

Introduction

❖ Indeterminate QuantiFERON-TB Gold In-Tube (QFT-GIT) test results pose a considerable challenge for clinical management.

❖ Comprehensive data characterizing the potential predictive factors of an indeterminate result are limited, particularly in terms of comparison in different clinical settings, such as ambulatory and hospitalized patients.

❖ The goal of this study was to compare the rates of indeterminate results in ambulatory and hospitalized patients and to identify clinical factors associated with indeterminate results.

Methods

❖ We retrospectively evaluated all NYU Lutheran Medical Center inpatients and outpatients who received QFT-GIT testing during either hospitalization or a clinic visit between 1/1/2012 and 9/30/2015.

❖ Demographic data and clinical and laboratory factors and their associations with indeterminate QFT-GIT results were assessed and compared between the two cohorts.

❖ Categorical variables and dichotomized (normal versus abnormal level) variables were compared by Chi square tests.

❖ Multivariate logistic regression was performed to estimate the adjusted odds ratio (OR) and corresponding 95% confidence interval (CI) of risk factors associated with indeterminate results. Covariates for multivariate analysis were selected based on clinical importance and statistical significance on bivariate analyses. Statistical significance was set at $p < 0.05$.

References

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2. Calabrese C, Overman RA, Dusetzina SB, Hajj-Ali RA. Indeterminate QuantiFERON-TB gold in-tube results in patients with Chronic Inflammatory Diseases on immunosuppressive therapy. *Arthritis Care Res (Hoboken)*. 2014 Sep 3. doi: 10.1002/acr.22454.
3. Jeong SJ, Han SH, Kim CO, Baek JH, Jin SJ, Ku NS, Choi JY, Song YG, Kim HS, Kim JM. Predictive factors for indeterminate result on the QuantiFERON test in an intermediate tuberculosis-burden country. *J Infect*. 2011 May;62(5):347-54.

Table 1. Clinical parameters and associations

Clinical parameters	Determinate results N (%) Inpatients	Indeterminate results N (%) Inpatients	P value Inpatients	Clinical parameters	Determinate results N(%) Outpatients	Indeterminate results N(%) Outpatients	P value Outpatients
PS*			< 0.001	HIV status			0.002
0-1	138 (52.1)	44 (28.9)		Negative	301 (93.48)	4 (50)	
≥2	127 (47.9)	108 (71.1)		Positive	21 (6.52)	4 (50)	
ICU stay			< 0.001	Immuno-suppression			0.008
No	233 (87.9)	104 (68.4)		No	265 (89.07)	4 (50)	
Yes	32 (12.1)	48 (31.6)		Yes	35 (10.93)	4 (50)	

Table 2. Laboratory parameters and associations

Laboratory parameters	Determinate results N (%) Inpatients	Indeterminate results N (%) Inpatients	P value Inpatients
QFT-GIT result			
Negative	271 (63.6)	155 (36.4)	
Positive	203 (47.6)	68 (16.0)	
WBC (x 10⁹/L), mean ± SD			0.006
Normal (4-10)	8.87 ± 4.34	8.88 ± 4.34	
Abnormal (<4 or >10)	179 (67.5)	82 (53.9)	
	86 (32.5)	70 (46.1)	
ALC (x 10⁹/L), mean ± SD			<0.001
≥1.0	1.54 ± 1.62	1.53 ± 1.64	
<1.0	212 (80)	82 (53.9)	
	53 (20)	70 (46.1)	
Hb (g/dl)			< 0.001
≥12	137 (51.7)	39 (25.7)	
<12	128 (48.3)	113 (74.3)	
Total protein (g/dl)			<0.001
≥6	179 (70.5)	72 (48.3)	
<6	75 (29.5)	77 (51.7)	
Albumin (g/dl)			<0.001
≥3.5	150 (59.1)	38 (25.5)	
<3.5	104 (40.9)	111 (74.5)	
Laboratory parameters	Determinate results N (%) Outpatients	Indeterminate results N (%) Outpatients	P value Outpatients
QFT-GIT result			
Negative	322 (97.6)	8 (2.4)	
Positive	234 (70.9)	88 (26.7)	
Hb (g/dl)			0.005
≥12	216 (80.6)	2 (28.6)	
<12	52 (19.4)	5 (71.4)	
Total protein (g/dl)			0.012
≥6	247 (98.02)	5 (71.4)	
<6	5 (1.98)	2 (28.6)	

Table 3. Multivariate regression analysis of predictors

Covariate Inpatients	OR (95% CI)	P value
PS*		
0-1 vs. ≥ 2	0.084 (0.012-0.174)	0.088
ICU		0.011
No vs. Yes	0.127 (0.036-0.275)	
WBC (x 10⁹/L)		0.123
Normal (4-10) vs. Abnormal (<4 or >10)	0.071 (0.019-0.160)	
ALC (x 10⁹/L)		< 0.001
≥ 1 vs. <1	0.189 (0.103-0.297)	
Hemoglobin (g/dl)		0.005
≥ 12 vs. < 12	0.137 (0.041-0.225)	
Total protein (g/dl)		0.576
≥ 6 vs. < 6	0.029 (0.074-0.132)	
Albumin (g/dl)		0.009
≥ 3.5 vs. < 3.5	0.148 (0.037-0.249)	
Covariate Outpatients	OR (95% CI)	P value
HIV		0.016
No vs. Yes	0.034 (0.002-0.535)	
Hemoglobin (g/dl)		0.012
≥ 12 vs. < 12	0.067 (0.008-0.556)	

