

Relationship Between Pitching a Complete Game and Spending Time on the Disabled List for Major League Baseball Pitchers

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Background: Injury rates among Major League Baseball pitchers have been increasing over the past several years. It is currently unknown whether pitching a complete game (CG) is a risk factor for spending time on the disabled list (DL).

Purpose/Hypothesis: The purpose of this study was to determine the relationship between pitching a CG and time on the DL. We hypothesized that pitchers who threw a CG (1) would be at increased risk for spending time on the DL, which would be earlier in the season and for a longer period, than those who did not and (2) would be at further increased risk for spending time on the DL during subsequent seasons than matched controls.

Study Design: Descriptive epidemiology study.

Methods: Pitchers who threw a CG between 2010 and 2016 at the major league level and were placed on the DL during the same season were included. Timing and length of period on the DL were determined, as well as placement on the DL during subsequent seasons. Matched controls who did not throw a CG were assessed for time spent on the DL during that season and subsequent seasons.

Results: Overall, 246 individual pitchers (501 pitcher-seasons) threw at least 1 CG between 2010 and 2016. Of the pitcher-seasons, 370 (73.9%) included a period on the DL, as compared with only 20% of controls. There were no differences in length of time on the DL ($P = .928$) or days from season start to time on the DL ($P = .861$) between pitchers who threw a CG and controls. Pitchers who threw a CG were significantly more likely than controls to spend subsequent seasons on the DL (1.9 ± 1.1 vs 0.5 ± 0.9 , $P < .001$).

Conclusion: Overall, 74% of pitchers who threw a CG spent time on the DL, as compared with 20% of controls. Pitchers who threw a CG during the study period spent more time in subsequent seasons on the DL than did matched controls who did not throw a CG.

Keywords: complete game; Major League Baseball; MLB; disabled list; DL; pitcher; elbow; shoulder

Injury rates among Major League Baseball (MLB) pitchers have been steadily increasing over the past several years.^{5,7,10,12} While several risk factors for sustaining an injury have been identified—including pitching velocity, pitching while fatigued, glenohumeral internal rotation deficit, overall workload, pitch counts, and other—preventative measures have fallen short in reducing injury rates.^{1,3,8,9,12,15,16} One potential risk factor for MLB pitchers to sustain an injury is throwing a complete game (CG). It is currently unknown if throwing a CG is a risk factor for injury.

Pitching a CG entails a pitcher's throwing every pitch of a particular game from start to finish, including extra innings if necessary. Pitching a CG has become uncommon among MLB pitchers, with 429 CGs thrown in the

1990 season versus 124 in the 2013 season.² There are several possible explanations for this decline, including increasing pitching velocity causing earlier pitcher fatigue, heightened awareness of pitch counts, and so on, although no single reason has been proven to be the driving factor in this drop. Regardless of the cause of this decline, throwing a CG in today's MLB is a difficult task for any pitcher and takes a toll on the pitcher's body. It is unknown if the microtrauma endured by throwing a CG is a contributing factor to a pitcher's spending time on the disabled list (DL).

Therefore, the purpose of this study was to determine the relationship between pitching a CG and time on the DL. We hypothesized that pitchers who threw a CG (1) would be more at risk for spending time on the DL, which would be earlier in the season and for a longer period, than those who did not and (2) would be at a higher risk for spending time on the DL during subsequent seasons than matched controls.

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METHODS

All MLB pitchers who spent time on the DL as well as all pitchers who threw at least 1 CG during the 2010-2016 seasons were identified with publically available data (team websites, media releases, Baseball-Reference.com, etc), therefore obviating the need for institutional review board approval. This search methodology was successfully used in prior studies by multiple authors evaluating injuries in MLB pitchers.^{4,6,7,13,14} With regard to pitchers who spent time on the DL, these pitchers were included if they successfully competed in at least 1 MLB game during the season in which they spent time on the DL. Each season was considered a separate entity, so pitchers who were on the DL or who threw a CG in more than 1 season were evaluated separately per season. The data for each season are referred to as a "pitcher-season." If a pitcher started the season on the DL and did not have a second stint on the DL during that same season, he was excluded because there was no way for him to have pitched a CG before his time on the DL. However, if a pitcher started the season on the DL, successfully returned and pitched during the season, and then had a second stint on the DL, this pitcher was included because he had the opportunity to pitch during the season prior to his time on the DL. The time from when the pitcher threw his first game to his DL date was recorded, as was time from the first CG to time on the DL.

A total of 1016 pitcher-seasons were included. Once this list of pitchers was compiled, their season statistics were reviewed to determine the pitchers who threw a CG at any point during the season in which they spent time on the DL. If they did throw a CG, the date (or dates) was recorded and compared with the date (or dates) on the DL. This group of pitchers who threw a CG and were on the DL in the same season were referred to as the CG/DL group.

