Recent Publications: Making the Case for Using NHSN

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2024 National Healthcare Safety Network Post-Acute Care Virtual Training, Wednesday, July 24, 2024

Publication

SARS-CoV-2 Infection and Death Rates Among Maintenance Dialysis Patients During Delta and Early Omicron Waves — United States, June 30, 2021–September 27, 2022

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Introduction

- Patients receiving maintenance dialysis are at increased risk for complications related to COVID-19 infection, including death
- Rates of SARS-CoV-2 infection and COVID-19-related death in this population are not well described
- From November 2020-May 2023, NHSN collected weekly data monitoring incidence of SARS-CoV-2 infections and COVID-19-related deaths among dialysis patients

Objective

- To describe rates of SARS-CoV-2 infection and COVID-19-related death among dialysis patients as reported to NHSN during June 30, 2021-September 27, 2022

Methods: Use of NHSN Data

- This study used **NHSN dialysis facility COVID-19 data** reported during June 30, 2021–September 27, 2022

- Facility-level data on SARS-CoV-2 infections and COVID-19-related deaths were stratified into waves:

  - Delta (June 30–October 26, 2021)

  - First Omicron (October 27, 2021–March 22, 2022)

  - Second Omicron (March 23–September 27, 2022)

Methods: Statistical Analysis

- **Pooled mean SARS-CoV-2 infection and death rates** (events per 10,000 patient-weeks) among dialysis patients were calculated as the sum of weekly cases divided by the weekly patient census during each wave.

- The rates by wave were stratified by facility level characteristics and vaccination status:
  - urbanicity, social vulnerability index, state, region, facility size, and primary series and monovalent booster dose vaccination completion status.

Results: Rates by Facility Characteristics

SARS-CoV-2 infection and COVID-19 related death among dialysis patients during each COVID-19 wave by facility characteristics

	Infection Rate (per 10,000 patient-weeks by wave)				Death Rate (per 10,000 patient-weeks by wave)			
Categories	**Overall**	**Delta**	**First Omicron**	**Second Omicron**	**Overall**	**Delta**	**First Omicron**	**Second Omicron**
Overall:	30.47	20.13	46.45	25.05	1.74	1.96	2.66	0.59
Region								
Midwest	27.64	16.92	52.48	23.55	1.65	1.43	3.52	0.54
Mountain	28.12	24.35	51.81	22.02	1.89	1.91	4.12	0.66
Northeast	28.26	9.90	52.72	28.87	1.63	1.00	2.90	0.87
Pacific	24.71	13.31	41.54	29.28	1.01	1.19	1.83	0.44
South	26.11	26.60	43.39	21.63	1.68	2.74	2.48	0.54
Non-contiguous	43.56	40.00	52.40	58.45	1.57	3.36	1.60	0.96
Urbanicity								
Large core metro	28.33	16.16	45.03	23.02	1.26	1.37	2.19	0.45
Large fringe metro	28.14	16.33	43.78	23.53	1.41	1.49	2.49	0.51
Medium metro	33.16	24.49	48.40	26.75	1.84	2.36	2.88	0.67
Small metro	32.78	25.43	48.64	25.14	2.15	2.92	3.40	0.66
Rural	35.70	27.66	52.62	27.73	2.62	3.75	3.94	0.85
Noncore	34.59	27.09	49.66	27.69	2.39	3.43	3.48	0.83
SVI								
Low	30.92	18.21	46.93	26.55	1.64	1.75	2.83	0.61
Medium	30.99	21.02	47.37	24.58	1.77	2.06	2.93	0.65
High	30.06	21.23	45.74	23.43	1.59	2.25	2.44	0.50
Facility Size								
Small	32.50	23.28	48.88	25.63	1.66	1.91	2.81	0.60
Medium	30.30	20.53	46.21	24.16	1.66	2.02	2.78	0.55
Large	30.28	18.38	46.09	25.57	1.65	1.93	2.68	0.63

