

COVID-19 Vaccination Among Hospitalized Patients at Seattle Children's Hospital

Hanna M. Schlaack

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Committee:

Daniel A. Enquobahrie

Annika M. Hofstetter

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Hanna M. Schlaack

University of Washington

**Abstract**

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Hanna M. Schlaack

Chair of Supervisory Committee

Daniel A. Enquobahrie

Department of Epidemiology

COVID-19 vaccines are recommended for children and adolescents 5-17 years old; however, little available data have described children and adolescents who have been vaccinated against COVID-19, particularly those who are at the highest risk of complications. This study aimed to characterize hospitalized patients 5-17 years old who received a COVID-19 vaccine before hospital admission and identify the demographic, clinical, and visit factors associated with COVID-19 vaccination status at the time of hospital admission. In addition, this study aimed to describe those who received a COVID-19 vaccine during hospitalization.

Electronic medical record data were used to obtain information for describing COVID-19 vaccination status before and during hospitalization among 5-17 year-old Washington State residents who were hospitalized on the medical, surgical, psychiatry and behavioral medicine, or rehabilitation unit at Seattle Children's Hospital between October 1<sup>st</sup>, 2021 and April 15<sup>th</sup>, 2022. Multivariable logistic regression was used to estimate adjusted odds ratios (AOR) and 95%

confidence intervals (CI) for associations between demographic, clinical, and visit factors and COVID-19 vaccination status at the time of hospital admission.

Of the 2,004 patients included in the study, 680 (33.9%) had received at least one dose of a COVID-19 vaccine before hospital admission. Patients had lower odds of having already received a COVID-19 vaccine before hospital admission if they were 5-11 years old (vs. 16-17 years old, AOR: 0.36; CI: 0.27-0.48) or were publicly insured or uninsured (vs. privately insured, AOR: 0.48; CI: 0.38-0.61). Those who had received an influenza vaccine in the 2020-21 or 2021-22 season before admission (vs. those who did not receive an influenza vaccine in the 2020-21 or 2021-22 season before admission) had higher odds (AOR: 3.76; CI: 2.90-4.91) of having received a COVID-19 vaccine before admission. Of the 2,004 patients included in the study, only 31 patients (1.5%) received a COVID-19 vaccine during hospitalization. The majority of these patients had complex chronic conditions (67.7%) and were admitted to a medical unit (70.4%).

This study revealed significant associations between certain demographic and clinical factors and COVID-19 vaccination status at the time of hospital admission. Low incidence of COVID-19 vaccination among inpatients during their hospital stay represents a missed opportunity to administer vaccines to high-risk children. These findings may be used to inform interventions to increase COVID-19 vaccine uptake among patients in pediatric hospital settings.

## Introduction

COVID-19 leads to significant morbidity and mortality among children in the United States<sup>1-3</sup>. COVID-19 vaccines are safe for children, and the benefits of vaccination against COVID-19, including protection from severe COVID-19 disease and death, have been shown to outweigh any associated risks<sup>2,3</sup>. Therefore, COVID-19 vaccination of eligible children has been a priority. Starting in late 2020, children became eligible to receive a COVID-19 vaccine via emergency use authorization (EUA) by the U.S. Food and Drug Administration. Children of different ages became eligible to receive COVID-19 vaccines at different times. Those 16 and older became eligible for COVID-19 vaccination at the same time as adults in December 2020<sup>4</sup>. EUA followed for the 12-15 year-old age group in May 2021<sup>5</sup> and for the 5-11 year-old age group in October 2021<sup>6</sup>.

Currently, there are little data describing pediatric populations who have been vaccinated against COVID-19. Previous research has assessed parent and caregiver attitudes about pediatric COVID-19 vaccination and their willingness to vaccinate their children once a pediatric COVID-19 vaccine became available<sup>7-10</sup>. These studies, however, did not quantify or characterize the population of children who have received COVID-19 vaccinations. Other studies have described trends in adolescent COVID-19 vaccination using parental report of COVID-19 vaccination status and demographic factors that may be associated with COVID-19 vaccination status<sup>11,12</sup>. However, these studies did not report on clinical and visit factors related to COVID-19 vaccination and did not include data for children 5-11 years old, who have more recently become eligible to receive a COVID-19 vaccine. It is also important to understand COVID-19 vaccination rates of hospitalized children, given that an estimated 70% have chronic disease that make them particularly vulnerable to COVID-19<sup>13</sup>. Previous research has shown that among

children with a COVID-19 diagnosis, those with chronic conditions have a higher risk of being hospitalized and experiencing severe illness when hospitalized, compared to children without chronic disease<sup>14</sup>.

