
Direct effect	**0.04 (-0.06–0.14)**	**0.41**	0.04 (-0.06–0.14)	0.45	**0.04 (-0.06–0.13)**	**0.46**	**0.06 (-0.04–0.15)**	**0.27**
Indirect effect	**0.00 (0.00–0.00)**	**0.00**	0.00 (0.00–0.00)	0.44	**0.01 (0.00–0.01)**	**0.00**	**0.00 (0.00–0.00)**	**0.02**
Total effect	**0.04 (-0.06–0.14)**	**0.41**	0.04 (-0.06–0.13)	0.46	**0.04 (-0.05–0.14)**	**0.39**	**0.05 (-0.04–0.15)**	**0.28**
Q4 vs. Q1								
Direct effect	0.15 (0.06–0.25)	0.00	0.16 (0.06–0.25)	0.00	***0.16 (0.06–0.25)***	***0.00***	***0.21 (0.11–0.31)***	***0.00***
Indirect effect	0.00 (0.00–0.00)	0.11	0.00 (0.00–0.00)	0.48	***0.02 (0.01–0.02)***	***0.00***	***-0.01 (-0.01–0.00)***	***0.00***
Total effect	0.15 (0.06–0.25)	0.00	0.16 (0.06–0.25)	0.00	***0.17 (0.07–0.27)***	***0.00***	***0.20 (0.10–0.30)***	***0.00***

*__Bold text__ = full mediation; ***bold and italicized text*** = partial mediation

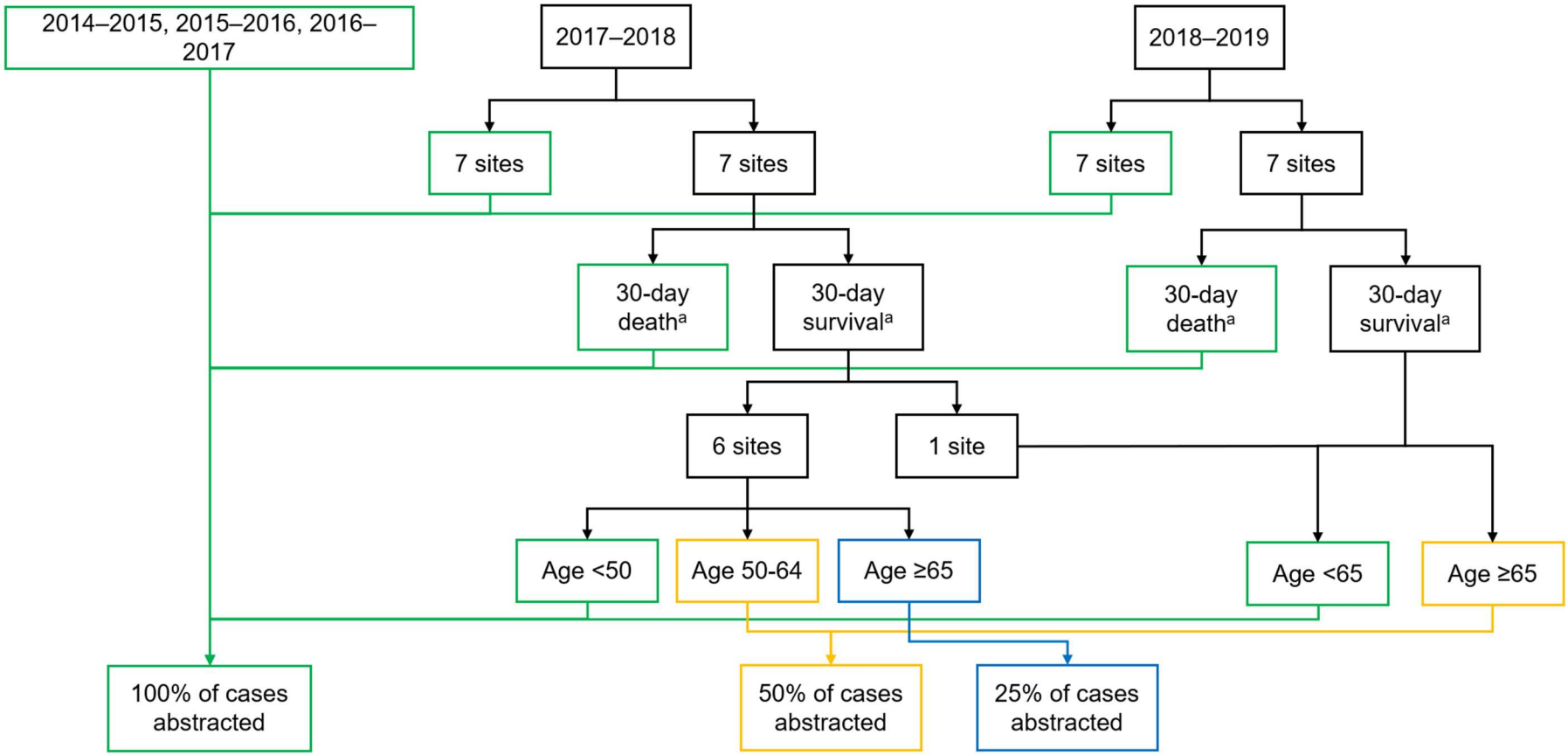
Abbreviations: CI = confidence interval; ECMO = extracorporeal membrane oxygenation; ICU = intensive care unit; IMV = invasive mechanical ventilation; SES = socioeconomic status; SVI = Social Vulnerability Index