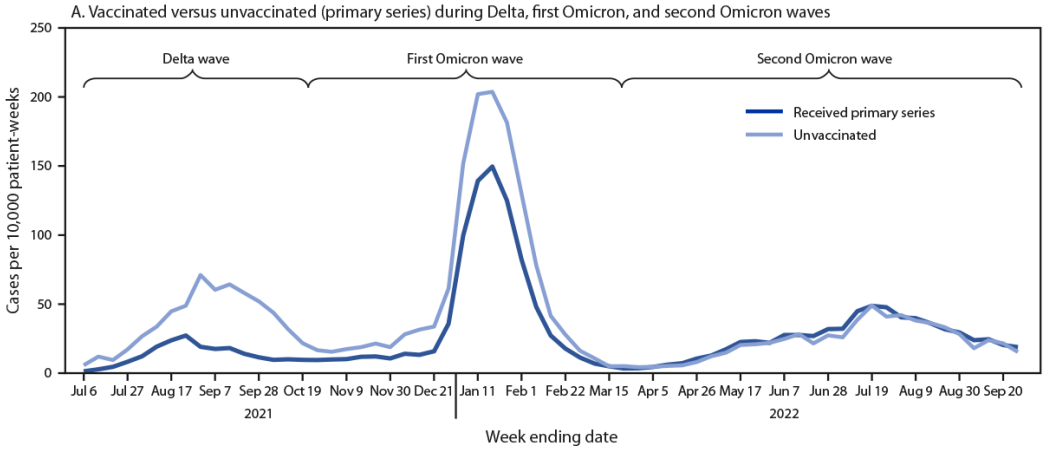
Results: Infection Rates by Vaccination Status

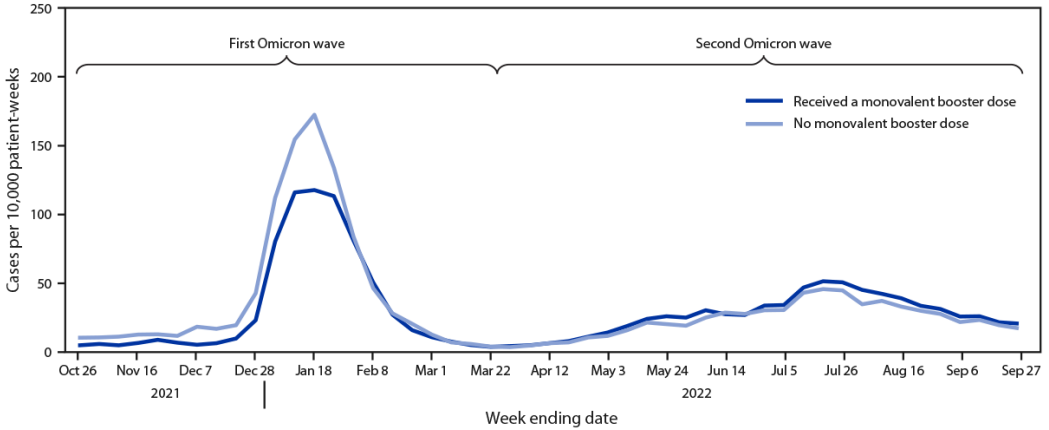
SARSCoV-2 infection rates among dialysis patients during each wave by vaccination status				
Infection Rate (per 10,000 patient -weeks by wave)				
Categories	Overall	Delta	First Omicron	Second Omicron
Primary Vaccination Status				
Full Primary dose	27.24	13.10	40.89	25.10
Not vaccinated	39.64	36.12	61.86	23.91
Monovalent Booster Dose Status				
Full primary dose and 1+ booster	30.62	-	38.32	26.70
No booster	33.69	-	42.21	22.93

Results

- Delta and first Omicron: the SARS-CoV-2 infection rate among vaccinated patients was lower than that among unvaccinated patients
- The highest rates were during the first Omicron wave

- First Omicron wave: the SARS-CoV-2 infection rate was lower among patients who received a booster than those who had not





