Risk Assessment of *Pneumocystis jirovecii* Pneumonia among Hospitalized Patients with Hypoxic Respiratory Failure – A Proposed Multivariable Calculator Based on Previous Prednisone Equivalent Dose

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Background

- Corticosteroids increase the risk of Pneumocystis jirovecii pneumonia (PJP).
- It is unknown how much corticosteroid dose exposure would modify the risk of PJP in different populations.
- We lack standardized recommendations for HIV-negative patients who may benefit from PJP prophylaxis
- We aim to develop a PJP risk calculator based on the previous dose of corticosteroids and modulated by additional clinical factors.

Methods

- Multicenter retrospective case-control study with patients tested for PJP between 2000 to 2021
- Developed model for estimating PJP risk based on a case-control study of previous prednisone equivalent doses (PED) and adjustable for additional clinical variables.
- PJP was fit to a generalized additive model (GAM), with a spline for prednisone dose and additive covariates for demographics and risk factors.
- A multicenter federated network was used to calibrate the model to estimate the PJP prevalence among hospitalized patients with hypoxic respiratory failure.

Results

199 patients
104 cases with PJP, 49% on steroids, PEDD 20.4mg
95 controls, 36.8% on steroids,, PEDD 15 mg
PJP prevalence among patients with ARDS: 0.126%

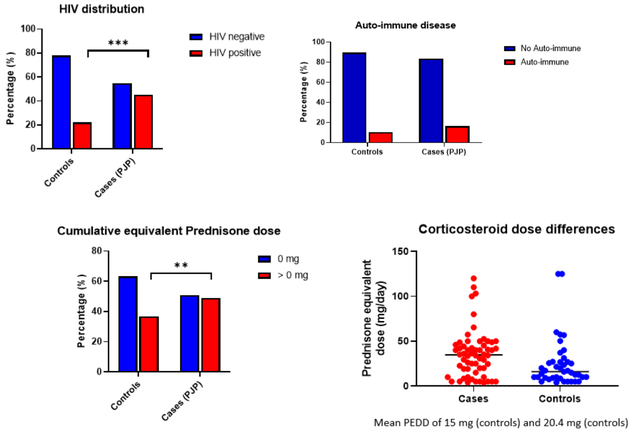
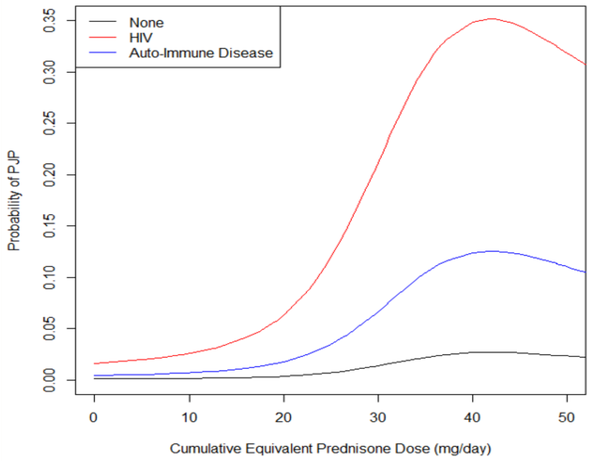


Table 1. Multivariable Analysis

Effect	Odds Ratio Estimate	95% CI		p value
Cumulative Equivalent Prednisone Dose (spline)				0.0001
Gender: Male vs Female	0.8906	0.3677	2.1572	0.7974
Race: White vs Non-White	0.6278	0.2449	1.6089	0.3322
Ethnicity: Not Hispanic or Latino vs Hispanic or Latino	0.1597	0.0168	1.5181	0.1104
HIV: Yes vs No	19.5923	6.3123	60.8114	0.0000
Solid Organ Transplant: Yes vs No	0.7695	0.1907	3.1057	0.7128
Smoking Overall				0.5023
Smoking: Former vs Never	0.7131	0.3092	1.6445	0.4277
Smoking: Current vs Never	0.5549	0.1772	1.7376	0.3119
Diabetes Mellitus: Yes vs No	4.1392	1.1585	14.7890	0.0288
Lung Disease: Yes vs No	0.2546	0.1000	0.6481	0.0041
Cancer-Solid Tumor: Yes vs No	0.4351	0.1417	1.3359	0.1460
Autoimmune disease: Yes vs No	5.1867	1.3982	19.2405	0.0139
PCP Prophylaxis Before Presentation or PCP test: Yes vs No	0.0570	0.0152	0.2136	0.0000
Age (per year)	1.0326	1.0030	1.0630	0.0304

Figure1. Predicted probability of PJP based on previous prednisone dose among hospitalized patients with hypoxic respiratory failure for three different clinical scenarios



E.g., A 20 mg equivalent dose of Prednisone a day would give a calculated annual PJP risk of approximately 1.74% (95% CI: (0.39%, 7.42%)) if you have an autoimmune disease only but 6.29% (95% CI: (1.34%, 24.91%)) if you are HIV-positive only

Potential 32 combinations to estimate risk

Conclusions

- Previous corticosteroid dose alone is inadequate to inform of an increased risk of PJP.
- A model calculator incorporating the absence or presence of additional traditional risk factors could optimally stratify the PJP risk.
- Future directions include validating the findings in external cohorts and modeling PJP risk in the ambulatory setting to inform the need for PJP prophylaxis.

Implications

- Antimicrobial prophylaxis against Pneumocystis jirovecii is effective. Correctly identifying patients at most risk is an important step to start prophylaxis.
- Prospective cohorts to validate findings
- Development of a calculator will be most beneficial in outpatient settings

Disclosures

- None