A group of control pitchers who had never thrown a CG in their careers was then matched to those in the CG/DL group. The controls were matched by age, year, and innings pitched during the "index season." The index season was designated for the control pitchers as the same season that the CG/DL players threw their CG and spent time on the DL.

Finally, all pitchers who threw a CG between 2010 and 2016 were identified—the CG group. They were evaluated to determine if they ever spent time on the DL over the study period and, if so, if it was the same season, different season, or both as the year that they threw their CG. A group of matched controls who did not throw a CG could not be obtained for this group, because there were not enough

pitchers in MLB during this time who had not thrown a CG but who also threw the same number of innings in a season as those who did throw a CG. As it was important to match the pitchers based on the number of innings pitched during comparable seasons to approximate the workload, a control group for this study group could not be created.¹²

Statistical Analysis

Descriptive statistics were calculated for each group. Data were nonnormally distributed; thus, nonparametric tests were used. Year, innings pitched, number of days on the DL, days from season start to time on the DL, and number of other seasons on the DL were compared between study group and controls with Mann-Whitney *U* tests. All analyses were conducted in Excel (Microsoft) and SPSS (v 23; IBM).

RESULTS

Of the 1016 pitcher-seasons included in the study, 501 consisted of pitchers who threw a CG. Of these, 370 (73.9%) included time on the DL during the study period: 32 (8.6%) DL placements were only during the season of the CG, 255 (69%) were during a season other than that of the CG, and 83 (22.4%) were during the season of the CG as well as another season. Thus, 31% of the pitcher-seasons with DL time included placement on the DL in the same season as the CG. The mean \pm SD number of seasons in which these pitchers spent some time on the DL was 1.9 ± 1.1 . In general, pitchers were more likely to pitch CGs early in the season (on average 32% of the way through the season) and were more likely to be on the DL later in the season (98 ± 36 days after season start) (Table 1). However, the timing of the period on the DL did not differ between study and control pitchers ($P = .861$).

A total of 246 individual pitchers (501 pitcher-seasons) threw at least 1 CG between 2010 and 2016: 121 of these individual pitchers threw a CG in more than 1 season; 92 individual pitchers spent time on the DL during the same season in which they threw their CG. Of the pitchers in the CG/DL group, 11 (12.0%) were placed on the DL more than once in the same season in which they threw their CG; 18 (19.6%) had more than 1 season in which they both threw a CG and were placed on the DL; and 90 (97.8%) were placed on the DL in more than 1 season over the study period.

Of the 1016 pitcher-seasons in this study, 115 (11.3%) were for pitchers who threw a CG during the same season

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Ethical approval was not sought for the present study.

TABLE 1
Comparison Between Groups^a

Variable	CG/DL ^b	Control	P ^c
Age, y	27.9 ± 4.1	28 ± 3.3	.621
Year of index season	2012.6 ± 1.9	2012.9 ± 2.2	.376
Innings pitched	136 ± 42	136 ± 37	.769
Days on the DL	43.8 ± 32.3	46.4 ± 39	.928
Days from season start to DL	98 ± 36	100.4 ± 41.6	.861
Proportion of season at which CG was pitched	0.32 ± 0.19	NA	NA
No. of subsequent seasons on the DL	1.9 ± 1.1	0.5 ± 0.9	<.001
Total seasons on the DL	2.4 ± 1.3	0.7 ± 0.9	<.001

^aData are reported as mean ± SD. CG, complete game; DL, disabled list; NA, not applicable.

^bSample size is counted as pitcher-seasons (n = 115).

^cP values are for Mann-Whitney U tests, as all data are non-normally distributed.

in which they were placed on the DL (Table 2). MLB pitchers in the CG/DL group spent 44.2 ± 32.5 days before they were taken off the DL (Table 3), which did not differ between CG/DL and controls (*P* = .0928).

A group of matched controls was created for the pitchers who threw a CG and spent time on the DL during the same season. No difference existed between the controls and cases for age, year of index season, or number of innings pitched during the index season. For the controls, 20% of pitchers spent time on the DL during the index season, while 50% spent time on the DL at some point during the study period. Control pitchers spent time in the DL in significantly fewer subsequent seasons than did pitchers in the CG/DL group (*P* < .001).

When controls were compared with the CG group (n = 501 pitcher-seasons), only 20% of the controls spent time on the DL in the index season versus 74% of players in the CG group. However, the number of innings pitched was different, as the controls averaged 136, and the CG group averaged 174.

DISCUSSION

Pitching a CG for MLB players has become less common in recent years given the increased awareness of overuse injuries in baseball pitchers. Our hypotheses were mostly correct: 74% of pitchers who threw a CG spent time on the DL during the study period, as opposed to 20% of controls, and pitchers who threw a CG were significantly more likely than controls to spend subsequent seasons on the DL (1.9 ± 1.1 vs 0.5 ± 0.9, *P* < .001). There were no differences between length of time on the DL (*P* = .928) or days from season start to time on the DL (*P* = .861) between controls and players who pitched a CG and spent time on the DL in the same season.