Discussion

- Overall SARS-CoV-2 infection rate of 30.47 per 10,000 patient-weeks
- During the Delta and first Omicron waves, differences in infection rates between vaccinated and unvaccinated dialysis patients were identified, a finding that has not been well documented in previous literature
- No difference in infection rate were found by vaccination status during the second Omicron wave
- The need for patient education, efforts to combat vaccine misinformation, and on-site vaccination at dialysis facilities is ongoing

Public Health Action

- The infection rate among persons receiving dialysis can be reduced by adherence to recommended infection prevention practices
- Approximately 70% of dialysis patients have completed a primary vaccination series, but only 54% received additional doses, indicating substantial potential for improvement in vaccination coverage
- These findings underscore the need for dialysis patients and staff members to stay up to date with primary COVID-19 vaccine and booster dose recommendations and for dialysis facilities to implement effective infection control strategies

Next Publication

A Brief Six-Year Follow Up of Bloodstream Infections in Hemodialysis Facilities in the US, National Healthcare Safety Network, 2020

A Brief Six-Year Follow Up of Bloodstream Infections in Hemodialysis Facilities in the US, National Healthcare Safety Network, 2020

Authors: John Keenan, PhD; Kira A. Barbre, MPH; Philip Dollard, MPH; Tamara Hoxworth, PhD; Iram Qureshi, MPH; Lindsay Dunham MPH, MS; Erin O'Leary, MPH; Selom Agbobli Nuwoaty, MPH; Suparna Bagchi PhD; Jonathan Edwards, MStat; Mary Lu, PhD; Andrea Benin, MD; Jeneita Bell, MD

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Introduction: Previous Surveillance Report, 2014

National Healthcare Safety Network (NHSN) Dialysis Event Surveillance Report for 2014

Duc B. Nguyen, Alicia Shugart, Christi Lines, Ami B. Shah, Jonathan Edwards, Daniel Pollock, Dawn Sievert, and

Table 2. Pooled means and percentiles of the distribution of rates of key dialysis events by type of vascular access (Dialysis Event Surveillance, National Healthcare Safety Network, 2014)

Type and Access	Events	Denominator	Pooled Mean	Percentile				
				10th	25th	50th	75th	90th
All bloodstream infection	29,516	4,578,827	0.64	0	0.25	0.53	0.91	1.42
Fistula	7587	2,876,871	0.26	0	0	0.15	0.39	0.72
Graft	3262	827,821	0.39	0	0	0	0.55	1.33
Other	76	15,016	0.51	0	0	0	0	0
CVC	18,591	859,119	2.16	0	0.53	1.68	3.23	5.26
Access-related bloodstream infection	22,576	4,578,827	0.49	0	0.16	0.39	0.7	1.13
Fistula	4518	2,876,871	0.16	0	0	0	0.24	0.47
Graft	2256	827,821	0.27	0	0	0	0.23	0.98
Other	49	15,016	0.33	0	0	0	0	0
CVC	15,753	859,119	1.83	0	0	1.33	2.78	4.71
Intravenous antimicrobial start	149,722	4,578,792	3.27	1.08	1.91	2.97	4.25	5.88
Fistula	59,532	2,876,851	2.07	0.3	0.89	1.72	2.78	4.08
Graft	21,770	827,809	2.63	0	0.53	2.05	3.8	6.11
Other	433	15,016	2.88	0	0	0	0	9.09
CVC	67,993	859,116	7.91	2.26	4.55	7.48	11.25	15.63

SIR. The median SIR was 0.84, sug

Clinical Journal of the American Society of Nephrology, Vol 12 July, 2017, p1139-1146 https://pubmed.ncbi.nlm.nih.gov/28663227/

Methods-Event Data

- **Vascular access**
  - Arteriovenous (AV) fistula
  - AV graft
  - Central Venous Catheter (CVC)
    - Tunneled
    - Non-tunneled
  - Other access
- **Risk strata for those with multiple access**
  - Non-tunneled CVC > tunneled CVC > other vascular access > AV graft > AV fistula
- **Event type (numerator)**
  - **BSI- Blood stream infection**
    - Any positive blood culture collected from an outpatient facility or within one calendar day of hospital admission