* PS = performance status

Figure 1. Distribution (%) of independent predictors in inpatients

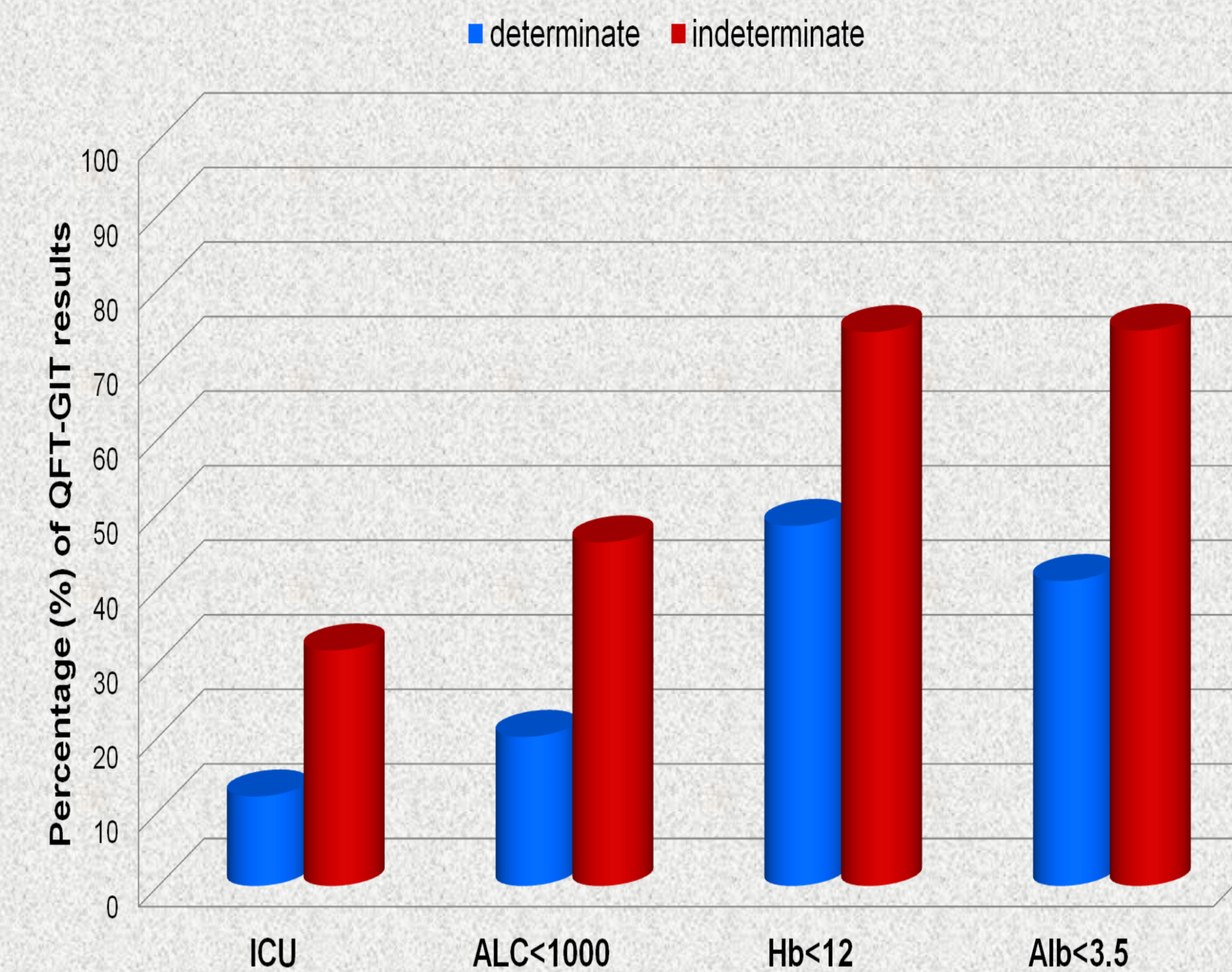
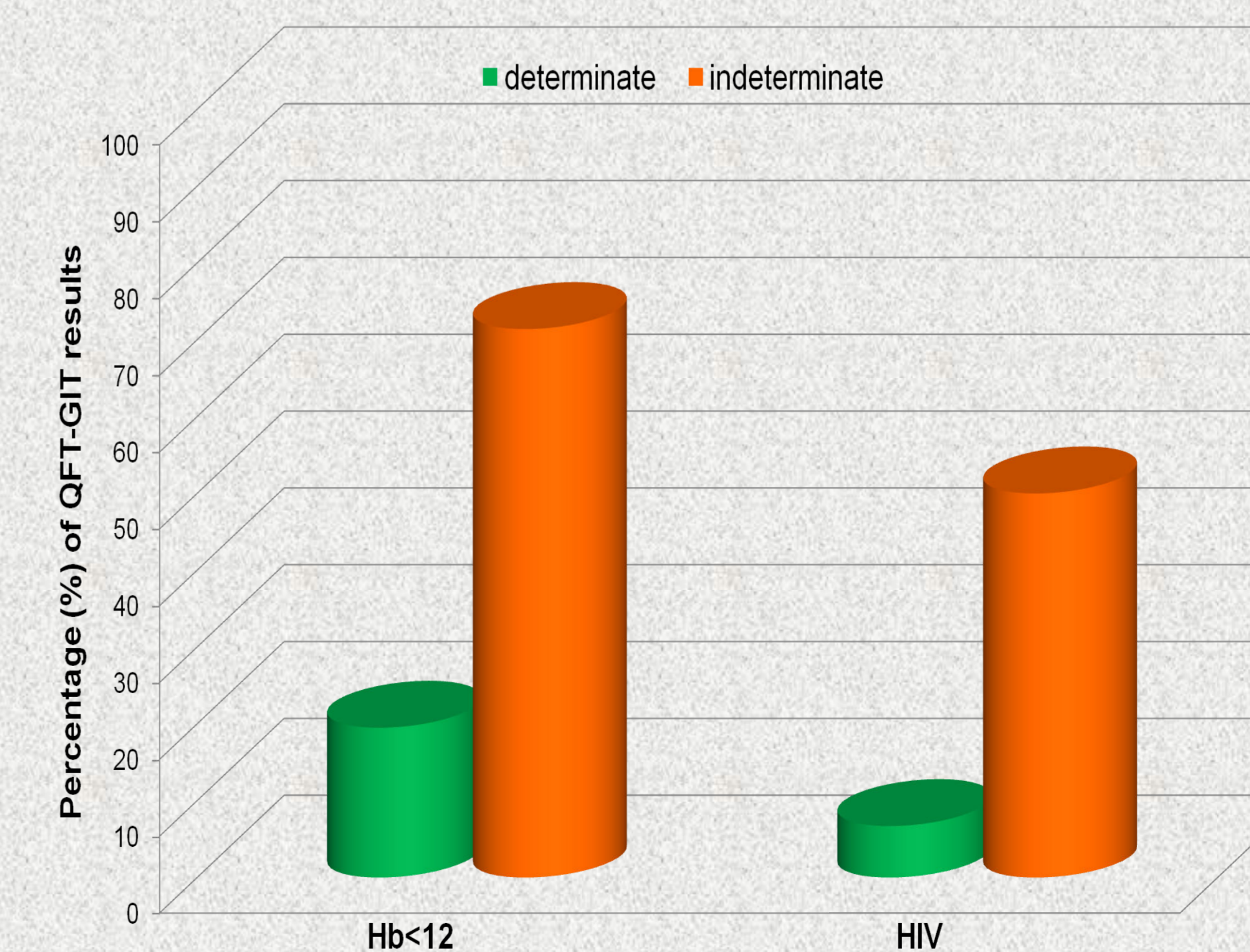