The current study assessed COVID-19 vaccination status at the time of admission for patients hospitalized at Seattle Children's Hospital in order to determine the prevalence of COVID-19 vaccination among hospitalized children and investigate factors associated with COVID-19 vaccination status. Better understanding of factors associated with COVID-19 vaccination status can inform interventions for increasing COVID-19 vaccine uptake and potentially tailor interventions to reach those who are most vulnerable. In addition to assessing COVID-19 vaccination status at the time of admission, this study characterized patients who received a COVID-19 vaccine during their hospitalization. These data will provide insight into the number of COVID-19 vaccines being administered to inpatients for planning of appropriate interventions.

## Methods

### **Study Setting and Population**

This cross-sectional study was conducted at Seattle Children's Hospital (SCH), a large pediatric medical center located in Seattle, WA. The study population included patients ages 5 to 17 years old who were admitted to the medical, surgical, rehabilitation, or psychiatry and behavioral medicine unit at SCH from October 1<sup>st</sup>, 2021 to April 15<sup>th</sup>, 2022. Patients 5-11 years old admitted before a COVID-19 vaccine was officially recommended for their age group on November 2<sup>nd</sup>, 2021 were excluded from analyses. The study population was limited to Washington residents, for whom state vaccination registry data were potentially available.

### **Data Source**

Patient demographic, clinical, and visit information was abstracted from the SCH electronic medical record (EMR) system. As COVID-19 vaccines became available for children, SCH began providing COVID-19 vaccines to inpatients during their hospital stay. These vaccine administrations were documented in the EMR. COVID-19 vaccine doses administered outside of SCH are captured in the patient's record given the bi-directional exchange of vaccine administration information between the SCH EMR and the Washington State Immunization Information System (WAIS). Past evaluations have found childhood vaccine administration data from the WAIS to be highly complete and accurate<sup>15</sup>. The Washington State Department of Health requires COVID-19 vaccine providers to report COVID-19 vaccine administration information within 24 hours; given this requirement, COVID-19 vaccination data are also likely highly complete and accurate<sup>16</sup>. For those patients who were admitted to SCH more than once during the study period, only data from their first admission were considered in analyses.

## **Outcome Measures**

The primary outcome of interest, COVID-19 vaccination status at the time of hospital admission, was operationalized as a binary outcome describing patients who had received at least one COVID-19 vaccine before hospital admission versus those who had not received a COVID-19 vaccine before hospital admission. Receipt of a COVID-19 vaccine during hospitalization was an additional outcome of interest assessed among inpatients. For the latter, doses received as part of their initial two-dose series as well as booster doses were included in analyses.

## **Exposures of interest**

Demographic factors of interest included patient age group at the time of admission (5-11 years, 12-15 years, 16-17 years), sex (female, male), race, ethnicity (Hispanic, Non-Hispanic), language (English, Other), and insurance status (private, public, uninsured). These data were verified with patients' families during registration at the time of admission. Race was collapsed into White, Black, Asian, and Multiracial/Other. The Multiracial/Other category included those patients who identify as more than one race, American Indian or Alaska Native (AI/AN), Native Hawaiian or Other Pacific Islander (NH/PI), or another race not otherwise specified. While included in the Multiracial/Other category for analyses, AI/AN and NH/PI data were disaggregated where possible. According to best practices, those who reported AI/AN or NH/PI race in combination with another race were included in the AI/AN and NH/PI racial categories<sup>17,18</sup>.

Clinical factors of interest included history of a positive COVID-19 test (positive COVID-19 test documented before hospital admission, no positive COVID-19 test documented before hospital admission), Pediatric Medical Complexity Algorithm categorization<sup>19</sup>, and influenza vaccination status at the time of admission (influenza vaccine received in either the 2020-21 or 2021-22

season, no influenza vaccine received in previous or current season). The Pediatric Medical Complexity Algorithm categorization is a publicly available algorithm that can be used to classify children with complex chronic disease, noncomplex chronic disease, or no chronic disease using hospital discharge data. Studies have shown this algorithm to have good sensitivity and specificity<sup>19</sup>.

