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Immunosuppressive Conditions Are Associated With Poor Outcomes in Patients Hospitalized for COVID-19

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BACKGROUND

- Adults with immunosuppressive conditions (solid organ transplant, HIV infection, primary immunodeficiency (PI)) are more likely to develop severe COVID-19
- Less is known about outcomes of severe COVID-19 for adults with specific immunosuppressive conditions

OBJECTIVE

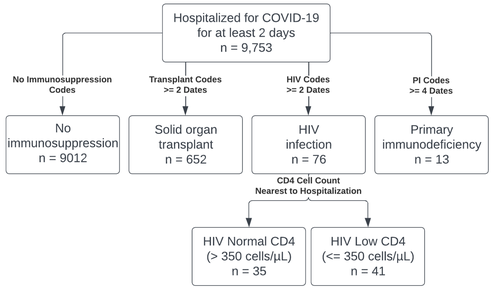
- Describe differences in hospitalization length, ICU length of stay, mortality, and ventilation requirements for adults with a history of transplant, HIV, or PI hospitalized for COVID-19 compared to immunocompetent adults hospitalized for COVID-19

DATA SOURCE

- Electronic health record (EHR) data from patients hospitalized for COVID-19 at Northwestern Medicine (NM) from March 1, 2020 to May 31, 2022

METHODS

- Diagnosis codes extracted from EHR data were used to determine immune status
- Manual chart review of portions of the cohort was performed to validate the phenotypes
- Demographics and outcomes information was extracted from the EHR
- Multivariate regression with age, diabetes, obesity, and COVID-19 wave as covariates was used to describe the effect of immune group on hospitalization length, ICU length of stay, mortality, and ventilation needs

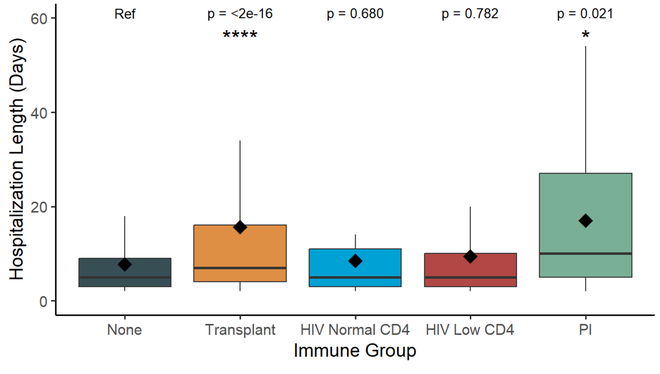


Patients with a history of transplant or primary immunodeficiency hospitalized for COVID-19 had worse outcomes than immunocompetent patients. Patients with a history of HIV (regardless of CD4 cell count at the time) generally did not have worse outcomes.

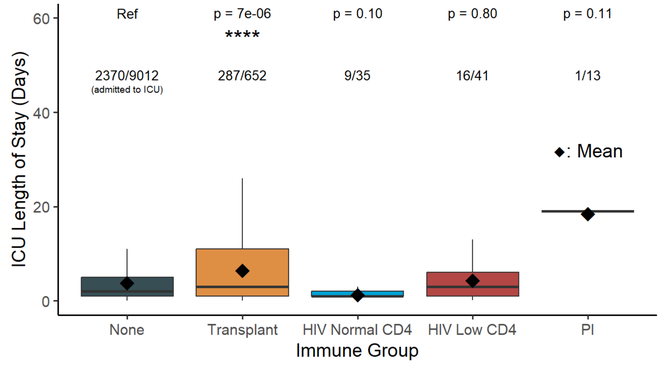
Demographics by Immunosuppression Group

	Total n = 9753	**None** n = 9012	**Transplant** n = 652	**HIV Normal CD4** n = 35	**HIV Low CD4** n = 41	**PI** n = 13
Mean age at admission, years (± SD)	61 (± 19)	61 (± 19)	57 (± 15)	50 (± 15)	51 (± 13)	59 (± 14)
Men, n (%)	4608 (47 %)	4149 (46 %)	397 (61 %)	21 (60 %)	35 (85 %)	6 (46 %)
Hispanic or Latinx, n (%)	1942 (20 %)	1764 (20 %)	169 (26 %)	3 (9 %)	4 (10 %)	2 (15 %)
Race						
American Indian or Alaska Native, n (%)	39 (0 %)	32 (0 %)	7 (1 %)	0 (0 %)	0 (0 %)	0 (0 %)
Asian, n (%)	332 (3 %)	301 (3 %)	30 (5 %)	0 (0 %)	1 (2 %)	0 (0 %)
Black or African American, n (%)	1643 (17 %)	1471 (16 %)	130 (20 %)	22 (63 %)	19 (46 %)	1 (8 %)
Native Hawaiian or Other Pacific Islander, n (%)	31 (0 %)	30 (0 %)	1 (0 %)	0 (0 %)	0 (0 %)	0 (0 %)
White, n (%)	6567 (67 %)	6141 (68 %)	389 (60 %)	12 (34 %)	16 (39 %)	9 (69 %)
Unknown, n (%)	1141 (12 %)	1037 (12 %)	95 (15 %)	1 (3 %)	5 (12 %)	3 (23 %)

Hospitalization Length by Immunosuppression Group



ICU Length of Stay by Immunosuppression Group



Mortality and Ventilation Outcomes by Immunosuppression Group

	None	**Transplant**	**HIV Normal CD4**	**HIV Low CD4**	**PI**
Mortality					
All cause mortality, day 14, n (%)	280 (3 %)	13 (2 %)	0 (0 %)	1 (2 %)	1 (8 %)
All cause mortality, day 28, n (%)	494 (5 %)	**37 (6 %)**	0 (0 %)	3 (7 %)	1 (8 %)
Ventilation					
Invasive ventilation, day 14, n (%)	681 (8 %)	**106 (16 %)**	1 (3 %)	5 (12 %)	1 (8 %)
Invasive ventilation, day 28, n (%)	765 (8 %)	**120 (18 %)**	1 (3 %)	**7 (17 %)**	2 (15 %)
Noninvasive ventilation, day 14, n (%)	2407 (27 %)	**191 (29 %)**	**3 (9 %)**	7 (17 %)	**8 (62 %)**
Noninvasive ventilation, day 28, n (%)	2483 (28 %)	**209 (32 %)**	4 (11 %)	9 (22 %)	**9 (69 %)**

Significantly **higher** in multivariate model Significantly **lower** in multivariate model

RESULTS

- 9753 patients hospitalized for COVID-19 at NM for at least 2 days were included
- Patients with a history of transplant had **significantly higher:**
  - Hospitalization length
  - ICU length of stay
  - Day 28 all cause mortality
  - Invasive and noninvasive ventilation at day 14 and day 28
- Patients with a history of PI had **significantly higher:**
  - Hospitalization length
  - Noninvasive ventilation at day 14 and day 28
- Outcomes for patients with a history of HIV (both normal CD4 and low CD4) were generally not significantly worse compared to outcomes for immunocompetent patients

CONCLUSIONS

- Our findings provide additional evidence that patients with different immunosuppressive phenotypes respond variably to severe COVID-19 and highlight the need to better understand these differences
  - Patients with a history of **transplant or PI generally fared worse**
  - Patients with a history of **HIV generally fared similarly**

LIMITATIONS

- All data was retrospective and collected from a single site (NM)
- Only structured data was used and EHR data in general has missingness
- Relatively small HIV and PI cohorts

ACKNOWLEDGMENTS

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