Methods-Data Analysis

- **Denominator data-**
  - Patient-months, number of patients receiving dialysis by access type during the first two working days of each month

- **Events and patient-months overall and stratified by vascular access type**

- **Percent of total events and patient-months contributed by each access type**

- **Pooled mean rates with 95% confidence intervals (CI)**
  - Overall and by access type
  - Per 100 patient-months

Methods-Data Analysis

- **SIR-Standard Infection Ratio** (https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf)
  - Ratio of observed events over predicted events based on national aggregate data
  - Predicted values generated by multiplying the standardized rates for each access type by the number of patients within that access based on the 2014 standard.
  - Overall SIR
  - Stratified by state/territory
  - BSI events, expected events, SIR, 95% CI
  - States/territories with fewer than five reporting facilities were suppressed to prevent possibility of attributing a SIR to any facility

Results-2020 Values

BSI[a] Access Type	Number of Events	Denominator	Percent of Total Events	Percent of Total Denominator	Pooled Mean Rate (95%CI)[c]
All BSI[a]	15,181	5,235,234	NA	NA	0.29 (0.290.30)
CVC[b]	9,548	1,195,670	62.90%	22.80%	0.80 (0.780.82)
Fistula	3,708	3,128,055	24.40%	59.80%	0.12 (0.120.12)
Graft	1,897	901,467	12.50%	17.20%	0.21 (0.290.22)
Other access	28	10,042	0.20%	0.20%	0.28 (0.190.40)

[a] BSI: Blood stream infection
[b] CVC: Central venous catheter (includes both tunneled and non-tunneled CVC)
[c] Pooled mean rate=(total number of events/total number of patient-months) x100

Results- Compared to 2014

Access Type	2014 BSI[b] Events	2014 Patient-Months	2014 Pooled Mean Rate (95% CI)	2020 BSI Events	2020 Patient-Months	2020 Pooled Mean Rate (95% CI)[c]
All BSI	29,156	4,578,827	0.64 (0.630.64)	15,181	5,235,234	0.29 (0.290.30)
CVC[d]	18,591	859,119	2.16 (2.132.20)	9,548	1,195,670	0.80 (0.780.82)
Fistula	7,587	2,876,781	0.26 (0.260.27)	3,708	3,128,055	0.12 (0.120.12)
Graft	3,263	827,821	0.39 (0.380.41)	1,897	901,467	0.21 (0.200.22)
Other	76	15,016	0.51 (0.400.63)	28	10,042	0.28 (0.190.40)

a 2014 data previously published in Nguyen DB, Shugart A, Lines C, Shah AB, Edwards J, Pollock D, et al.: National Healthcare Safety Network (NHSN) Dialysis Event Surveillance Report for 2014. Clin J Am Soc Nephrol, 12: 1139-1146, 2017 10.2215/cjn.11411116
b BSI: Blood stream infection
c Pooled mean rate=(total number of events/total number of patient-months) x100
d CVC: Central venous catheter (includes both tunneled and non-tunneled CVC)

