

In October of 2017 Bill Deane noted in his blog (<https://dizzydeane.wordpress.com/2017/10/17/the-declining-influence-of-good-pitchers/>) that more innings are shifting from teams' best pitchers to their worst.

Bill found that for the years 1962, 1999, 2017 there is a clear trend of fewer innings thrown by top pitchers. He ranked pitchers by innings pitched and found

Year	Total	#1	#1-10	other
1962	1450	252	1350	100
1999	1440	216	1206	234
2017	1442	184	1061	383

This raises questions about how the trend fits into other seasons, and how effective these pitchers were. The data at Baseball databank was used (<https://github.com/chadwickbureau/baseballdatabank>).

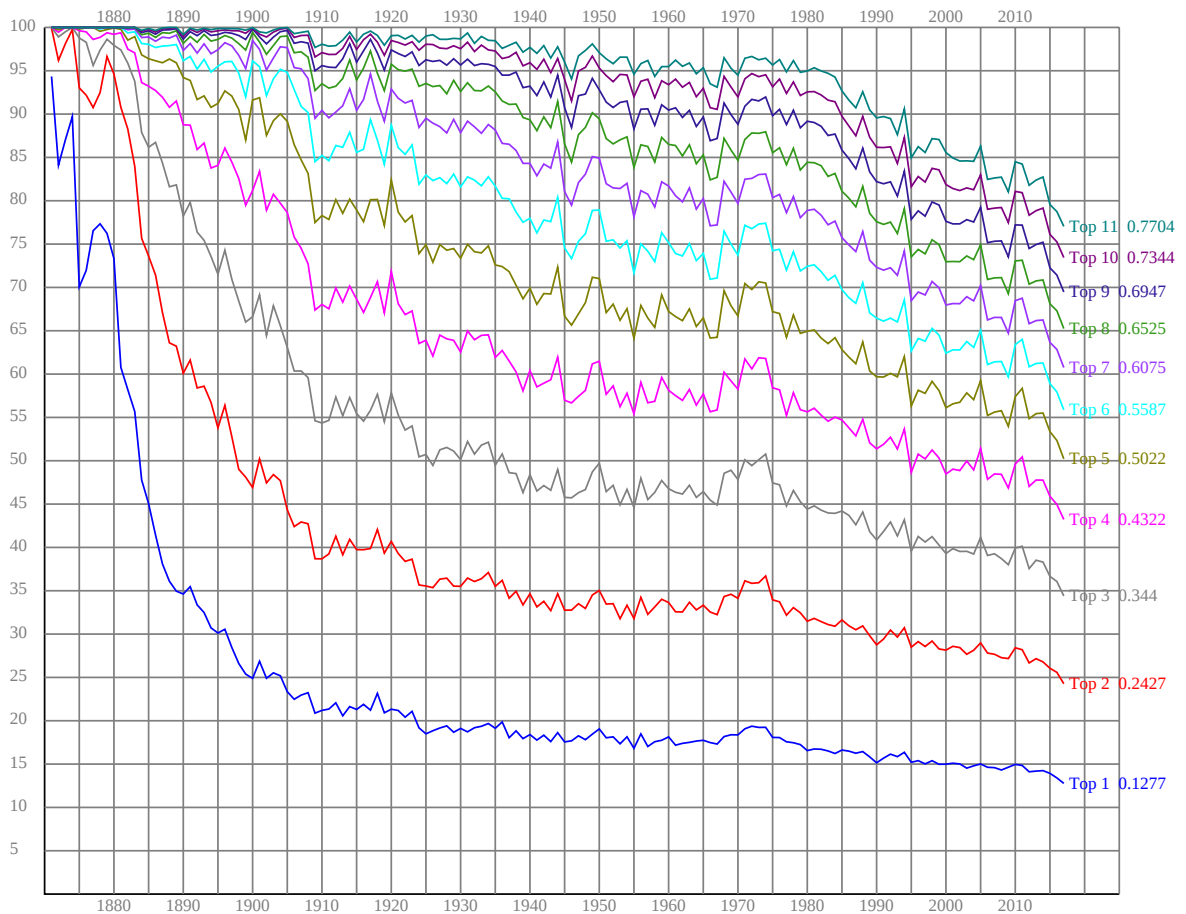


Figure 1: The fraction of innings pitched by the top n pitchers in innings pitched. Teams' innings pitched leaders pitched 12.77% of all innings in 2017

The fraction of innings pitched by the top ten pitchers dropped to 73.44%

in 2017, the first year below 75%. The percentage dropped below 90% for the first time in 1985 and below 80% for the first time in 2001. The graph shows that the decline in innings pitched by the leading pitchers has been declining rapidly over the last four years.