[a] Models for ICU admission and IMV/ECMO were adjusted for age group (18–49, 50–64, and ≥65 years), number of categories of medical conditions (0, 1, 2, 3, ≥4), influenza season, female sex, and category of race and ethnicity. All models included an interaction term between age group and race and ethnicity. Evidence of mediation was considered when the indirect effects were significant (i.e., 95% confidence intervals did not cross zero), with partial mediation determined when the direct effects were also significant and full mediation when they were non-significant. A review of full analytic output was conducted for any confidence intervals appearing to not cross zero due to rounding.

[b] This model removed underlying medical conditions as a covariate to analyze as a potential mediator.

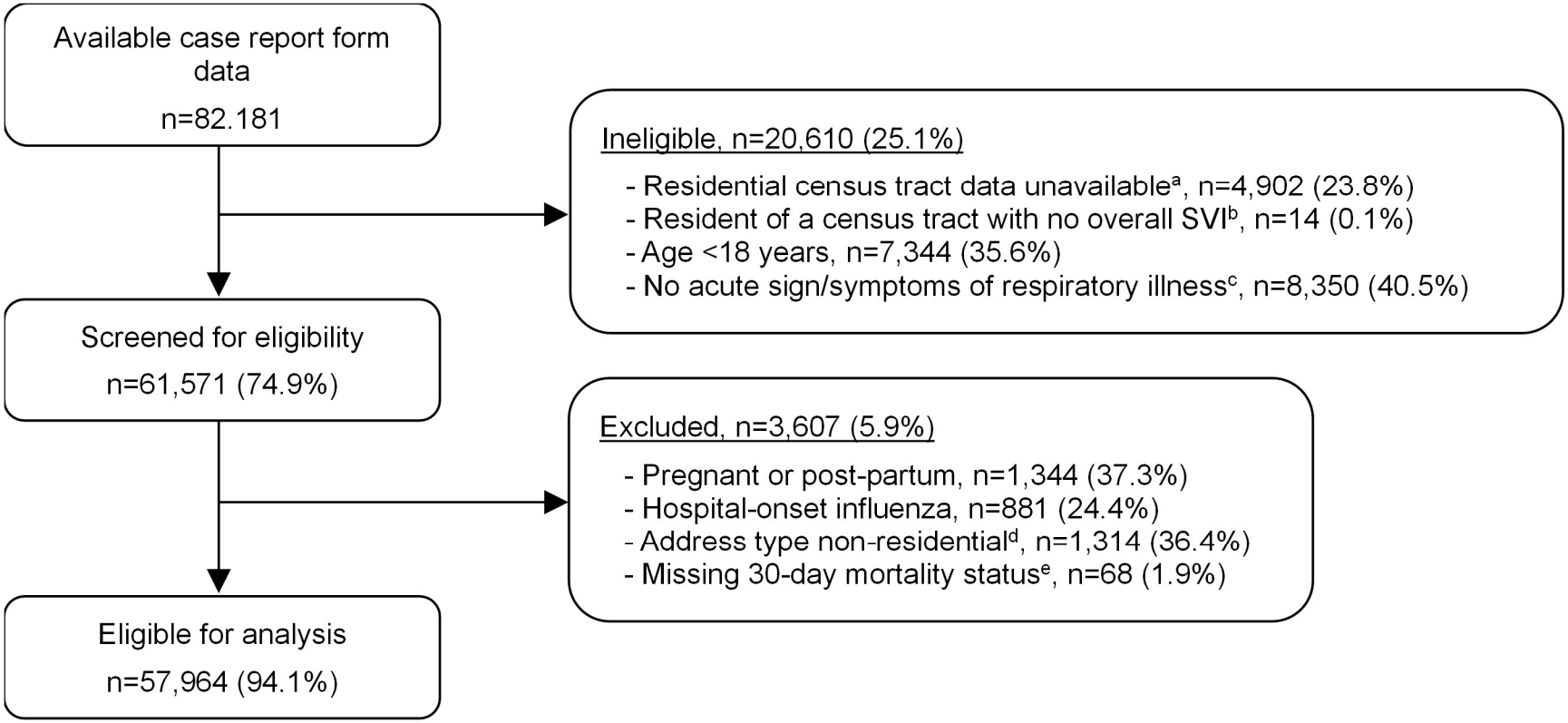
[c] FluSurv-NET respiratory signs and symptoms include congestion/runny nose, shortness of breath/respiratory distress, cough, sore throat, upper respiratory infections and influenza-like illness (URI/ILI), and/or wheezing occurring within 14 days prior to hospital admission.

eFigure 1. Random Sampling Scheme for FluSurv-NET 2014-2015 to 2018-2019 Influenza Seasons



[a] Alive or deceased at 30 days following hospital discharge.

eFigure 2. Patient Flow Diagram



Abbreviations: SVI = Social Vulnerability Index

[a] Contributing FluSurv-NET site was unable to geocode census tract due to lack of patient residential address. Cases among patients using a post office box as an address were not geocoded by contributing sites.