Results

State or Territory	Number of BSI[a] events	Expected BSI events	SIR[b]	95% CI Lower	95% CI Upper
AK	19	43.39	0.44	0.27	0.67
AL	262	639.96	0.41	0.36	0.46
AR	147	385.90	0.38	0.32	0.45
AS	NA	NA	NA	NA	NA
AZ	235	741.40	0.32	0.28	0.36
CA	1,866	5,020.2	0.37	0.36	0.39
CO	121	310.20	0.39	0.33	0.46
CT	124	285.10	0.43	0.36	0.52
DC	37	109.84	0.34	0.24	0.46
DE	33	121.10	0.27	0.19	0.38
FL	1,106	2,512.6	0.44	0.41	0.47
GA	572	1,428.7	0.40	0.37	0.43
GU	39	81.39	0.48	0.35	0.65
HI	202	283.90	0.71	0.62	0.81
IA	72	203.62	0.35	0.28	0.44
ID	37	93.99	0.39	0.28	0.54
IL	434	1,497.6	0.29	0.26	0.32
IN	295	763.38	0.39	0.34	0.43
KS	68	195.87	0.35	0.27	0.44
KY	151	434.26	0.35	0.30	0.41
LA	329	699.54	0.47	0.42	0.52
MA	243	498.38	0.49	0.43	0.55
MD	316	870.81	0.36	0.32	0.40
ME	35	85.49	0.41	0.29	0.56
MI	391	1,099.8	0.36	0.32	0.39
MN	189	389.19	0.49	0.42	0.56
MO	277	611.62	0.45	0.40	0.51
MP	NA	NA	NA	NA	NA
MS	342	502.76	0.68	0.61	0.76

State or Territory	Number of BSI events	Expected BSI events	SIR	95% CI Lower	95% CI Upper
MS	342	502.76	0.68	0.61	0.76
MT	29	62.96	0.46	0.31	0.65
NC	587	1,305.31	0.45	0.41	0.49
ND	64	56.04	1.14	0.89	1.45
NE	58	133.74	0.43	0.33	0.56
NH	28	95.38	0.29	0.20	0.42
NJ	394	1,001.21	0.39	0.36	0.43
NM	93	252.88	0.37	0.30	0.45
NV	81	400.42	0.20	0.16	0.25
NY	977	2,123.09	0.46	0.43	0.49
OH	626	1,418.86	0.44	0.41	0.48
OK	170	407.60	0.42	0.36	0.48
OR	76	320.83	0.24	0.19	0.29
PA	664	1,382.89	0.48	0.44	0.52
PR	261	625.55	0.42	0.37	0.47
RI	61	76.49	0.80	0.62	1.02
SC	252	645.39	0.39	0.34	0.44
SD	106	78.96	1.34	1.10	1.62
TN	351	864.99	0.41	0.36	0.45
TX	1,336	3,890.54	0.34	0.33	0.36
UT	34	106.73	0.32	0.22	0.44
VA	329	973.81	0.34	0.30	0.38
VI	NA	NA	NA	NA	NA
VT	16	33.98	0.47	0.28	0.75
WA	215	538.80	0.40	0.35	0.46
WI	296	552.61	0.54	0.48	0.60
WV	76	221.45	0.34	0.27	0.43
WY	19	30.02	0.63	0.39	0.97

[a]BSI: Bloodstream infection
[b]SIR: Standardized infection ratio
[c]Data from states and territories with < 5 facilities was suppressed

Conclusions, Implications and Applications

- **Median SIR decreased from 0.84 in 2014 to 0.40 in 2020**
- **Lower pooled mean rates overall and in each access type strata**
- **State/territory**
  - Majority have SIR less than one (95%CI less than one)
  - South Dakota SIR >1-SIR 1.34 (1.10-1.62)
  - North Dakota SIR >1 – SIR 1.14 (0.89-1.45)
- **Decrease in BSIs welcome observation occurring during a period of increased quality improvement efforts**
- **CVC group could be a valuable target for future interventions**

Discussion

- **Limitations**
  - Self-reported data
    - Previous reports of both under and over reporting of BSI
    - Missing data/not participating/zero events
  - One year- no longitudinal look
  - Occurs during COVID
    - Pandemic contributed to reduced completeness and quality of HAIs submitted by acute care hospitals
  - Can’t accurately describe the effect of the various quality improvement programs (or other programs, patient-level or program-level) on BSI reduction

Other

- **Dashboard**
  - Currently displaying 2019 data
    - Healthcare Associated Infections in Dialysis | A.R. & Patient Safety Portal (cdc.gov) https://arpsp.cdc.gov/profile/dialysis/all-123
  - 2020, 2021 available this summer

