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Which immunodeficiency status has greater risks of poor *Pneumocystic* pneumonia outcomes than other immunocompromised populations?

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BACKGROUND
- A significant knowledge gap of the PCP outcomes and course of illness among non-HIV immunocompromised patients

OBJECTIVE
- Compare the manifestations and severity of PCP among patients with different immunocompromising conditions

QUESTION
- What are the contributing factors to severe outcomes of PCP?

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METHODS

- A retrospective cohort study
- Patients diagnosed with PCP at University Health Network, Toronto, Canada
- January 1, 2011 - December 31, 2021
- Composite outcomes including 21-day ICU admission and 28-day all-cause mortality following PCP diagnosis
- Univariate analysis to preliminary identify risk factors of the composite outcomes
- Multivariable logistic regression analysis and estimated adjusted odds ratio (aOR) to determine the concurrent effects of covariates

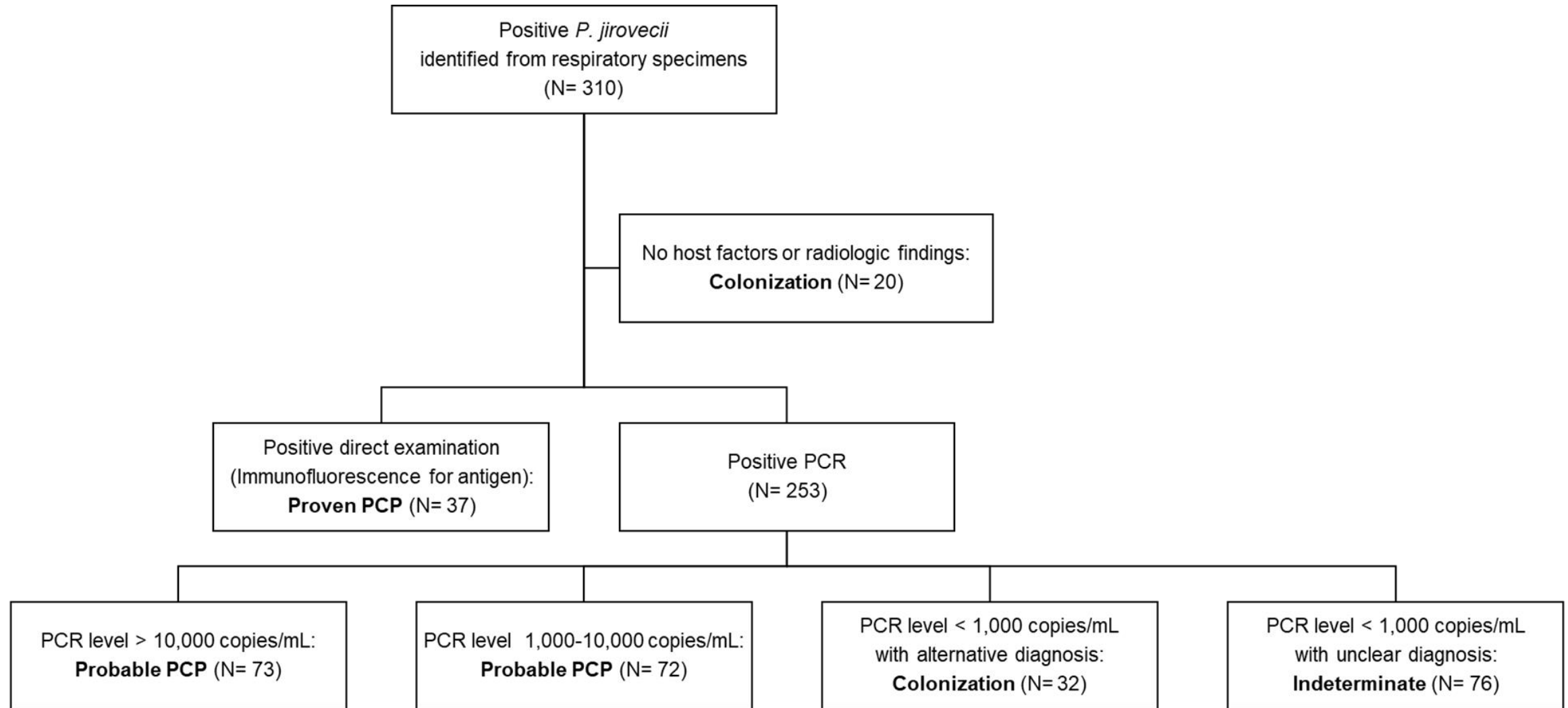# **Figure 1.** Diagnostic algorithm of *Pneumocystis* pneumonia