Information collected to assess visit factors included hospital admission and discharge dates, which were used to calculate length of stay, hospital service (medicine, surgery, psychiatry and behavioral medicine, rehabilitation), as well as receipt of an influenza vaccine during hospitalization.

### **Data Analysis**

Descriptive statistics were used to summarize study population characteristics, including patient age, sex, race, ethnicity, language, insurance status, chronic disease status, influenza vaccination status at the time of admission, and history of a positive COVID-19 test result. Since children of different ages became eligible to receive a COVID-19 vaccine at different times, descriptive statistics were assessed among each age group in addition to the overall study population.

Vaccination data obtained from the EMR were used to assess the prevalence of COVID-19 vaccination at the time of admission and the incidence of COVID-19 vaccination during hospitalization among the overall study population. Among the patients who received a COVID-19 vaccine during hospitalization, further descriptive analyses were conducted to describe visit factors such as hospital service, length of stay, and inpatient influenza vaccine administration.

Multivariable logistic regression was used to assess the association between demographic and clinical factors of interest and COVID-19 vaccination status at the time of admission. Adjusted

odds ratios (AOR) and 95% confidence intervals (CI) were calculated to estimate the association of sex, age, race, ethnicity, language, insurance status, chronic disease status, and influenza vaccination status with COVID-19 vaccination status in the overall study population.

Given previous research that suggests COVID-19 vaccine uptake may vary by racial group<sup>7,8,11,12</sup>, stratified multivariable logistic regression analyses were used to assess effect modification of White, Black, and Asian race on the potential associations of age, sex, insurance status, language, chronic disease status, and influenza vaccination status with COVID-19 vaccination status. Likelihood ratio tests were used to determine if models containing an interaction term for race and exposures of interest offered significantly better fit compared to the overall model. Given the heterogeneity of the racial identities included in the Multiracial/Other category, Multiracial/Other race was not assessed in stratified analyses.

P-values were based on two-tailed tests ( $\alpha < 0.05$ ). R version 4.1.2 was used to conduct all statistical analyses. The Seattle Children's Institutional Review Board approved the collection and use of these data in project-related analyses.

## Results

Between October 1<sup>st</sup>, 2021 and April 15<sup>th</sup>, 2022, a total of 2,004 eligible patients 5 to 17 years old were admitted to the medical, surgical, psychiatry and behavioral medicine, or rehabilitation unit at SCH (Figure 1). Most patients were White (52.7%), non-Hispanic (73.3%), and English-speaking (86.3%). The majority of patients had a chronic condition (75.6%), had not received an influenza vaccine in the 2020-21 or 2021-22 season at the time of their admission (82.1%), and had no history of a positive COVID-19 test documented in their medical record (96.8%).

Demographic and clinical characteristics were similar across age groups (Table 1).

At the time of admission, 680 (33.9%) patients had already received at least one dose of a COVID-19 vaccine. Prevalence of COVID-19 vaccination was highest in the age group of children 16-17 years old (43.3%), followed by children 12-15 years old (39.9%), and children 5-11 years old (23.2%). The odds of having received at least one dose of the COVID-19 vaccine before admission were lower for patients who were 5-11 years old (vs. 16-17 years old, AOR: 0.36; CI 0.27-0.48) and for those that were publicly insured or uninsured (vs. privately insured, AOR: 0.48; CI: 0.38-0.61) (Table 2). For patients who had received an influenza vaccine in either the 2020-21 or 2021-22 season, the odds of having received at least one dose of the COVID-19 vaccine before admission were higher (AOR: 3.76; CI: 2.90-4.91) compared to patients who had not received an influenza vaccine in the previous or current season. In unadjusted analyses, NH/PI and Hispanic children had lower rates of COVID-19 vaccination compared to White children and non-Hispanic children, respectively. Conversely, children with complex chronic disease had a higher rate of COVID-19 vaccination compared with children who had no chronic disease. These associations were not significant after adjustment for potential confounders, though this may be related to sample size limitations.

In general, differences in associations of most demographic and clinical factors with COVID-19 vaccine status at the time of admission were not observed across patients who identify as White, Black, or Asian (Table 3). White patients who were publicly insured or uninsured were significantly less likely to be already vaccinated against COVID-19 at the time of admission (AOR: 0.44; CI: 0.34-0.63), but this association was not significant among Black (AOR: 0.54; 0.23-1.24) or Asian (AOR: 1.15; 0.49-2.72) patients.