Figure 2. Distribution (%) of independent predictors in outpatients



Results

❖ In total, 756 patients were studied, 426 inpatients and 330 outpatients.

❖ 155/426 (36.4%) of test results were reported as indeterminate in the inpatient group.

❖ Only 8/330 (2.4%) indeterminate results were found in the outpatient cohort ($p < 0.001$).

❖ In the inpatient setting, poor performance status ($PS \geq 2$), history of ICU stay, abnormal WBC count (< 4 or $> 10 \times 10^9/L$), lymphopenia ($< 1 \times 10^9/L$), anemia ($Hb \leq 12$ g/dl), hypoalbuminemia (≤ 3.5 g/dl), and low serum total protein (< 6 g/dl) were significantly associated with indeterminate results in bivariate analysis.

❖ In the multivariate model, also for the inpatient setting, ICU stay ($p = 0.011$), absolute lymphocyte count (ALC) ($p < 0.001$), Hb ($p = 0.005$), and albumin level ($p < 0.009$) were independent predictors.

❖ In the outpatient setting, HIV positivity ($p = 0.002$), use of immunosuppressive medications ($p = 0.008$), anemia ($p = 0.005$), and low total protein ($p = 0.012$) were associated with indeterminate results in bivariate analysis, with HIV status ($p = 0.016$) and anemia ($p = 0.012$) retaining their independent significance in the multivariate model.

Conclusions

❖ Our results suggest that inpatients and outpatients differ significantly in the rate of indeterminate QFT-GIT results and in associated risk predictors of an indeterminate result.

❖ Critical illness, hypoalbuminemia and low lymphocyte count appear to be important factors in inpatient testing, whereas HIV positivity is an independent predictor for outpatients.

❖ Anemia is encountered in both settings as an independent risk factor.

❖ Knowledge of the above clinical characteristics may help providers in their utilization of QFT-GIT and may help reduce testing in hospitalized patients likely to have indeterminate results.