

Margin of Error Guide for QOPAs

The QOPA shown are estimates of the underlying pitching ability of the player, team, or league. The values shown are the actual performance, but if the performance were repeated, the results may vary. The estimate of uncertainty based on repeated performance is given by the **margin of error (ME)**.

$$QOPA \pm ME$$

is the interval within which we are very (95%) confident that the true pitching ability lies.

$$ME = 1.96 \times \frac{SD}{\sqrt{\# \text{ of pitches}}}$$

where SD is the population standard deviation QOPV for MLB, which is about 2.75. If individual intervals overlap, then the corresponding pitching abilities may be the same; otherwise they may confidently be said to differ. Table 1 shows the ME for common numbers of pitches.

	Number of Pitches	ME
Individuals	10	1.706
	30	0.985
	100	0.540
	500	0.241
	1000	0.171
League pitch classification	10000	0.054
Team avg. # of pitches/season	24213	0.035
	50000	0.024
	100000	0.017
	250000	0.011
League avg. # of pitches/season	724600	0.006

Table 1: Margin of Error for common numbers of pitches.

For example, in 2015, the QOPA for the San Francisco Giants was 4.55, compared with the Boston Red Sox, which was 4.60. The MEs are approximately 4.55 ± 0.035 and 4.60 ± 0.035 , or 4.515 to 4.585 and 4.565 to 4.635. Since these two intervals overlap, the differences in QOPA are not large enough to conclude the Red Sox have a higher QOPA than the Giants.

Using this approach, one can see that to conclude two underlying pitching abilities are different, the distance between two QOPAs should be greater than or equal to the sum of the ME for each QOPA. For example, in 2015, the QOPA for the four seam fastball (FF) was 4.81 ± 0.011 compared with the QOPA for the two seam fastball (FT) was 5.10 ± 0.017 . The sum of the MEs is $0.011 + 0.017 \approx 0.03$. Since the QOPAs are substantially more than 0.03 apart, we are confident that the two seam fastballs really were better thrown than the four seam.