A total of thirty-one patients, representing all three age groups, received a COVID-19 vaccine during hospitalization. The majority of patients who received a COVID-19 vaccine during hospitalization had complex chronic conditions (67.7%) and were admitted to the medical unit (70.4%). Of these patients, ten also received an influenza vaccine during hospitalization. The median length of stay for patients who received a COVID-19 vaccine during hospitalization was nine days, with the minimum stay being one day and the maximum stay being ninety-six days. Most had no history of COVID-19 vaccination (64.5%). One patient received two doses of the COVID-19 vaccine during their hospital stay.

## Discussion

This study offers a unique perspective of COVID-19 vaccination among high-risk children through its evaluation of demographic, clinical, and visit factors associated with COVID-19 vaccination in a large, diverse group of hospitalized children with varying medical needs. Importantly, this study identified older age group, private insurance, and recent receipt of an influenza vaccine as factors significantly associated with higher COVID-19 vaccination. The overall COVID-19 vaccination rate at the time of admission was 33.9%. Few patients were found to have been vaccinated against COVID-19 during hospitalization, with an overall hospital vaccination rate of 1.5%. These data may guide future studies related to COVID-19 vaccination in children.

The age-related findings of this study were as expected. The respiratory season began several weeks before COVID-19 vaccine was approved for emergency use in children ages 5-11 years old on October 29<sup>th</sup>, 2021 and recommended by the Advisory Committee on Immunization Practices (ACIP) and Centers for Disease Control and Prevention (CDC) on November 2<sup>nd</sup>, 2021. Given that children 5-11 years old had less opportunity to receive a COVID-19 vaccination compared to children 12-15 years old and children 16-17 years old, it is reasonable that the prevalence of COVID-19 vaccination at the time of admission was lower in this group. However, even nearly 6 months after a COVID-19 vaccine became available for children 5-11 years old, national data show that COVID-19 vaccination in this age group is still lagging compared to older age groups. In April 2022, only about 35% of children 5-11 years old had received at least one dose of the COVID-19 vaccine compared to 68% of children and adolescents 12-17 years old<sup>20</sup>. These findings indicate that greater efforts are needed to increase vaccine uptake in the 5–11-year-old age group.

Compared to patients with private insurance, those who were publicly insured or uninsured were found to have significantly lower odds of COVID-19 vaccination. This finding is consistent with trends seen in vaccination rates among publicly insured or uninsured children and adolescents for other needed vaccines<sup>21,22</sup>. Hospitals have previously been identified as an important alternative setting for vaccination, especially in cases where patients lack access to preventive care<sup>23</sup>.

Hospitals serving high numbers of publicly insured or uninsured patients should take advantage of the opportunity to administer COVID-19 vaccines during admission, as publicly insured or uninsured patients are less likely to have a medical home or usual source of care<sup>24</sup>.

The direction of potential associations between insurance status and COVID-19 vaccination status varied for patients identifying as White, Black, and Asian. Among White patients, those who were publicly insured or uninsured were found to have lower odds of COVID-19 vaccination. This association was not observed among Black or Asian patients, possibly due to small sample size. Of note, while race was not found to be significantly associated with COVID-19 vaccination status at the time of admission in adjusted analyses and analyses stratified by race showed similar results, the rate of COVID-19 vaccination at the time of admission was highest for Asian patients. This finding is consistent with previous research that has identified Asian race as a factor predicting increased willingness of parents to vaccinate their children against COVID-19<sup>7,8,11</sup>.

Recent receipt of influenza vaccine was found to be a strong predictor of COVID-19 vaccination status at the time of admission, with patients who had recently received an influenza vaccine being much more likely to have already received a COVID-19 vaccine at the time of hospital admission compared to patients who had not received an influenza vaccine in a recent season. This finding supports previous research conducted before COVID-19 vaccine became available

for children, showing that caregiver willingness to accept a COVID-19 vaccine for their child was associated with a history of influenza vaccination<sup>8-10</sup>.