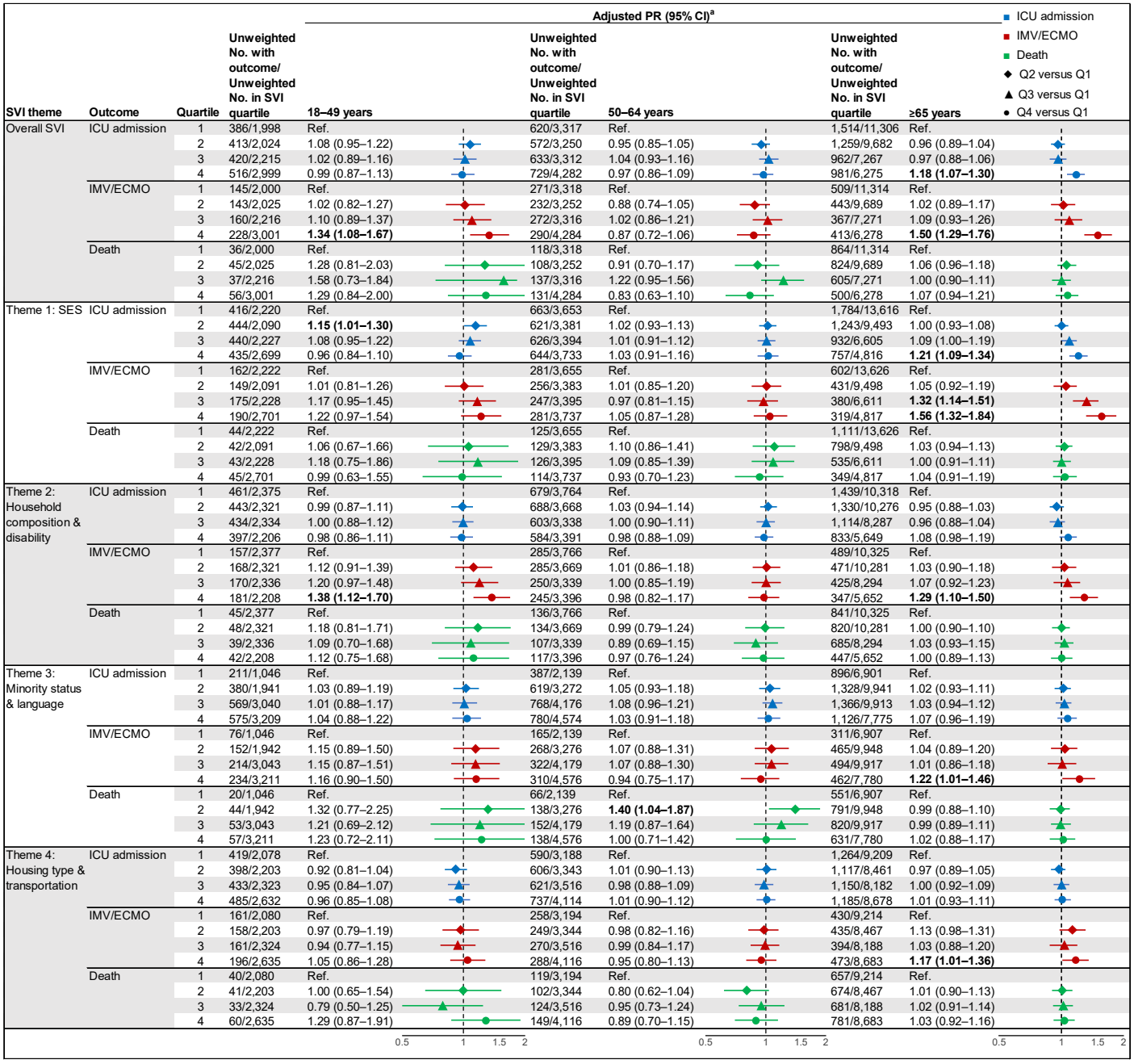
[b] Includes census tracts with zero estimates for total population and tracts that did not provide one or more census indicators used to derive SVI.

[c] FluSurv-NET eligibility criteria includes cases among patients with the non-respiratory influenza symptoms of altered mental status/confusion, fever/chills, and seizures.

[d] Non-residential address types included homeless or homeless shelters, alcohol and drug treatment centers, inpatient rehabilitation facilities, correctional and detention facilities, inpatient psychiatric facilities, and unknown address type.

[e] Cases among patients were excluded if it was unknown whether they were alive or deceased at 30 days following hospital discharge. Cases among patients missing intensive care unit admission status and receipt of invasive mechanical ventilation or extracorporeal membrane oxygenation were only excluded from those respective primary outcome models.

