

# Which Preoperative Variables Improve the Predictive Accuracy of the Risk Assessment and Prediction Tool (RAPT) in Primary Total Hip Arthroplasty?

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INTRODUCTION:

Previous literature has explored the idea that patients’ discharge disposition following total joint arthroplasty may be predictable, developing and improving upon models such as the Risk Assessment and Prediction Tool (RAPT). The purpose of the present study was to determine if pre-operative laboratory values and other previously unstudied demographic factors could improve the predictive accuracy of the RAPT.

## METHODS:

This study retrospectively reviewed 1457 patients who underwent primary total hip arthroplasty (THA) from 2014 to 2021 at a single academic institution. All patients included had RAPT scores in addition to the following pre-operative laboratory values: red blood cell count (RBC), albumin, and vitamin D. All values were recorded within 90 days of surgery. Demographic variables including marital status, American Society of Anesthesiologists (ASA) scores, body mass index (BMI), Charlson Comorbidity Index (CCI), and depression were also evaluated. Multicollinearity between variables was quantified using variance inflation factors (VIFs). Binary logistic regression was used to determine the significance of each factor in association with discharge disposition.

## RESULTS:

Univariate logistic regression found significant associations between discharge disposition and all original RAPT factors as well as non-married patients (p<0.001); ASA of 3-4 (p<0.001); BMI >30 kg/m<sup>2</sup> (p=0.065); RBC <4 million/mm<sup>3</sup> (p<0.001); albumin <3.5 g/dL (p<0.001); CCI (p<0.001); and a past history of depression (p<0.001). All significant univariate models were used to create a multivariate model with an overall PA of 90.1%. The removal of sex from the multivariate model did not significantly impact PA.

## DISCUSSION AND CONCLUSION:

The addition of easily-obtained preoperative lab values and additional demographic data to the RAPT may improve its predictive accuracy. Orthopedic surgeons may benefit from incorporating these values as a part of their pre-operative and discharge planning in THA. Further work with machine learning may be able to identify other factors to make the model even more predictive.

Table 1. Demographics (n=1457)			
	Home (n=1286)	Facility (n=171)	P-Value
Sex			0.011
Male	441 (34.3%)	42 (24.6%)	
Female	845 (65.7%)	129 (75.4%)	
Age (years ± SD)	66.91 ± 8.75	73.62 ± 9.27	<0.001
Race			0.395
White	1012 (78.7%)	130 (76.0%)	
Black	144 (11.2%)	21 (12.3%)	
Asian	23 (1.8%)	1 (0.6%)	
Other	107 (8.3%)	19 (11.1%)	
BMI (kg/m <sup>2</sup> ± SD)	28.56 ± 5.67	29.86 ± 6.97	0.021
CCI (± SD)	1.29 ± 1.73	2.20 ± 2.10	<0.001
RAPT (± SD)	0.18 ± 2.04	5.73 ± 2.54	<0.001

Table 2. Multicollinearity Testing		
	Tolerance	VIF
Marital Status	0.751	1.331
ASA	0.781	1.281
BMI	0.902	1.109
RBC	0.908	1.102
Albumin	0.971	1.029
Vitamin D	0.940	1.063
CCI	0.884	1.131
Depression	0.932	1.073
Age Group	0.790	1.266
Sex	0.893	1.120
Average Walking	0.725	1.379
Gait Aid	0.668	1.498
Community Supports	0.889	1.125
Caregiver	0.782	1.279

Table 3. Univariate Logistic Regression Analysis				
	Coefficient	Standard Error	P-Value	Odds Ratio
Marital Status	-1.314	0.189	<0.001	0.269
ASA	-1.020	0.185	<0.001	0.359
BMI	-0.056	0.165	0.707	0.946
RBC	-0.794	0.181	<0.001	0.452
Albumin	-1.514	0.407	<0.001	0.216
Vitamin D	-0.089	0.266	0.739	0.913
CCI	-1.125	0.173	<0.001	0.285
Depression	-0.704	0.188	<0.001	0.495
Age Group	-0.886	0.112	<0.001	0.412
Sex	-0.497	0.189	0.008	0.608
Average Walking	-1.171	0.139	<0.001	0.300
Gait Aid	-1.383	0.118	<0.001	0.251
Community Supports	-2.071	0.251	<0.001	0.126
Caregiver	-0.673	0.058	<0.001	0.510

Table 4. Multivariate Logistic Regression Analysis				
	Coefficient	Standard Error	P-Value	Odds Ratio
Marital Status	-0.001	0.000	0.421	0.999
ASA	-0.732	0.227	0.001	0.481
BMI	-0.064	0.211	0.762	0.938
RBC	-0.204	0.234	0.384	0.816
Albumin	-0.888	0.392	0.014	0.412
CCI	-0.842	0.224	0.000	0.437
Depression	-0.363	0.237	0.126	0.695
Age Group	-0.633	0.180	<0.001	0.542
Sex*	-0.041	0.234	0.859	0.959
Average Walking	-0.471	0.144	0.001	0.624
Gait Aid	-0.744	0.154	<0.001	0.475
Community Supports	-0.800	0.324	0.014	0.449
Caregiver	-0.294	0.075	<0.001	0.752

\*removed did not change predictive accuracy