How effective have the top pitchers been? Figure 2 shows the ERA since 1900 for the major leagues (in black), the innings pitched leaders (in blue), the top ten (in red), and the others- those not in the top ten in innings pitched (in purple).

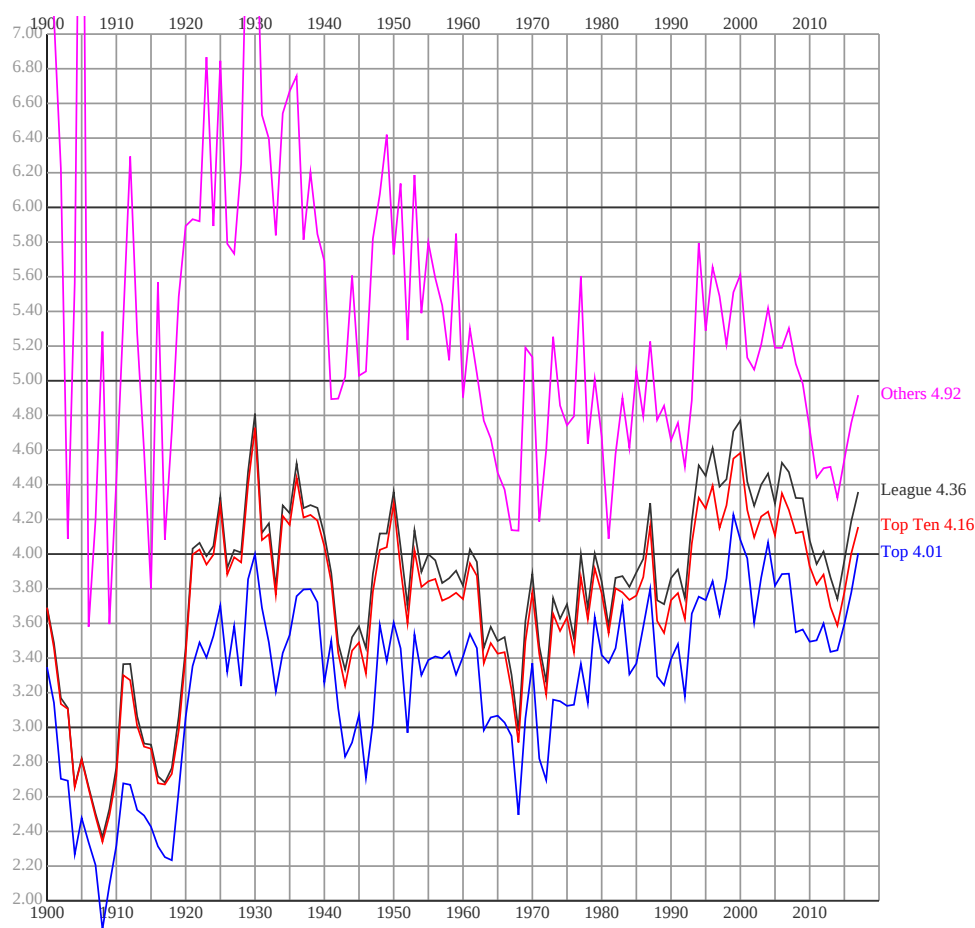


Figure 2: ERA for the major leagues (in black), Innings pitched leaders (in blue), top ten in innings pitched (in red), and pitchers not in the top ten in innings pitched (in purple).

The next question is how much impact there is on the league ERA? Figure 3 shows the annual difference between the league ERA and the ERA of the top ten pitchers.