Next Publication

Factors Related to Low Seasonal Influenza and COVID-19 Primary Series and Booster Vaccination Coverage among Healthcare Personnel Working in Outpatient Hemodialysis Facilities in the United States, 2021-2022

Factors Related to Low Seasonal Influenza and COVID-19 Primary Series and Booster Vaccination Coverage among Healthcare Personnel Working in Outpatient Hemodialysis Facilities in the United States, 2021-2022

Iram Qureshi, MPH, CPH, Leidos CDC

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Background

- Patients receiving hemodialysis are at increased risk for severe illness from influenza and COVID-19
- These patients have frequent contact with healthcare personnel (HCP)
- ACIP recommendations: HCP receive an annual influenza vaccine; ages ≥6 months stay up to date on COVID-19 vaccination
- Influenza and COVID-19 vaccination coverage among HCP at hemodialysis facilities and how they vary by facility characteristics is unknown

Image from: Making Dialysis Safer for Patients Coalition 2022

Objectives

- To quantify influenza and COVID-19 vaccination coverage among HCP in outpatient hemodialysis facilities during the 2021-2022 respiratory virus season

- To investigate facility-level characteristics that may be associated with vaccination coverage among HCP

Methods: Use of NHSN Data

NHSN Data included in analysis:

- **Annual HCP influenza survey vaccination data** reported for the October 2021-March 2022 season

- **Weekly HCP COVID-19 vaccination data** (primary series and booster dose) reported by March 2022

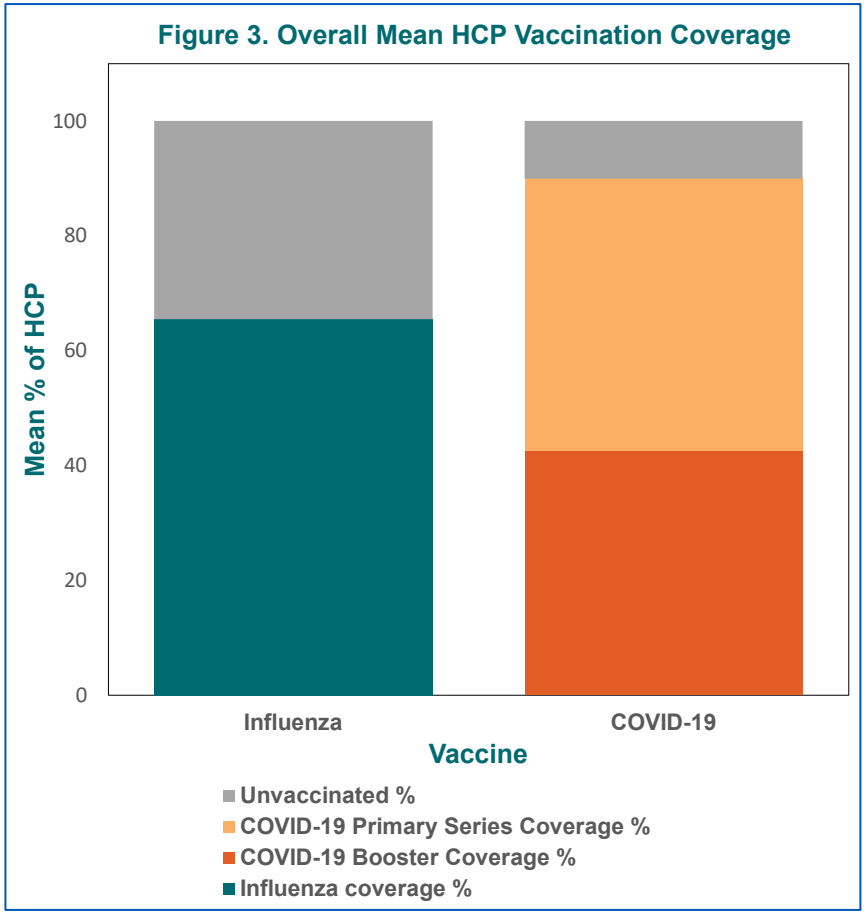
Methods: Statistical Analysis

- Two separate negative binomial models were created to analyze **COVID-19 booster vaccination coverage** and **influenza vaccination coverage** among HCP
  - The offset variable for the influenza coverage model was total staff
  - the offset variable for the COVID-19 booster dose(s) model was total staff vaccinated with the primary series

