Retrospective Analysis of Vaccinated and Unvaccinated Monoclonal Antibody Patients and their Emergent Needs (RAVEN) and Hospital Utilization

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Background

Monoclonal antibody (MAB) therapy was granted Emergency Use Authorization (EUA) by the US Food and Drug Administration (FDA) in response to the ongoing COVID-19 pandemic. Concurrent with MAB, different vaccines targeting the COVID-19 virus received FDA EUA authorization or approval. While vaccines aim to prevent patients from getting infected or developing symptoms, MAB aims to prevent patients with mild to moderate symptoms from progressing to severe disease.

Per EUA, MAB can only be administered at sites that respond to potential infusion-related adverse events. Spectrum Health provides MAB treatment at the outpatient COVID infusion clinic and mobile unit during scheduled appointments and in the ER to the sick patients that do not get admitted to the hospital following ER visit.

As COVID vaccination became widespread, breakthrough cases of COVID began to emerge. Unexpectedly, the administration of MAB was distributed in nearly equal proportion to patients vaccinated for COVID-19 and unvaccinated patients. This has raised the question of whether vaccinated and unvaccinated individuals respond differently to MAB therapy.

We evaluated the response of vaccinated (2 doses of Pfizer or Moderna or one dose of J&J) and unvaccinated COVID patients to MAB therapy by measuring ED and hospital utilization within 14 days and mortality rate within 30 days of MAB therapy.
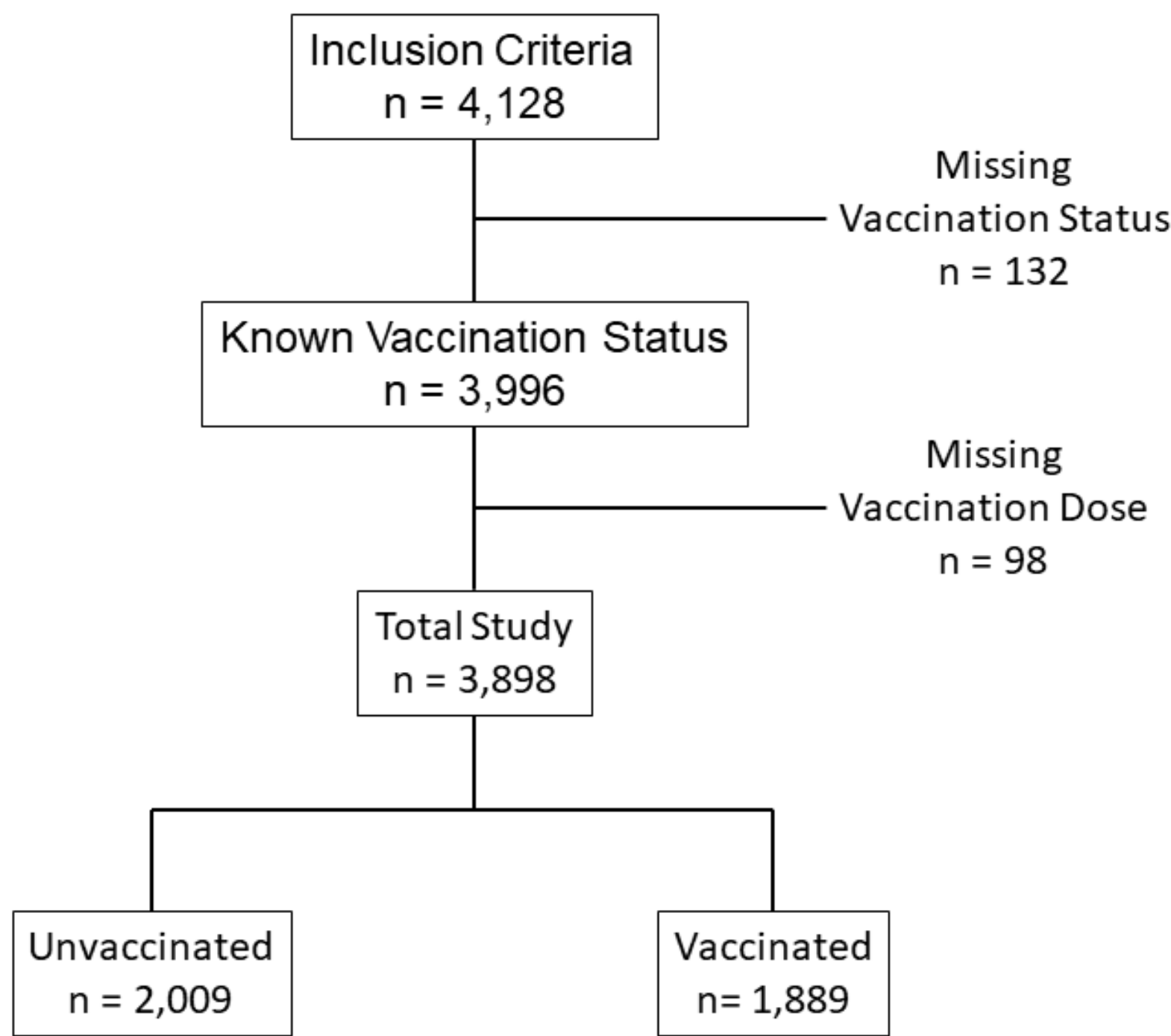
Methods

