Trends in Total Wrist Arthroplasty: Medicare Projections Through 2060

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Abstract

Purpose: Total wrist arthroplasty (TWA) is an alternative to arthrodesis for end-stage wrist arthritis, offering preserved wrist motion and functional improvement. Historically limited by high complication and revision rates, TWA has seen renewed interest with advances in implant design and expanding indications beyond rheumatoid arthritis. The purpose of this study was to analyze national trends in TWA utilization and project future procedure volumes for both primary and revision TWA through 2060 using Medicare data.

Methods: Procedure volumes for Medicare Part-B beneficiaries undergoing primary or revision TWA between 2000 and 2022 were obtained from CMS Medicare Part-B data and adjusted for Medicare Advantage enrollment using population ratios from the Kaiser Family Foundation. Forecasting models — including Poisson regression, log-linear, negative binomial, and ARIMA — were applied to project annual volumes through 2060. Model performance was evaluated using mean absolute error (MAE) and root mean square error (RMSE).

Results: From 2000 to 2022, primary TWA increased by 173% (107 to 292 procedures), and revision TWA increased by 502% (47 to 283 procedures). Poisson regression demonstrated superior predictive performance and was selected for future projections. By 2060, primary TWA is projected to increase by 256% (1,040 procedures), and revision TWA by 1,053% (3,262 procedures). Revision procedures are expected to grow at a faster annual rate (6.6%) compared to primary TWA (3.8%).

Conclusions: TWA utilization is projected to rise substantially, particularly for revision procedures. These trends reflect growing clinical adoption and highlight the need for continued innovation in implant design, improved durability, and robust prospective studies to inform patient selection and long-term outcomes.

Table 1. Uplifted Historical Procedure Volume of Primary and Revision Total Wrist Arthroplasty From 2000 to 2022

Year Intervals	Primary Total Wrist Arthroplasty			Revision Total Wrist Arthroplasty		
	Adjusted Volume	Percent Change		Adjusted Volume	Percent Change	
		5-Year	1-Year		5-Year	1-Year
2000	107	-	-	47	-	-
2001	100	-	-6.5	68	-	44.7
2002	100	-	0.0	55	-	-19.1
2003	134	-	34.0	68	-	23.6
2004	136	-	1.5	90	-	32.4
2005	124	15.9	-8.8	91	93.6	1.1
2006	155	55.0	25.0	86	26.5	-5.5
2007	158	58.0	1.9	99	80.0	15.1
2008	185	38.1	17.1	119	75.0	20.2
2009	171	25.7	-7.6	155	72.2	30.3
2010	184	48.4	7.6	157	72.5	1.3
2011	189	21.9	2.7	193	124.4	22.9
2012	132	-16.5	-30.2	185	86.9	-4.2
2013	144	-22.2	9.1	183	53.8	-1.1
2014	128	-25.2	-11.1	199	28.4	8.7
2015	151	-17.9	18.0	169	7.6	-15.1
2016	191	1.1	26.5	199	3.1	17.8
2017	209	58.3	9.4	194	4.9	-2.5
2018	229	59.0	9.6	194	6.0	0.0
2019	233	82.0	1.8	210	5.5	8.3
2020	219	45.0	-6.0	209	23.7	-0.5
2021	246	28.8	12.3	265	33.2	26.8
2022	292	39.7	18.7	283	45.9	6.8

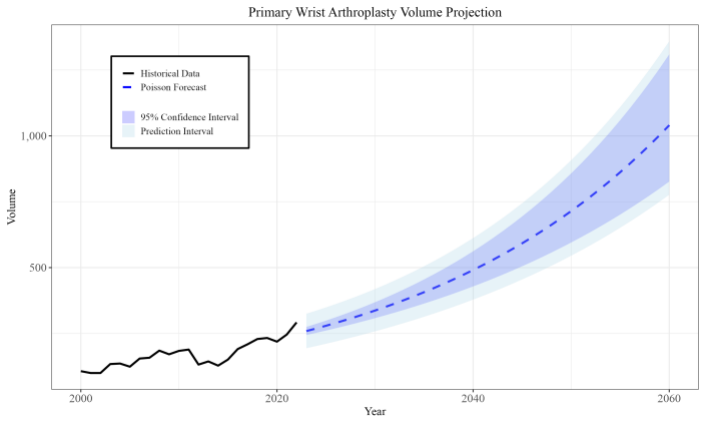

Table 2. Forecast Model Outputs for Primary Total Wrist Arthroplasty

Model	Intercept	Trend Estimate	Standard Error	Growth Rate	95% CI	MAE	RMSE
Log-Linear	-69.198	0.0369	0.00499	3.8%	(2.8%, 4.8%)	165	172
Poisson	-70.425	0.0376	0.00245	3.8%	(3.3%, 4.2%)	20	25
NegBinom	-69.471	0.0371	0.00469	3.7%	(2.8%, 4.6%)	20	25
ARIMA	Drift: 8.409	ARIMA(0,1,0) with drift	NA	NA	NA	17	22

CI = Confidence Interval; MAE = Mean Absolute Error; RMSE = Root Mean Square Error; NegBinom = Negative Binomial; ARIMA = Auto-Regressive Integrated Moving Average; NA = Not Applicable.