There has been a recent push to limit the number of innings pitched and pitches thrown among MLB pitchers in an attempt to decrease injury rates, as studies have shown that increased pitching workload is a risk factor for

injury, although not necessarily a risk for revision surgery following ulnar collateral ligament reconstruction.^{6,9,12} This study found that 74% of pitchers who threw a CG during the study period spent time on the DL and that pitchers who threw a CG were significantly more likely than controls to spend subsequent seasons on the DL. These results suggest that pitchers who pitch a CG are at greater risk of injury than those who do not.

There is an interesting finding from this study: CG pitchers—not just the ones who spent time on the DL and whom we matched to controls but all pitchers with a CG—have a high volume of innings thrown per season (174), and they are much more likely to be injured (ie, spend time on the DL) than medium- to high-volume pitchers. The controls averaged 136 innings pitched per year, so although these players were not quite as high volume as the overall CG group, they did still throw a high volume of innings each year. What is interesting is their injury rate is one-third during the index season and one-half during other seasons when compared with the overall CG group (0.7 other seasons on the DL vs 1.5 other seasons on the DL). This finding suggests that a threshold likely exists of innings pitched per season—somewhere between 136 and 175 innings per year—in which injury rates dramatically increase (from a reasonable 20% to an unreasonable 74%). Further work is needed to determine what this inning limit is so that pitchers can stay below it in an effort to reduce injury rates. Even if a guideline is set for all MLB pitchers, note that the specific inning limit may be individualized per player, as some can pitch more innings per year without injury than others.

When all of the pitchers who threw a CG were analyzed and their time spent on the DL was broken down, 6.8% were placed on the DL only during the season in which they threw their CG. The majority (70.8%) were actually placed on the DL during a season other than the one in which they threw a CG, while 22.4% spent time on the DL during the season in which they threw their CG as well as during another season during the study period. Hence, almost 30% spent time on the DL during the season in which they threw their CG. This finding suggests that throwing a CG is not necessarily a risk factor for being placed on the DL; instead, being a high-volume pitcher in general increases the risk of spending time on the DL, as compared with being a lower-volume pitcher.

Hence, throwing a CG in isolation may not be a risk factor for spending time on the DL; rather, throwing a CG associates with being a high-volume pitcher who throws a significant number of innings per season, which places him at risk for spending time on the DL.

Limitations

This study used publically available data and, as such, is subject to the limitations that accompany this. Although multiple prior studies have used this methodology, there are still limitations, including inability to identify all pitchers and inaccurate dates of being on the DL.^{7,11,13,14} The study did not examine the type of injury that placed pitchers on the DL and so could not comment on the likelihood of various injuries. Data on the number of innings pitched, the

TABLE 2
Pitchers Who Spent Time on the DL by Year and Day Between Their Last CG and Placement on the DL^a

Year	Pitchers Who Spent Time on the DL	Pitchers Placed on the DL >1 Time Throughout the Season	Pitchers Who Threw a CG the Season They Were on the DL ^b	Mean Time Between Last CG and DL Placement, d
2010	149	7	20	44.1
2011	149	10	19	46.7
2012	136	13	19	32.6
2013	131	14	18	41.4
2014	114	11	17	42.1
2015	160	10	12	59.5
2016	177	20	10	32.1

^aValues are counted as pitcher-seasons. CG, complete game; DL, disabled list.

^bCG/DL group.

TABLE 3
Days Spent on the DL Between Pitchers Who Threw a CG and Those Who Did Not During the Season They Were on the DL^a

	During Season on DL		P
	Did Not Throw a CG	Threw a CG	
Days spent on DL, mean ± SD	49.3 ± 37.3	44.2 ± 32.5	.0928

^aCG, complete game; DL, disabled list.

pitchers who threw CGs, and whether a pitcher spent time on the DL were readily available, accurate, and clinically meaningful (as in previous studies), but the exact diagnosis associated with a player's stint on the DL is not always as reliable, so this data point was not included to avoid misinformation.^{6,12} The DL recently added a 10-day designation, and this could have contributed to more players being placed on it, although the effect should be the same for controls and cases. Finally, while conclusions can be drawn regarding the controls, it was not possible to find controls who pitched the same number of innings in a season as the cases. This speaks to a potential inning limit for pitchers to pitch in a season, although this must be evaluated separately.

CONCLUSION

Overall, 74% of pitchers who threw a CG spent time on the DL, as compared with 20% of controls. Pitchers who threw a CG during the study period spent more time on the DL in subsequent seasons than matched controls who did not throw a CG.

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