Previous influenza vaccination research has highlighted hospital encounters as an opportunity to increase influenza vaccine uptake among children<sup>25-27</sup>. Hospital-based COVID-19 vaccination programs have the potential to achieve similar results by utilizing existing infrastructure for delivering the influenza vaccine and other routine vaccines to inpatients<sup>28</sup>. Overall, this study revealed low incidence of COVID-19 vaccination during hospitalization, with only thirty-one vaccinations among 2,004 unique patient admissions. However, these data suggest that it is possible to administer COVID-19 vaccines to children with a wide range of chronic conditions who are admitted to various hospital units even during short stays. These data also show the promise of administering both COVID-19 and influenza vaccines to children during the same encounter. Of the fifteen patients who received a COVID-19 vaccine during their hospital stay and were not already vaccinated against influenza during the 2021-22 season at the time of admission, ten patients (66.6%) received an influenza vaccine during their admission. In two of these cases, patients received their COVID-19 and influenza vaccines on the same day. In future respiratory seasons, co-administering COVID-19 and influenza vaccines to eligible patients could help provide protection to vulnerable children from serious respiratory disease.

The ability to confirm COVID-19 vaccination and characterize chronic disease status using EMR information is a strength of this study design. This study also has several limitations. First, this study is cross-sectional, capturing patient vaccination status during their first admission of the study period. It is possible that as the season progressed, patients who were not vaccinated against COVID-19 at the time of their hospital admission received a COVID-19 vaccine. The cross-sectional study design also limits the strength of the causal statements that can be made

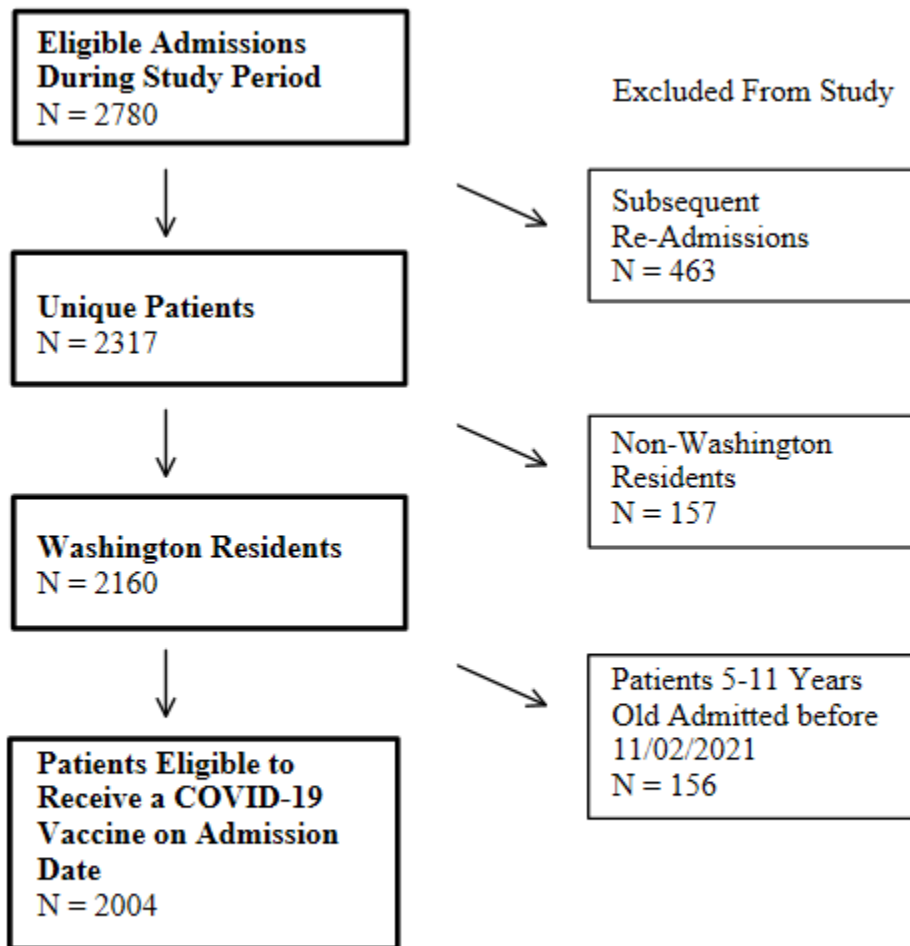
about the association between factors of interest and COVID-19 vaccination status. An additional limitation is that the primary outcome was defined as any COVID-19 vaccination before hospital admission. At the start of the study period, two doses of the COVID-19 vaccine were recommended for most children to be considered fully vaccinated. The CDC expanded their recommendation to include a booster dose five months after completion of an initial two-dose series for children 12-15 years old in January 2022<sup>29</sup> and children 5-11 years old in May 2022<sup>30</sup>. Partial vaccination was not considered in this analysis. The secondary outcome, receipt of a COVID-19 vaccine during hospitalization, was assessed among all inpatients. However, not all patients may have been eligible to receive a COVID-19 vaccine during admission due to contraindications or because they were fully vaccinated against COVID-19 or had started the COVID-19 vaccine series and were not within window to receive their next COVID-19 dose during hospitalization. Further limitations are related to the generalizability of the research findings. The study population was limited to hospitalized children who were Washington State residents. Findings may be generalized to inpatient pediatric populations in states with comparable rates of COVID-19 vaccination<sup>20</sup>. Finally, there may be missing WAIS data for some Washington State residents due to the matching algorithm linking patient records in WAIS and the SCH EMR and possible under-reporting of vaccine administrations to WAIS.