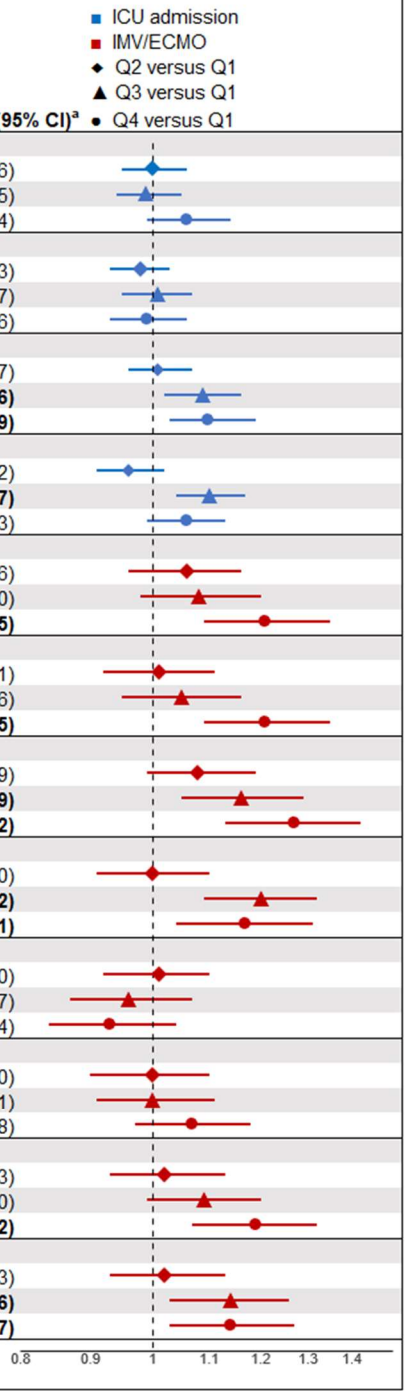
eFigure 3. Adjusted Prevalence Ratio of Influenza Outcomes Stratified by Age Group, 2014-2015 to 2018-2019 Influenza Seasons, FluSurv-NET