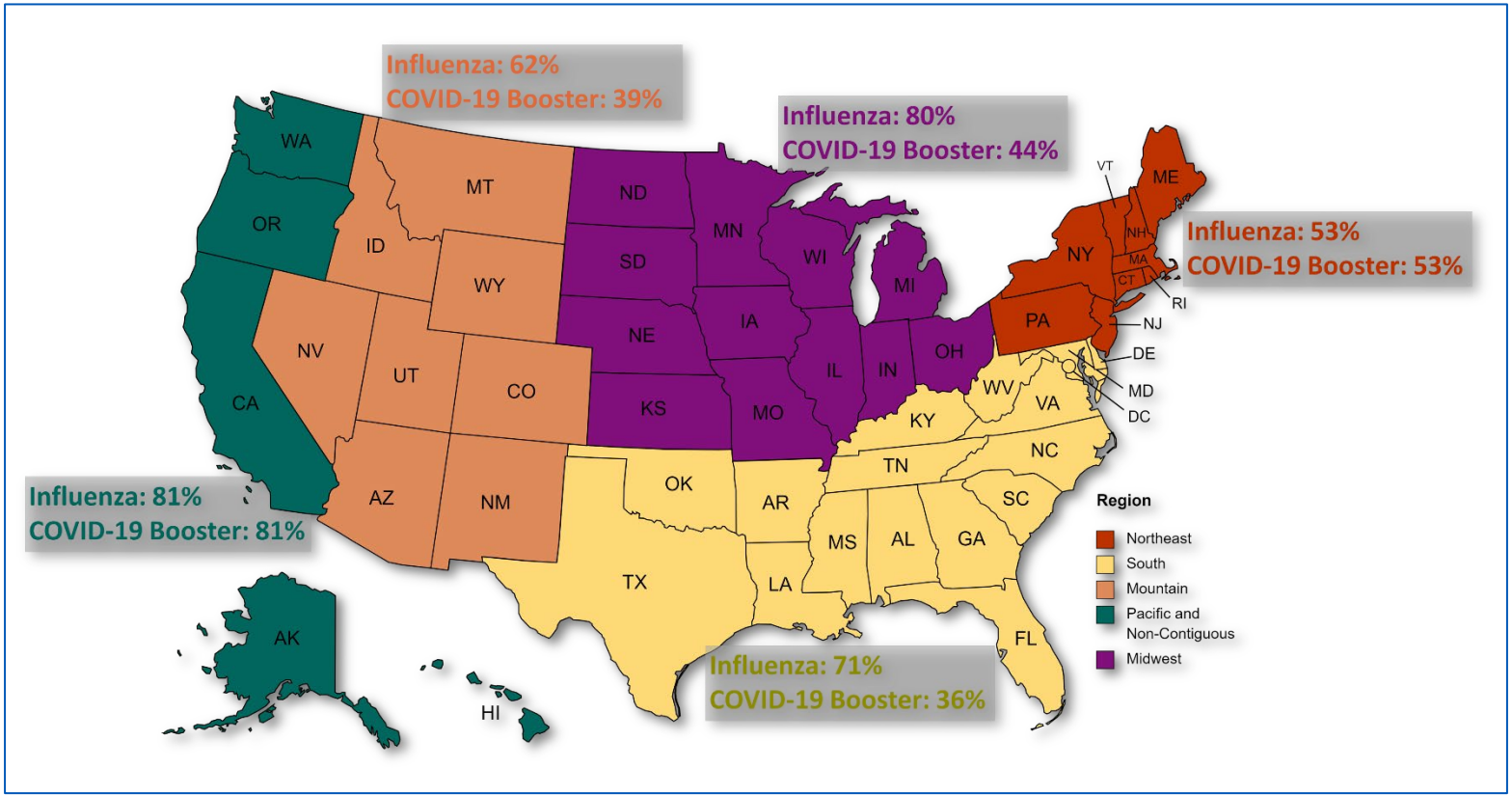
- Facility-level characteristics included in both models: **geographic region**, **urbanicity**, **social vulnerability index (SVI)**, **facility ownership**, **location**, and **facility size**