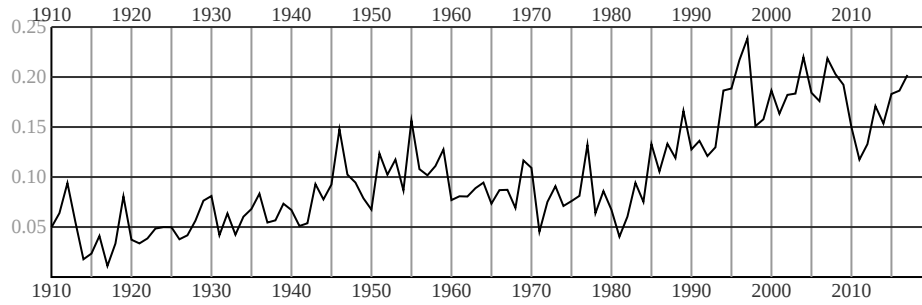


Figure 3: The difference between the major league ERA and the ERA of the top-ten pitchers, where top-ten pitchers are in the top ten in innings pitched on their team.

During the expansion era the standard deviation in League ERA was 0.39 and the standard deviation for the difference between the league and top ten was 0.05. The correlation between the two was +0.80.

This is in contrast to the numbers during the pre-expansion lively ball era, 1920-1961. The standard deviation for the league ERA was 0.30, for the difference, 0.03. the correlation between the two was -0.18 . In the pre-expansion era the number of innings pitched by non-top ten pitchers was tiny and had little effect on the league ERA.

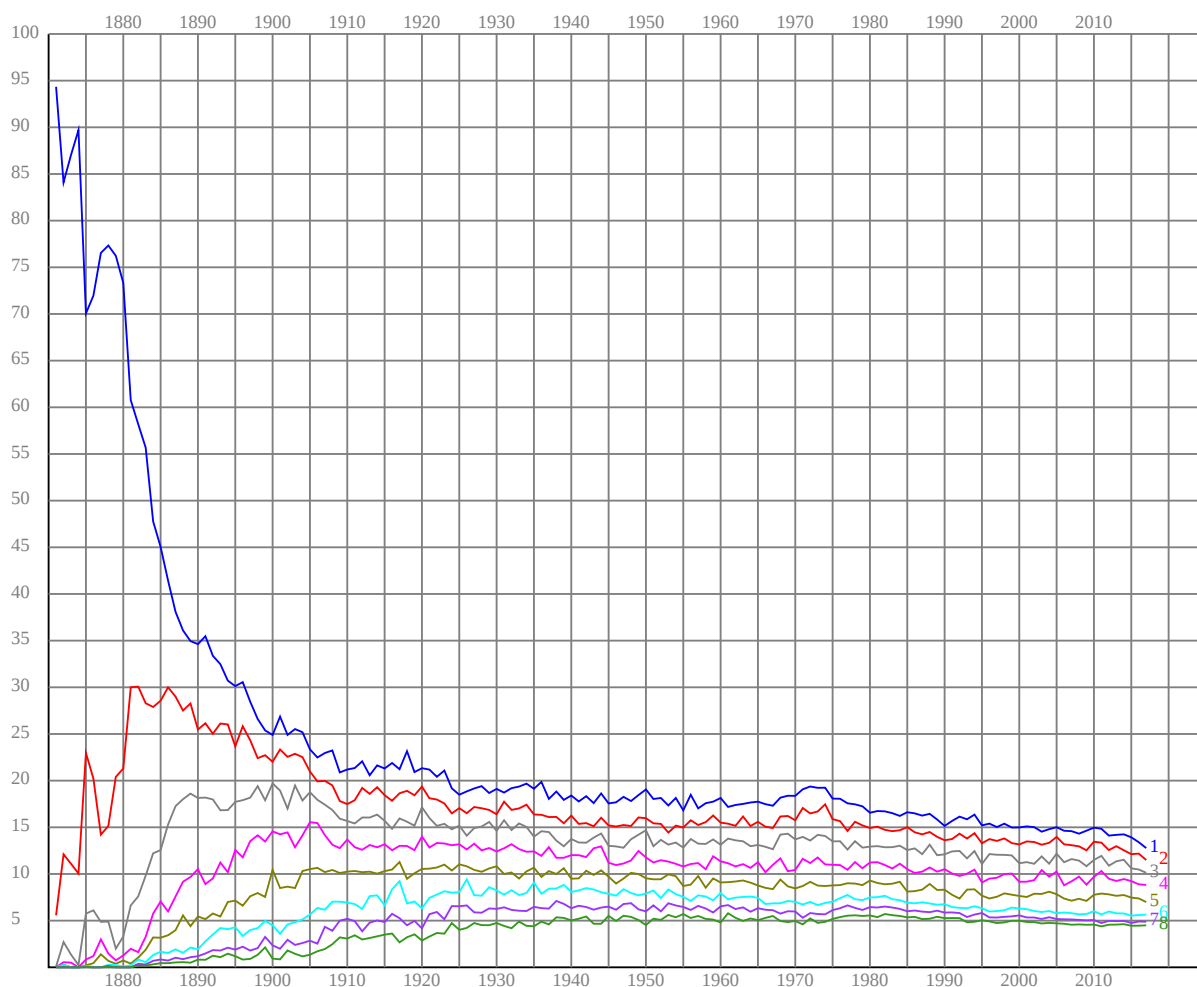
Breaking the totals into decades we have