SVI theme	Outcome	Quartile	Unweighted No. with outcome/ Unweighted No. in SVI quartile	18–49 years	Unweighted No. with outcome/ Unweighted No. in SVI quartile	50–64 years	Unweighted No. with outcome/ Unweighted No. in SVI quartile	≥65 years
Overall SVI	ICU admission	1	386/1,998	Ref.	620/3,317	Ref.	1,514/11,306	Ref.
		2	413/2,024	1.08 (0.95–1.22)	572/3,250	0.95 (0.85–1.05)	1,259/9,682	0.96 (0.89–1.04)
		3	420/2,215	1.02 (0.89–1.16)	633/3,312	1.04 (0.93–1.16)	962/7,267	0.97 (0.88–1.06)
		4	516/2,999	0.99 (0.87–1.13)	729/4,282	0.97 (0.86–1.09)	981/6,275	**1.18 (1.07–1.30)**
	IMV/ECMO	1	145/2,000	Ref.	271/3,318	Ref.	509/11,314	Ref.
		2	143/2,025	1.02 (0.82–1.27)	232/3,252	0.88 (0.74–1.05)	443/9,689	1.02 (0.89–1.17)
		3	160/2,216	1.10 (0.89–1.37)	272/3,316	1.02 (0.86–1.21)	367/7,271	1.09 (0.93–1.26)
		4	228/3,001	**1.34 (1.08–1.67)**	290/4,284	0.87 (0.72–1.06)	413/6,278	**1.50 (1.29–1.76)**
	Death	1	36/2,000	Ref.	118/3,318	Ref.	864/11,314	Ref.
		2	45/2,025	1.28 (0.81–2.03)	108/3,252	0.91 (0.70–1.17)	824/9,689	1.06 (0.96–1.18)
		3	37/2,216	1.58 (0.73–1.84)	137/3,316	1.22 (0.95–1.56)	605/7,271	1.00 (0.90–1.11)
		4	56/3,001	1.29 (0.84–2.00)	131/4,284	0.83 (0.63–1.10)	500/6,278	1.07 (0.94–1.21)
Theme 1: SES	ICU admission	1	416/2,220	Ref.	663/3,653	Ref.	1,784/13,616	Ref.
		2	444/2,090	**1.15 (1.01–1.30)**	621/3,381	1.02 (0.93–1.13)	1,243/9,493	1.00 (0.93–1.08)
		3	440/2,227	1.08 (0.95–1.22)	626/3,394	1.01 (0.91–1.12)	932/6,605	1.09 (1.00–1.19)
		4	435/2,699	0.96 (0.84–1.10)	644/3,733	1.03 (0.91–1.16)	757/4,816	**1.21 (1.09–1.34)**
	IMV/ECMO	1	162/2,222	Ref.	281/3,655	Ref.	602/13,626	Ref.
		2	149/2,091	1.01 (0.81–1.26)	256/3,383	1.01 (0.85–1.20)	431/9,498	1.05 (0.92–1.19)
		3	175/2,228	1.17 (0.95–1.45)	247/3,395	0.97 (0.81–1.15)	380/6,611	**1.32 (1.14–1.51)**
		4	190/2,701	1.22 (0.97–1.54)	281/3,737	1.05 (0.87–1.28)	319/4,817	**1.56 (1.32–1.84)**
	Death	1	44/2,222	Ref.	125/3,655	Ref.	1,111/13,626	Ref.
		2	42/2,091	1.06 (0.67–1.66)	129/3,383	1.10 (0.86–1.41)	798/9,498	1.03 (0.94–1.13)
		3	43/2,228	1.18 (0.75–1.86)	126/3,395	1.09 (0.85–1.39)	535/6,611	1.00 (0.91–1.11)
		4	45/2,701	0.99 (0.63–1.55)	114/3,737	0.93 (0.70–1.23)	349/4,817	1.04 (0.91–1.19)
Theme 2: Household composition & disability	ICU admission	1	461/2,375	Ref.	679/3,764	Ref.	1,439/10,318	Ref.
		2	443/2,321	0.99 (0.87–1.11)	688/3,668	1.03 (0.94–1.14)	1,330/10,276	0.95 (0.88–1.03)
		3	434/2,334	1.00 (0.88–1.12)	603/3,338	1.00 (0.90–1.11)	1,114/8,287	0.96 (0.88–1.04)
		4	397/2,206	0.98 (0.86–1.11)	584/3,391	0.98 (0.88–1.09)	833/5,649	1.08 (0.98–1.19)