Results

- **650** outpatient dialysis facilities with **21,696 HCP**
- Mean Influenza vaccination coverage was **65.5%**
- Mean COVID-19 primary vaccination coverage: **90.0%**, of which a mean of **47.3%** had received a COVID-19 booster
- The overall mean COVID-19 up to date booster coverage was **43.7%**



Results: HCP Vaccination Coverage by Geographic Region



Results: Influenza and COVID-19 Booster Coverage by Facility Characteristics and Results of Negative Binomial Models

	Influenza Vaccination Coverage			COVID-19 Booster Dose Coverage		
	Mean %	RR	P-value	Mean %	RR	P-value
Region**						
Pacific/ Non-contiguous	81.05%	ref		81.47%	ref	
Northeast	52.81%	0.60	<.0001	53.44%	0.64	<.0001
Midwest	79.82%	0.82	0.0519	43.70%	0.48	<.0001
Mountain	62.22%	0.67	<.0001	38.53%	0.39	<.0001
South	71.14%	0.79	0.0118	36.09%	0.39	<.0001
Urbanicity						
Large core metro	62.48%	ref		53.11%	ref	
Large fringe metro	57.86%	1.00	0.9611	45.68%	0.98	0.721
Medium metro	66.62%	1.13	0.0594	44.14%	1.10	0.1881
Small metro	65.69%	1.04	0.7051	39.27%	0.90	0.3137
Rural	76.06%	1.14	0.114	48.14%	1.10	0.3004
Noncore	74.57%	1.08	0.4172	44.21%	1.11	0.3993
SVI						
Low	66.70%	ref		44.14%	ref	
Medium	65.40%	0.91	0.1822	48.70%	0.99	0.8729
High	66.56%	0.88	0.2101	41.09%	0.86	0.162
Ownership**						
Non-Profit	74.14%	ref		48.55%	ref	
Profit	58.14%	0.88	0.0114	46.66%	0.88	0.0213
Government	78.01%	0.90	0.527	63.91%	0.93	0.6884
Location**						
Freestanding Clinic	61.89%	ref		45.09%	ref	
Freestanding Clinic Owned by Hospital	86.00%	1.33	0.0011	61.25%	1.32	0.003
Hospital-Based Clinic	81.16%	1.22	0.0112	59.68%	1.30	0.0023
Size						
Small	70.80%	ref		47.69%	ref	
Medium	63.45%	0.96	0.5009	45.15%	1.02	0.7756
Large	58.85%	0.90	0.0634	48.90%	1.02	0.7969

Discussion

- COVID-19 primary series vaccination coverage was high, but less than half of HCP received a booster dose
- Two-thirds of HCP received the influenza vaccine
- Coverage of both vaccines varied by region and was lower in hemodialysis facilities without hospital affiliations and in for-profit facilities
- These aggregate data were self-reported by facilities on behalf of HCP, which limited the analysis to facility-level characteristics and may have led to an underestimate of vaccination acquired outside of the facility

Public Health Action

- To optimize protection of HCP and hemodialysis patients from vaccine preventable respiratory viruses, there is a need to promote evidence-based strategies to increase influenza and COVID-19 vaccination coverage among HCP in dialysis facilities

- Vaccination campaign strategies tailored by region and focusing on hemodialysis facilities that are for-profit and/or not affiliated with a hospital may increase vaccination coverage

Thank You

For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 cdc.gov