Group	1960s	1970s	1980s	1990s	2000s	2010s
League	3.58	3.69	3.86	4.28	4.43	4.02
Top ten	3.49	3.59	3.76	4.12	4.23	3.86
Difference	0.09	0.10	0.10	0.16	0.20	0.16

This suggests to me that the increased use of other pitchers is adding about a tenth of a run per game relative to 1962.

A few other things

The number of innings pitched by the top pitcher has been steadily dropping since 1871, leaving room for the number of innings pitched by other pitchers room to grow. Figure 4 shows the ratio of innings pitched by pitchers one through eight.



The innings pitched for the number two pitchers peaked in the 1880s. The usage for number three pitchers peaked in the early 1900s. For the number four pitchers the peak was 1905-06. Usage of number five pitchers peaked in the late teens and the 1920s. The peak for number six and seven pitchers was spread out over the 1940s, 50s, and 60s, with a second peak in the early years of the designated hitter(DH). Usage for the eighth pitcher peaked in the 1960s, started falling and then rose again after the DH was introduced, peaking in the early 1980s.

The average ERA for each season is

	x0	x1	x2	x3	x4	x5	x6	x7	x8	x9
1870s		4.22	3.65	3.40	2.19	2.23	2.31	2.81	2.30	2.50
1880s	2.37	2.77	2.80	3.22	3.11	3.03	3.37	4.17	2.95	3.93
1890s	3.88	3.53	3.28	4.66	5.33	4.77	4.36	4.30	3.60	3.85
1900s	3.69	3.49	3.17	3.11	2.66	2.82	2.66	2.50	2.37	2.53
1910s	2.77	3.36	3.37	3.06	2.91	2.90	2.72	2.68	2.77	3.06
1920s	3.46	4.03	4.06	3.99	4.05	4.33	3.92	4.02	4.01	4.48
1930s	4.81	4.12	4.18	3.81	4.28	4.24	4.52	4.27	4.28	4.27
1940s	4.11	3.89	3.48	3.33	3.52	3.58	3.46	3.89	4.12	4.12
1950s	4.36	4.04	3.70	4.14	3.90	4.00	3.96	3.83	3.86	3.90
1960s	3.82	4.03	3.96	3.46	3.58	3.50	3.52	3.30	2.98	3.61
1970s	3.89	3.47	3.26	3.75	3.63	3.71	3.51	4.00	3.69	4.00
1980s	3.84	3.58	3.86	3.87	3.81	3.89	3.97	4.29	3.73	3.71
1990s	3.86	3.91	3.75	4.19	4.51	4.45	4.61	4.39	4.43	4.71
2000s	4.77	4.42	4.28	4.40	4.46	4.29	4.53	4.47	4.32	4.32
2010s	4.08	3.94	4.01	3.87	3.74	3.96	4.19	4.36		

What is the average ERA of the innings pitched leaders each season?