## Conclusion

This study identified low levels of COVID-19 vaccination among 5-17 years old children at the time of hospital admission and during hospitalization. Factors associated with COVID-19 vaccination included patient age group, insurance status, and recent influenza vaccination. Vaccinating children against COVID-19 is a key strategy for controlling the COVID-19 pandemic, and these findings may help identify children who could benefit from targeted interventions to increase vaccine uptake. These findings also highlight hospital encounters as a currently under-utilized opportunity to administer COVID-19 vaccines to high-risk children. Further investigation of factors associated with COVID-19 vaccination in a larger cohort of children is needed. Future research is also needed to assess the potential role of additional factors that may contribute to missed COVID-19 vaccination opportunities during hospital admissions, such as parent risk perception, provider communication, lack of standing orders, and other logistical challenges.

Appendices

**Figure 1**



**Table 1: Characteristics of Washington Residents 5-17 Years Old Admitted to Medical, Surgical, Rehabilitation, or Psychiatry and Behavioral Medicine Units at Seattle Children's Hospital between October 1, 2021 and April 15, 2022**

	<b>Total Cohort (%) N= 2004</b>	<b>5-11 Years (%) N= 796</b>	<b>12-15 Years (%) N= 827</b>	<b>16-17 Years (%) N= 381</b>
<b>Sex</b>				
Female	1049 (52.3)	340 (42.7)	485 (58.6)	224 (58.8)
Male	955 (47.7)	456 (57.3)	342 (41.4)	157 (41.2)
<b>Race</b>				
White	1056 (52.7)	399 (50.1)	452 (54.7)	205 (53.8)
Black	137 (6.8)	52 (6.5)	58 (7.0)	27 (7.1)
Asian	156 (7.8)	69 (8.7)	56 (6.8)	31 (8.1)
Multiracial/Other <sup>1</sup>	526 (26.2)	233 (29.3)	101 (24.3)	92 (24.1)
American Indian or Alaska Native	44 (2.2)	18 (2.3)	20 (2.4)	6 (1.6)
Native Hawaiian or Other Pacific Islander	33 (1.6)	17 (2.1)	13 (1.6)	3 (0.8)
NA	129 (6.4)	43 (5.4)	60 (7.3)	26 (6.8)
<b>Ethnicity</b>				
Not Hispanic	1468 (73.3)	582 (73.1)	603 (72.9)	283 (74.2)
Hispanic	427 (21.3)	186 (23.4)	169 (20.4)	72 (18.9)
NA	109 (5.4)	28 (3.5)	55 (6.7)	26 (6.8)
<b>Language</b>				
English-Speaking	1730 (86.3)	677 (85.1)	733 (88.6)	320 (84.0)
Non-English-Speaking	274 (13.7)	119 (14.9)	94 (11.4)	61 (16.0)
<b>Insurance Status</b>				
Private	1040 (51.9)	374 (47.0)	461 (55.7)	205 (53.8)
Public/Uninsured	964 (48.1)	422 (53.0)	366 (44.3)	176 (46.2)
<b>Chronic Disease Status</b>				
Non-chronic	490 (24.5)	231 (29.0)	164 (19.8)	95 (24.9)
Non-complex Chronic	709 (35.4)	252 (31.7)	321 (38.8)	136 (35.7)
Complex Chronic	805 (40.2)	313 (39.3)	342 (41.4)	150 (39.4)
<b>Flu Vaccination Status at Admission</b>				
No vaccination in 2020-21 or 2021-22 Season	1646 (82.1)	631 (79.3)	699 (84.5)	316 (82.9)
Vaccinated in 2020-21 or 2021-22 Season	358 (17.9)	165 (20.7)	128 (15.5)	65 (17.1)
<b>Hx Positive COVID-19 Result<sup>2</sup></b>				
Yes	65 (3.2)	25 (3.1)	26 (3.1)	14 (3.7)
No	1939 (96.8)	769 (96.9)	799 (96.9)	365 (96.3)