Table 1. Characteristics of each immunodeficiency groups

Factors	HIV	Hematologic Malignancies	HSCT	SOT	Solid Tumors	Autoimmune Diseases	Others	p-value
Number of cases (%)	19 (10.4)	54 (29.7)	32 (17.6)	26 (14.3)	33 (18.1)	12 (6.6)	6 (3.3)	
Age, Median	46.5	63.5	58.5	57.5	69.5	63.5	44.0	< 0.001
(IQR)	(39.5, 52.5)	(51.5, 73.5)	(43.5, 66.5)	(35.5, 64.5)	(61.5, 75.5)	(59.5, 71.5)	(32.5, 50.5)	
Male	16 (84)	36 (67)	18 (56)	15 (58)	20 (61)	3 (25)	4 (67)	0.059
Female	3 (16)	18 (33)	14 (44)	11 (42)	13 (39)	9 (75)	2 (33)	
Chronic lung disease	1 (5)	4 (7)	5 (16)	8 (31)	7 (21)	3 (25)	1 (17)	0.11
Chronic liver disease	0	5 (9)	3 (9)	9 (35)	2 (6)	3 (25)	2 (33)	0.002
Chronic heart disease	0	10 (19)	7 (22)	13 (50)	5 (15)	5 (42)	0	< 0.001
Chronic kidney disease	1 (5)	9 (17)	2 (6)	19 (73)	2 (6)	5 (42)	1 (17)	< 0.001
Diabetes	0	8 (15)	4 (13)	7 (27)	4 (12)	2 (17)	1 (17)	0.32
Hypertension	1 (5)	16 (30)	6 (19)	14 (54)	14 (42)	6 (50)	1 (17)	0.005
Dyslipidemia	1 (5)	7 (13)	7 (22)	6 (23)	9 (27)	2 (17)	0	0.31
Prolonged neutropenia[†]	0	18 (33)	8 (25)	1 (4)	0	0	0	< 0.001
Prolonged lymphopenia[‡]	13 (72)	37 (69)	14 (44)	16 (64)	20 (65)	10 (83)	5 (83)	0.14
Chronic steroid use	1 (5)	13 (24)	14 (44)	22 (85)	21 (64)	10 (83)	2 (33)	< 0.001

HIV: Human immunodeficiency virus; HSCT: Hematopoietic stem cell transplantation; ICU: Intensive care unit; IQR: Interquartile range; PCR: Polymerase chain reaction; SOT: Solid organ transplant recipients.

[†] Neutrophil counts less than 0.5×10^9/L for more than 4 weeks
[‡] Lymphocyte counts less than 0.8×10^9/L for more than 4 weeks