- Retrospective chart review of patients treated with MAB between March 1, 2021, and November 30, 2021.

- Vaccination Status: Patients who completed 2 doses of Pfizer or Moderna or one dose of J&J vaccine were considered vaccinated.

- Statistical Methods
  - Absolute risk
  - Chi-Square test assessed statistical significance at p value < 0.05.
  - Data collected from our patients were used to create models of estimated risk for unvaccinated individuals when compared to vaccinated individuals.

Figure 1: Subject Flow Diagram

Inclusion Criteria n = 4,128 → Missing Vaccination Status n = 132

Known Vaccination Status n = 3,996 → Missing Vaccination Dose n = 98

Total Study n = 3,898

Unvaccinated n = 2,009 | Vaccinated n = 1,889

Results

Table 1:
MAB Patient Demographics, n = 3898

Characteristic	n = 3,898	
	Vaccinated n = 1,889	Unvaccinated n = 2,009
Age (Years), mean ± SD	580 ± 18.8	52.4 ± 16.4
Sex, n (%)		
Female	1,059 (56.1)	1,147 (57.1)
Male	830 (43.9)	862 (42.9)
Race, n (%)		
Non-Hispanic/Latino	1,742 (92.2)	1,783 (88.7)
Black or African American	39 (2.1)	72 (3.6)
Hispanic/Latino	37 (2.0)	62 (3.1)
Other	34 (1.8)	40 (2)
Unknown	37 (2.0)	52 (2.6)
Insurance Status, n (%)		
Commercial	1,062 (56.2)	1,147 (57.1)
Medicare	656 (34.7)	459 (22.8)
Medicaid	78 (4.1)	223 (11.1)
Self Pay/Other	93 (4.9)	180 (9.0)
Disease Stage (Days from symptom onset when infused), n (%)		
Early (1-3)	288 (15.2)	361 (18.0)
Typical (4-7)	1,246 (66)	1,179 (58.7)
Late (8-10)	355 (18.8)	469 (23.3)
Location of Infusion		
Infusion Clinic	1,612 (85.3)	1,264 (62.9)
Emergency Department/ Observation	151 (8.0)	590 (29.4)
Mobile Unit	126 (6.7)	155 (7.7)

Table 2:
MAB Patient Comorbidities, n = 3898

Comorbidity	Incidence, n (%)	
	Vaccinated n = 1,889	Unvaccinated n = 2,009
Elevated BMI *	1,446 (76.5)	1,441 (71.7)
Hypertension	775 (41.0)	527 (26.2)
Smoker *	550 (29.1)	547 (27.2)
Lung Disease *	402 (21.3)	336 (16.7)
Cardiovascular Ds *	380 (20.1)	243 (12.1)
Diabetes *	324 (17.2)	222 (11.1)
Cancer *	200 (13.8)	118 (5.9)
Immunosuppression *	147 (7.8)	114 (7.2)
Chronic Kidney Ds *	119 (6.3)	70 (3.5)
Neurological Condition *	79 (4.2)	67 (3.3)
Pregnancy	13 (0.7)	33 (1.6)
Transplant Patient	27 (1.4)	9 (0.4)
Others	45 (2.4)	34 (1.7)
Number of Comorbidities per Patient		
Zero or One	560 (37.3)	940 (62.7)
Two	566 (49.9)	569 (50.1)
Three	404 (57.5)	298 (42.5)
Four or More	359 (64)	202 (36)