<sup>1</sup> For purposes of analyses, those who identify as American Indian or Alaska Native (AI/AN) and Native Hawaiian or Pacific Islander (NH/PI) will be included Multiracial/Other race category.

One patient in the 5-11 year age group, one patient in the 12-15 year age group, and one patient in the 16-17 year age group identified as both AI/AN and NH/PI.

<sup>2</sup> Due to concern for missing data, history of a positive COVID-19 test result was not included in the logistic regression model.

**Table 2: Associations between Demographic, Clinical, and Visit Factors and COVID-19 Vaccination Status at Hospital Admission**

	<b>Not Yet Vaccinated (%)</b> N = 1324	<b>Already Vaccinated (%)</b> N = 680	<b>Crude OR (95% CI)</b>	<b>Adjusted OR (95% CI)</b>
<b>Age</b>				
16-17	216 (56.7)	165 (43.3)	Ref	Ref
12-15	497 (60.1)	330 (39.9)	0.87 (0.68-1.11)	0.88 (0.67-1.15)
5-11	611 (76.8)	185 (23.2)	0.40 (0.31-0.52)***	0.36 (0.27-0.48)***
<b>Sex</b>				
Female	674 (64.3)	375 (35.7)	Ref	Ref
Male	650 (68.1)	305 (31.9)	0.84 (0.70-1.02)	0.90 (0.73-1.11)
<b>Race</b>				
White	682 (64.6)	374 (35.4)	Ref	Ref
Black	90 (65.7)	47 (34.3)	0.96 (0.66-1.39)	1.13 (0.74-1.69)
Asian American	93 (59.6)	63 (40.4)	1.25 (0.89-1.75)	1.26 (0.86-1.85)
Multiracial/Other <sup>1</sup>	359 (68.3)	167 (31.7)	0.85 (0.68-1.05)	1.03 (0.78-1.37)
American Indian or Alaska Native	33 (75.0)	11 (25.0)	0.61 (0.29-1.20)	-
Native Hawaiian or Pacific Islander	28 (84.8)	5 (15.2)	0.33 (0.11-0.81)*	-
<b>Ethnicity</b>				
Non-Hispanic	945 (64.4)	523 (35.6)	Ref	Ref
Hispanic	297 (69.6)	130 (30.4)	0.79 (0.63-0.99)*	1.02 (0.75-1.40)
<b>Language</b>				
English Speaking	1131 (65.4)	599 (34.6)	Ref	Ref
Non-English Speaking	193 (70.4)	81 (29.6)	0.79 (0.59-1.04)	0.98 (0.68-1.41)
<b>Insurance Status</b>				
Private	616 (59.2)	424 (40.8)	Ref	
Public/Uninsured	708 (73.4)	256 (26.6)	0.52 (0.43-0.63)***	0.48 (0.38-0.61)***
<b>Chronic Disease Status</b>				
Non-chronic	342 (69.8)	148 (30.2)	Ref	Ref
Non-complex Chronic	494 (69.7)	215 (30.3)	1.01 (0.78-1.29)	0.87 (0.66-1.15)
Complex Chronic	488 (60.6)	317 (39.4)	1.50 (1.18-1.91)***	1.27 (0.98-1.66)
<b>Flu Vaccination Status at Admission</b>				
No vaccination in 2020-21 or 2021-22 Season	1168 (71.0)	478 (29.0)	Ref	Ref
Vaccinated in 2020-21 or 2021-22 Season	156 (43.6)	202 (56.4)	3.16 (2.50-4.00)***	3.76 (2.90-4.91) ***

\* p <0.05, \*\* p <0.01, \*\*\* p <0.001

<sup>1</sup> Those who identify as American Indian and Alaska Native and Native Hawaiian and Pacific Islander included in Multiracial/Other race category for logistic regression

**Table 3: Assessment of Race Effect Modification on the Associations between Demographic, Clinical, and Visit Factors and COVID-19 Vaccination Status at Hospital Admission**