	IMV/ECMO	1	157/2,377	Ref.	285/3,766	Ref.	489/10,325	Ref.
		2	168/2,321	1.12 (0.91–1.39)	285/3,669	1.01 (0.86–1.18)	471/10,281	1.03 (0.90–1.18)
		3	170/2,336	1.20 (0.97–1.48)	250/3,339	1.00 (0.85–1.19)	425/8,294	1.07 (0.92–1.23)
		4	181/2,208	**1.38 (1.12–1.70)**	245/3,396	0.98 (0.82–1.17)	347/5,652	**1.29 (1.10–1.50)**
	Death	1	45/2,377	Ref.	136/3,766	Ref.	841/10,325	Ref.
		2	48/2,321	1.18 (0.81–1.71)	134/3,669	0.99 (0.79–1.24)	820/10,281	1.00 (0.90–1.10)
		3	39/2,336	1.09 (0.70–1.68)	107/3,339	0.89 (0.69–1.15)	685/8,294	1.03 (0.93–1.15)
		4	42/2,208	1.12 (0.75–1.68)	117/3,396	0.97 (0.76–1.24)	447/5,652	1.00 (0.89–1.13)
Theme 3: Minority status & language	ICU admission	1	211/1,046	Ref.	387/2,139	Ref.	896/6,901	Ref.
		2	380/1,941	1.03 (0.89–1.19)	619/3,272	1.05 (0.93–1.18)	1,328/9,941	1.02 (0.93–1.11)
		3	569/3,040	1.01 (0.88–1.17)	768/4,176	1.08 (0.96–1.21)	1,366/9,913	1.03 (0.94–1.12)
		4	575/3,209	1.04 (0.88–1.22)	780/4,574	1.03 (0.91–1.18)	1,126/7,775	1.07 (0.96–1.19)
	IMV/ECMO	1	76/1,046	Ref.	165/2,139	Ref.	311/6,907	Ref.
		2	152/1,942	1.15 (0.89–1.50)	268/3,276	1.07 (0.88–1.31)	465/9,948	1.04 (0.89–1.20)
		3	214/3,043	1.15 (0.87–1.51)	322/4,179	1.07 (0.88–1.30)	494/9,917	1.01 (0.86–1.18)
		4	234/3,211	1.16 (0.90–1.50)	310/4,576	0.94 (0.75–1.17)	462/7,780	**1.22 (1.01–1.46)**
	Death	1	20/1,046	Ref.	66/2,139	Ref.	551/6,907	Ref.
		2	44/1,942	1.32 (0.77–2.25)	138/3,276	**1.40 (1.04–1.87)**	791/9,948	0.99 (0.88–1.10)
		3	53/3,043	1.21 (0.69–2.12)	152/4,179	1.19 (0.87–1.64)	820/9,917	0.99 (0.89–1.11)
		4	57/3,211	1.23 (0.72–2.11)	138/4,576	1.00 (0.71–1.42)	631/7,780	1.02 (0.88–1.17)
Theme 4: Housing type & transportation	ICU admission	1	419/2,078	Ref.	590/3,188	Ref.	1,264/9,209	Ref.
		2	398/2,203	0.92 (0.81–1.04)	606/3,343	1.01 (0.90–1.13)	1,117/8,461	0.97 (0.89–1.05)
		3	433/2,323	0.95 (0.84–1.07)	621/3,516	0.98 (0.88–1.09)	1,150/8,182	1.00 (0.92–1.09)
		4	485/2,632	0.96 (0.85–1.08)	737/4,114	1.01 (0.90–1.12)	1,185/8,678	1.01 (0.93–1.11)
	IMV/ECMO	1	161/2,080	Ref.	258/3,194	Ref.	430/9,214	Ref.
		2	158/2,203	0.97 (0.79–1.19)	249/3,344	0.98 (0.82–1.16)	435/8,467	1.13 (0.98–1.31)
		3	161/2,324	0.94 (0.77–1.15)	270/3,516	0.99 (0.84–1.17)	394/8,188	1.03 (0.88–1.20)
		4	196/2,635	1.05 (0.86–1.28)	288/4,116	0.95 (0.80–1.13)	473/8,683	**1.17 (1.01–1.36)**
	Death	1	40/2,080	Ref.	119/3,194	Ref.	657/9,214	Ref.
		2	41/2,203	1.00 (0.65–1.54)	102/3,344	0.80 (0.62–1.04)	674/8,467	1.01 (0.90–1.13)
		3	33/2,324	0.79 (0.50–1.25)	124/3,516	0.95 (0.73–1.24)	681/8,188	1.02 (0.91–1.14)
		4	60/2,635	1.29 (0.87–1.91)	149/4,116	0.89 (0.70–1.15)	781/8,683	1.03 (0.92–1.16)