Used to develop RR models;
Patients may have multiple comorbidities

Figure 3: Outcomes Following MAB Therapy

Deaths | 12
Patients with Severe Disease | 25
Patients with Hospital Admissions | 154
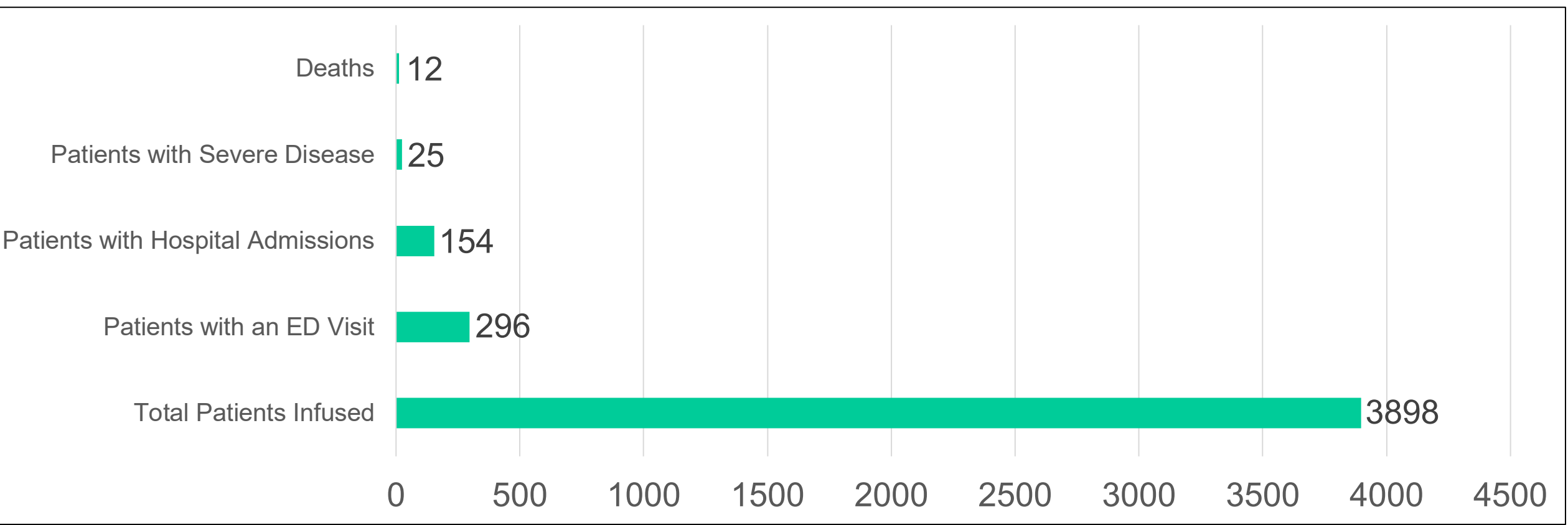Patients with an ED Visit | 296
Total Patients Infused | 3898

Figure 4: Comparison of Outcomes by Vaccination Status

Patients with Severe Diseaes | Vaccinated 6 | Unvaccinated 19
Patients with Hospital Admissions | Vaccinated 38 | Unvaccinated 116
Patients with an ED Visit | Vaccinated 79 | Unvaccinated 217