	<b>White Adjusted OR (95% CI)</b>	<b>Black Adjusted OR (95% CI)</b>	<b>Asian Adjusted OR (95% CI)</b>
<b>Age</b>			
16-17	Ref	Ref	Ref
12-15	0.72 (0.50-1.03)	0.51 (0.19-1.38)	1.28 (0.49-3.43)
5-11	0.35 (0.24-0.51)***	0.27 (0.09-0.80)*	0.33 (0.12-0.86)*
<b>Sex</b>			
Female	Ref	Ref	Ref
Male	0.95 (0.72-1.25)	0.90 (0.41-1.99)	1.79 (0.86-3.77)
<b>Ethnicity</b>			
Non-Hispanic	Ref	Ref	Ref
Hispanic	1.08 (0.65-1.76)	1.41 (0.26-6.61)	1.94 (0.06-62.80)
<b>Language</b>			
English Speaking	Ref	Ref	Ref
Non-English Speaking	0.51 (0.14-1.52)	0.41 (0.10-1.30)	0.67 (0.26-1.65)
<b>Insurance Status</b>			
Private	Ref	Ref	Ref
Public/Uninsured	0.44 (0.34-0.63)***	0.54 (0.23-1.24)	1.15 (0.49-2.72)
<b>Chronic Disease Status</b>			
Non-chronic	Ref	Ref	Ref
Non-complex Chronic	0.94 (0.65-1.36)	1.00 (0.31-3.47)	0.91 (0.35-2.36)
Complex Chronic	1.49 (1.04-2.14)*	1.25 (0.40-4.24)	1.38 (0.54-3.63)
<b>Flu Vaccination Status at Admission</b>			
No vaccination in 2020-21 or 2021-22 Season	Ref	Ref	Ref
Vaccinated in 2020-21 or 2021-22 Season	4.36 (3.03-6.35)***	2.57 (1.03-6.57)*	4.59 (1.88-11.97)**

\* p <0.05, \*\* p <0.01, \*\*\* p <0.001

**Table 4: Characteristics of Washington Residents 5-17 Years Old Admitted to Medical, Surgical, Rehabilitation, or Psychiatry and Behavioral Medicine Units at Seattle Children’s Hospital Who Received a COVID-19 Vaccine During Admission between October 1, 2021 and April 15, 2022**

	<b>Total Cohort (%), N = 31</b>
<b>Sex</b>	
Female	18 (58.1)
Male	13 (41.9)
<b>Race and/or ethnicity</b>	
White	13 (41.9)
Black	1 (3.2)
Asian	6 (19.4)
Multiracial or Other	9 (29.0)
NA	2 (6.5)
<b>Ethnicity</b>	
Not Hispanic	20 (64.5)
Hispanic	9 (29.0)
NA	2 (6.5)
<b>Language</b>	
English Speaking	23 (74.2)
Non-English Speaking	8 (25.8)
<b>Insurance Status</b>	
Private	14 (45.2)
Public/Uninsured	17 (54.8)
<b>Chronic Disease Status</b>	
Non-chronic	1 (3.2)
Non-complex Chronic	9 (29.0)
Complex Chronic	21 (67.7)
<b>Flu Vaccination Status at Admission</b>	
No vaccination in 2020-21 or 2021-22 Season	15 (48.4.0)
Vaccinated in 2021-21 or 2021-22 Season	16 (51.6)
<b>Inpatient Flu Admin.</b>	
Received While Inpatient	10 (32.3)
Did Not Receive While Inpatient	21 (67.7)

**Table 4: Characteristics of Washington Residents 5-17 Years Old Admitted to Medical, Surgical, Rehabilitation, or Psychiatry and Behavioral Medicine Units at Seattle Children’s Hospital Who Received a COVID-19 Vaccine During Admission between October 1, 2021 and April 15, 2022 Cont.**

	<b>Total Cohort (%), N = 31</b>
<b>Hx Positive COVID-19 Result</b>	
Yes	-
No	31 (100)
<b>Hospital Service</b>	
Medicine	19 (70.4)
Surgery	7 (25.9)
Psychiatry	4 (12.9)
Rehabilitation	1 (3.7)
<b>Median Length of Stay in Days (IQR)</b>	9.0 (5.5-15.5)

<sup>1</sup> Interquartile range (IQR) reported for length of stay in days

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