eFigure 4. Adjusted Prevalence Ratio of Influenza Outcomes by SVI Indicator, 2014-2015 to 2018-2019 Influenza Seasons, FluSurv-NET

SVI theme	Outcome	Indicator	Quartile	Unweighted No. with outcome/ Unweighted No. in SVI quartile	Weighted % (95% CI)	Adjusted PR (95% CI)[a]
Theme 1: SES	ICU admission	1: Below poverty	1	2,868/18,974	14.5 (14.0–15.0)	Ref.
			2	2,233/14,550	14.7 (14.1–15.4)	1.00 (0.95–1.06)
			3	1,927/12,217	15.1 (14.4–15.7)	0.99 (0.94–1.05)
			4	1,977/12,186	16.0 (15.3–16.7)	1.06 (0.99–1.14)
		2: Unemployment	1	2,743/17,760	14.8 (14.3–15.3)	Ref.
			2	2,339/15,229	14.8 (14.2–15.4)	0.98 (0.93–1.03)
			3	2,044/12,926	15.2 (14.6–15.9)	1.01 (0.95–1.07)
			4	1,879/12,012	15.2 (14.5–15.9)	0.99 (0.93–1.06)
		3: Income	1	2,875/19,544	14.0 (13.5–14.5)	Ref.
			2	2,498/16,545	14.6 (14.0–15.1)	1.01 (0.96–1.07)
			3	1,875/11,318	16.2 (15.5–16.9)	**1.09 (1.02–1.16)**
			4	1,757/10,520	16.3 (15.6–17.1)	**1.10 (1.03–1.19)**
		4: No HS diploma	1	2,634/17,791	14.1 (13.6–14.6)	Ref.
			2	2,325/15,857	14.1 (13.6–14.7)	0.96 (0.91–1.02)
			3	2,151/12,811	16.3 (15.6–17.0)	**1.10 (1.04–1.17)**
			4	1,895/11,468	16.1 (15.4–16.8)	1.06 (0.99–1.13)
	IMV/ECMO	1: Below poverty	1	1,045/18,989	5.2 (4.9–5.5)	Ref.
			2	842/14,561	5.5 (5.1–5.9)	1.06 (0.96–1.16)
			3	758/12,220	5.8 (5.4–6.3)	1.08 (0.98–1.20)
			4	828/12,194	6.6 (6.1–7.1)	**1.21 (1.09–1.35)**
		2: Unemployment	1	993/17,767	5.3 (5–5.6)	Ref.
			2	870/15,239	5.5 (5.1–5.9)	1.01 (0.92–1.11)
			3	784/12,932	5.7 (5.3–6.1)	1.05 (0.95–1.16)
			4	826/12,026	6.6 (6.1–7)	**1.21 (1.09–1.35)**
		3: Income	1	1,042/19,558	4.9 (4.6–5.2)	Ref.
			2	953/16,557	5.5 (5.2–5.9)	1.08 (0.99–1.19)
			3	734/11,324	6.2 (5.7–6.7)	**1.16 (1.05–1.29)**
			4	744/10,525	6.8 (6.3–7.4)	**1.27 (1.13–1.42)**