Starting in 1871 we have

	x0	x1	x2	x3	x4	x5	x6	x7	x8	x9
1870s		4.11	3.47	3.29	2.12	2.18	2.08	2.55	2.03	2.35
1880s	2.19	2.57	2.56	2.89	2.81	2.58	2.99	3.70	2.67	3.40
1890s	3.33	3.14	2.97	3.97	4.45	3.98	3.86	3.78	3.04	3.68
1900s	3.35	3.14	2.70	2.69	2.27	2.48	2.34	2.21	1.83	2.09
1910s	2.32	2.68	2.67	2.52	2.49	2.43	2.31	2.25	2.23	2.64
1920s	3.06	3.35	3.49	3.40	3.53	3.70	3.32	3.58	3.24	3.85
1930s	4.00	3.69	3.49	3.21	3.43	3.53	3.76	3.80	3.80	3.72
1940s	3.26	3.50	3.11	2.83	2.91	3.07	2.71	3.03	3.59	3.38
1950s	3.60	3.46	2.97	3.54	3.30	3.39	3.41	3.40	3.44	3.30
1960s	3.41	3.54	3.46	2.98	3.06	3.07	3.03	2.95	2.50	3.05
1970s	3.37	2.82	2.70	3.16	3.15	3.12	3.13	3.37	3.14	3.64
1980s	3.42	3.37	3.46	3.71	3.31	3.37	3.58	3.80	3.29	3.24
1990s	3.39	3.48	3.18	3.66	3.75	3.73	3.84	3.65	3.86	4.23
2000s	4.08	3.98	3.60	3.86	4.07	3.82	3.88	3.89	3.55	3.56
2010s	3.49	3.50	3.60	3.44	3.45	3.60	3.78	4.01		

The relative ERA, League divided by leader, is

	x0	x1	x2	x3	x4	x5	x6	x7	x8	x9
1870s		103	105	103	103	102	111	110	114	106
1880s	108	108	111	111	118	113	113	110	116	117
1890s	117	112	111	117	120	120	113	114	119	105
1900s	110	111	117	116	117	114	114	113	129	121
1910s	119	126	126	122	117	119	118	119	124	116
1920s	113	120	116	117	114	117	118	112	124	116
1930s	120	112	120	119	125	120	120	112	113	115
1940s	126	111	112	118	121	117	128	128	115	122
1950s	121	117	125	117	118	118	116	113	112	118
1960s	112	114	114	116	117	114	116	112	119	118
1970s	115	123	121	119	115	119	112	119	117	110
1980s	112	106	112	104	115	116	111	113	113	115
1990s	114	112	118	114	120	119	120	120	115	111
2000s	117	111	119	114	110	112	117	115	122	121
2010s	117	113	112	112	108	110	110	109		

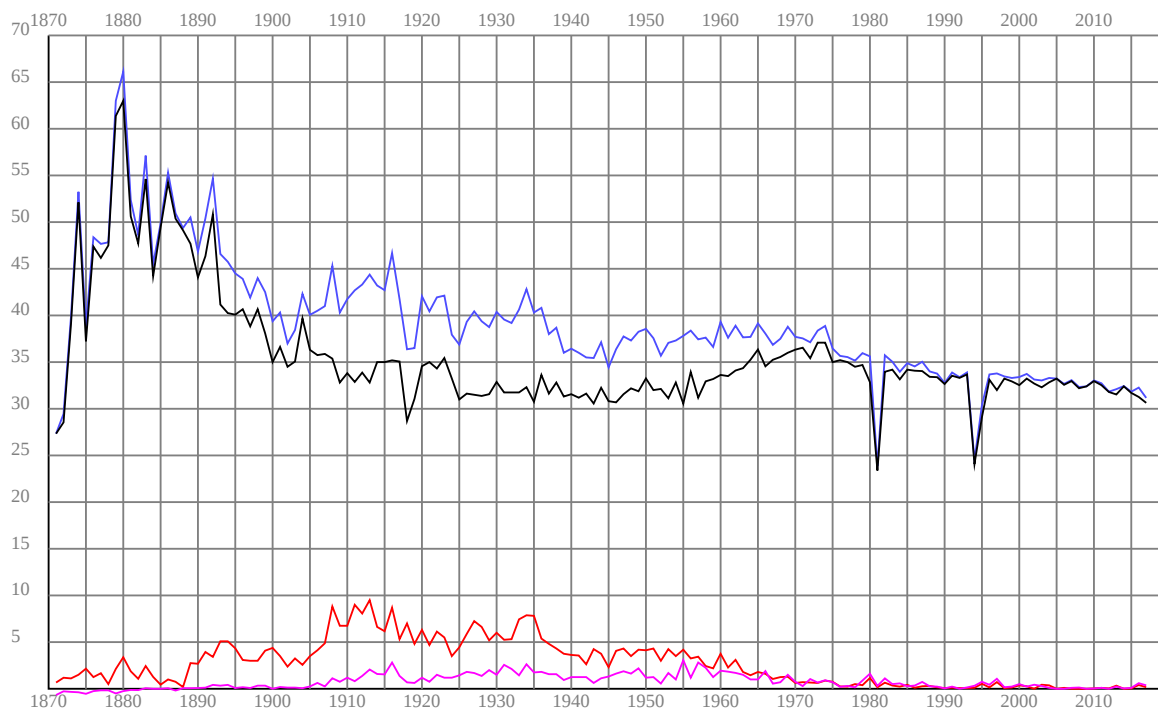
The ERA for the top ten pitchers has been