■ Vaccinated ■ Unvaccinated

Figure 4: Relative Risk by Vaccination Status
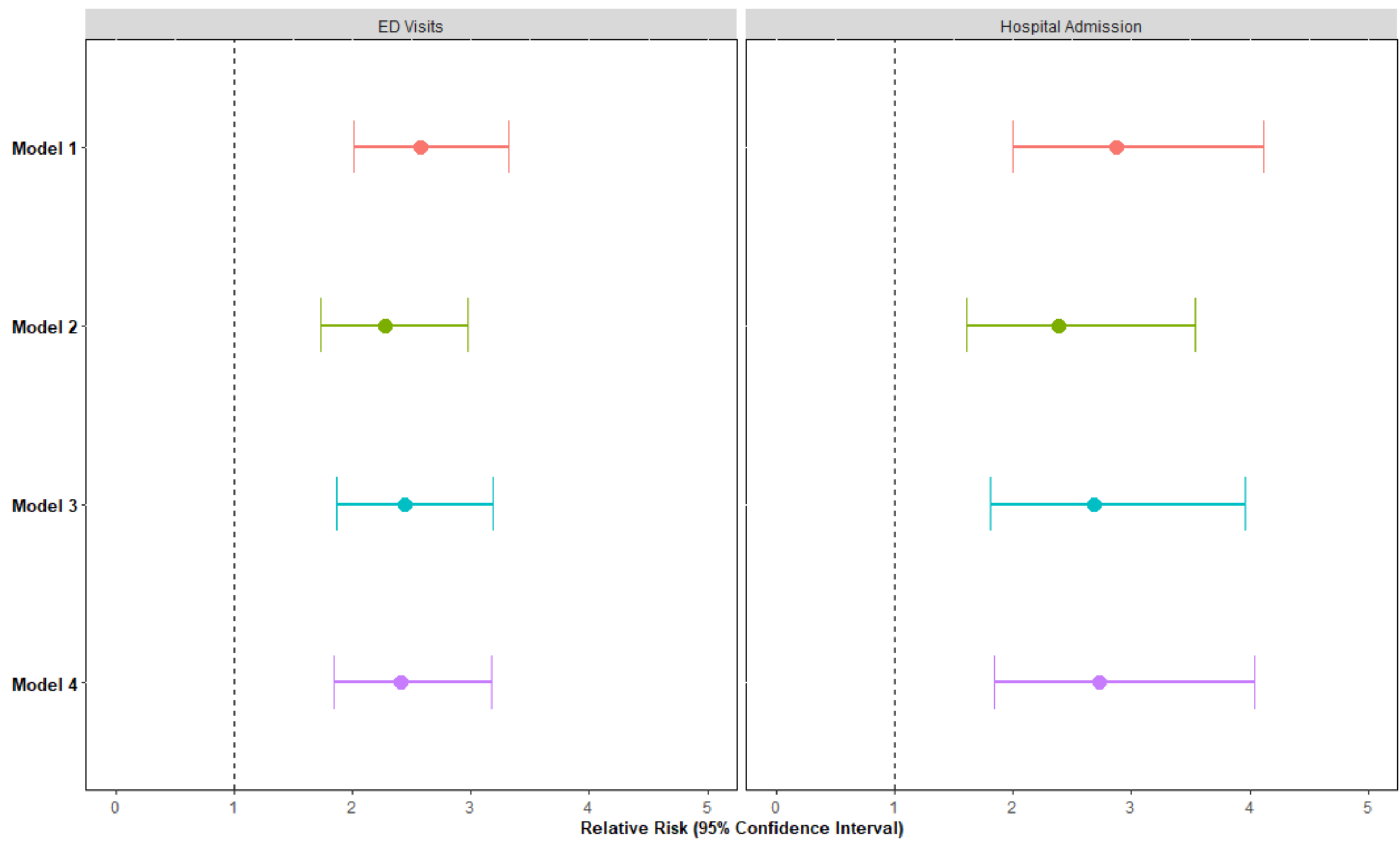
Risk is higher in all models for ED visits and hospital admissions in non vaccinated individuals
Model 1 – Unadjusted
Model 2 – Adjusted for financial class, infusion location, patient sex, patient age, patient race, and time to infusion
Model 3 – Model 2 Variables + Comorbidity Count
Model 4 – Model 2 + Specific Comorbidities (diabetes, cancer, immunosuppression, BMI, chronic kidney disease, cardiovascular disease, lung disease, neurological disorders, and smoking)

Discussion

- From 3898 included patients, 51.5% were unvaccinated. Groups were similar in terms of age and gender distribution. Non-Hispanic Caucasians made up most of patients in both vaccinated and unvaccinated groups (92.2% and 88.7%), suggesting racial and ethnic disparities potentially due to a lack of access to healthcare.
- All comorbidities except pregnancy were predominant in the vaccinated cohort. We also found a positive correlation between the number of comorbidities and vaccination rates.
- Overall, morbidity and mortality in treated patients were low. Of the 3898 treated patients, 296 (7.59%) had at least one ED visit and 154 (3.95%) were hospitalized within 14 days. 12 patients (0.31%) died within 30 days following MAB administration.
- Compared with vaccinated, unvaccinated patients had a 2.41 higher risk of seeking help in the ED and a 2.73 higher risk of getting hospitalized.
- Unvaccinated patients were treated more frequently in the ED (29.4% vs. 8%) and the late stage of disease (12% vs. 9.1%), suggesting that they might be sicker at the time of treatment, despite having fewer comorbidities at baseline.

Conclusion

- Vaccinated patients utilized hospital resources and progressed to severe disease less frequently than our unvaccinated patients.
- The association between timing of MAB therapy administration and hospital utilization may vary according to vaccination status.

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