		4: No HS diploma	1	963/17,802	5.1 (4.8–5.4)	Ref.
			2	874/15,867	5.3 (4.9–5.7)	1.00 (0.91–1.10)
			3	866/12,823	6.4 (6.0–6.9)	**1.20 (1.09–1.32)**
			4	770/11,472	6.4 (6.0–6.9)	**1.17 (1.04–1.31)**
Theme 2: Household composition & disability	IMV/ECMO	1: ≥65 years	1	1,090/17,277	6.0 (5.7–6.4)	Ref.
			2	980/15,593	5.9 (5.6–6.3)	1.01 (0.92–1.10)
			3	734/12,806	5.5 (5.1–5.9)	0.96 (0.87–1.07)
			4	669/12,288	5.1 (4.7–5.5)	0.93 (0.84–1.04)
		2: <18 years	1	849/15,012	5.5 (5.1–5.9)	Ref.
			2	826/14,359	5.5 (5.1–5.9)	1.00 (0.90–1.10)
			3	849/13,955	5.7 (5.3–6.1)	1.00 (0.91–1.11)
			4	949/14,638	6.1 (5.7–6.5)	1.07 (0.97–1.18)
		3: Disability	1	912/16,070	5.3 (4.9–5.6)	Ref.
			2	956/16,609	5.5 (5.1–5.8)	1.02 (0.93–1.13)
			3	860/14,223	5.8 (5.4–6.2)	1.09 (0.99–1.20)
			4	745/11,062	6.5 (6.1–7.0)	**1.19 (1.07–1.32)**
		4: Single-parent HH	1	772/14,268	5.1 (4.8–5.5)	Ref.
			2	810/14,429	5.3 (4.9–5.7)	1.02 (0.93–1.13)
			3	853/13,543	6.1 (5.6–6.5)	**1.14 (1.03–1.26)**
			4	1,038/15,724	6.3 (5.9–6.7)	**1.14 (1.03–1.27)**



Abbreviations: CI = confidence interval; ECMO = extracorporeal membrane oxygenation; HH = household; HS = high school; ICU = intensive care unit; IMV = invasive mechanical ventilation; PR = prevalence ratio; SES = socioeconomic status; SVI = Social Vulnerability Index

[a] Models for ICU admission and IMV/ECMO were adjusted for age group (18–49, 50–64, and ≥65 years), number of categories of medical conditions (0, 1, 2, 3, ≥4), influenza season, female sex, and category of race and ethnicity. All models included an interaction term between age group and race and ethnicity. Models for ICU admission and IMV/ECMO exclude cases among patients with unknown outcome status.