# Table 2. Findings and outcomes of each groups with PCP

Factors	HIV	Hematologic Malignancies	HSCT	SOT	Solid Tumors	Autoimmune Diseases	Others	*p-value*
Number of cases (%)	19 (10.4)	54 (29.7)	32 (17.6)	26 (14.3)	33 (18.1)	12 (6.6)	6 (3.3)	
Clinical findings								
Fever	11 (58)	36 (68)	24 (75)	14 (56)	19 (59)	8 (73)	1 (20)	*0.25*
Cough	19 (100)	27 (50)	19 (59)	14 (56)	20 (63)	7 (64)	3 (60)	*0.018*
Sputum production	11 (61)	5 (10)	1 (3)	7 (28)	7 (22)	1 (10)	2 (40)	*< 0.001*
Dyspnea	19 (100)	30 (57)	23 (72)	25 (96)	26 (81)	9 (82)	3 (60)	*< 0.001*
Hypoxemia	12 (75)	13 (37)	10 (50)	15 (75)	18 (78)	7 (70)	4 (80)	*0.012*
Abnormal chest radiographic findings								
Ground-glass opacities	16 (84)	48 (91)	28 (88)	20 (87)	29 (88)	10 (91)	3 (75)	*0.97*
Nodules	5 (26)	41 (76)	25 (78)	14 (54)	20 (61)	6 (50)	2 (33)	*0.001*
Consolidation	8 (42)	30 (56)	21 (66)	19 (73)	15 (45)	7 (58)	5 (83)	*0.17*
Cavity	0	1 (2)	0	0	0	1	1	*0.036*
Pneumatocele	2 (11)	3 (6)	1 (3)	1 (4)	3 (9)	0 (0)	0	*0.77*
Effusion	2 (11)	8 (15)	2 (6)	8 (31)	4 (12)	1 (8)	2 (33)	*0.14*
PCR diagnostic values								
> 10,000 copies/mL*	18 (95)	26 (48)	18 (56)	18 (69)	16 (48)	8 (67)	6 (100)	*0.002*
1,000-10,000 copies/mL	1 (5)	28 (52)	14 (44)	8 (31)	17 (52)	4 (33)	0	
Treatment and outcomes								
Treatment received	19 (100)	52 (96)	30 (94)	25 (96)	29 (88)	12 (100)	5 (83)	*0.37*
Composite outcome	5 (26)	6 (11)	2 (6)	13 (50)	7 (21)	6 (50)	5 (83)	*< 0.001*
21-day ICU admission	5 (26)	5 (9)	1 (3)	13 (50)	5 (15)	5 (42)	5 (83)	*< 0.001*
28-day mortality	0 (0)	2 (4)	1 (3)	2 (8)	4 (12)	4 (33)	4 (67)	*< 0.001*

* Both >10,000 copies/mL and positive immunofluorescence were included in this group
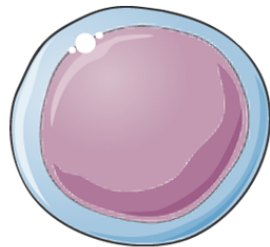
Figure 2. Risk factors affecting composite outcomes of PCP
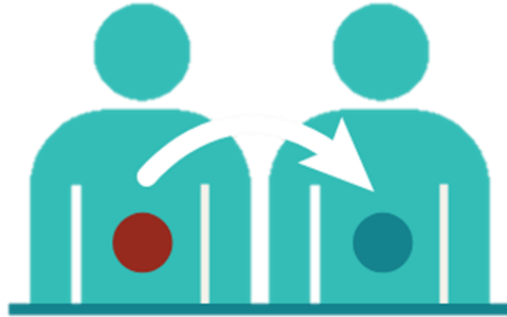
Solid organ transplantation
aOR= 3.84 (95% CI 1.063 – 13.844), p = 0.04
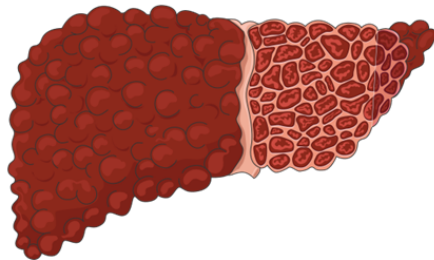
Chronic liver disease
aOR= 6.30 (95% CI 1.790 – 22.203), p = 0.004

Prolonged lymphopenia
aOR= 8.82 (95% CI 2.080 – 37.393), p = 0.003

aOR: Adjusted odds ratio; CI: confident interval

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CONCLUSION

- SOT recipients were at a greater risk of ICU admission and mortality, compared to non-SOT immunocompromised patients.

- Prolonged lymphopenia and chronic liver disease were also correlated with composite outcomes and poorer prognosis despite appropriate anti-PCP treatment.

- The course of illness and O2 requirement should be closely monitored.

- Further studies are required to compare the PCP pathophysiology among non-HIV immunocompromised populations.

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