	x0	x1	x2	x3	x4	x5	x6	x7	x8	x9
1900s	3.69	3.46	3.14	3.11	2.66	2.81	2.65	2.49	2.34	2.49
1910s	2.72	3.30	3.27	3.01	2.89	2.88	2.68	2.67	2.73	2.98
1920s	3.42	4.00	4.03	3.94	4.00	4.28	3.88	3.98	3.95	4.40
1930s	4.73	4.08	4.11	3.76	4.22	4.17	4.44	4.21	4.23	4.19
1940s	4.05	3.84	3.43	3.24	3.44	3.49	3.31	3.78	4.02	4.04
1950s	4.29	3.92	3.60	4.02	3.81	3.84	3.86	3.73	3.75	3.78
1960s	3.74	3.95	3.87	3.37	3.49	3.43	3.43	3.22	2.91	3.50
1970s	3.78	3.42	3.19	3.66	3.39	3.63	3.43	3.87	3.62	3.92
1980s	3.77	3.54	3.80	3.78	3.74	3.76	3.87	4.16	3.61	3.54
1990s	3.73	3.78	3.62	4.07	4.33	4.26	4.39	4.15	4.28	4.55
2000s	4.58	4.25	4.10	4.22	4.24	4.11	4.35	4.25	4.12	4.13
2010s	3.93	3.82	3.88	3.69	3.59	3.78	4.00	4.16		

In 1908 the Major League's ERA was 2.37 and the ERA for the most-used pitchers was 1.83.

Team	Pitcher	IP	ERA	W-L	Age	G	GS	GF
Bro NL	Nap Rucker	333.3	2.08	17-19	23	42	37	4
Bos AL	Cy Young	299	1.26	21-11	41	36	33	3
Bos NL	Vive Lindaman	270.7	2.36	12-16	30	43	30	11
Chi AL	Ed Walsh	464	1.42	40-15	27	66	49	16
Chi NL	Three-Finger Brown	312.3	1.47	29-9	31	44	31	12
Cin NL	Bob Ewing	293.7	2.21	17-15	35	37	32	5
Cle AL	Addie Joss	325	1.16	24-11	28	42	35	6
Det AL	Ed Summers	301	1.64	24-12	23	40	32	8
NY NL	Christy Mathewson	390.2	1.43	37-11	27	56	44	9
NY AL	Jack Chesboro	288.7	2.93	14-20	34	45	31	13
Phi AL	Rube Vickers	317	2.21	18-19	30	53	34	17
Phi NL	George McQuillan	359.7	1.53	23-17	23	48	42	6
Pit NL	Vic Willis	304.7	2.07	23-11	32	41	38	3
StL AL	Harry Howell	324.3	1.89	18-18	31	41	32	7
StL NL	Bugs Raymond	324.3	2.03	15-25	26	48	37	8
Was AL	Tom Hughes	276.3	2.21	18-15	29	43	31	11
	Average	324.04	1.83	21.88-15.25	29.38	45.31	34.88	8.69

I also took a look at the number of games pitched by the leading pitchers. The graph shows the average number of games pitched in blue, the average number of starts in black, the average number of games finished in red, and the average number of middle relief appearances (neither starts nor finishes) in purple.



The number of starts dropped into the low 30s shortly after the lively ball era started, rose in the post-WWII years, and started a gradual decline in the mid 1970s that has returned games started to the levels of the late 1920s.

The rising use of relief pitchers in the early 1900s included increasing uses of the ace to finish off games. That usage started to drop in the late 1930s and had nearly disappeared by the mid 1970s as the distinction between starters and relievers hardened.

The number of middle relief appearances by aces stayed low even as the total number of middle relief appearances rose. The aces' middle relief appearances dropped through the post-WWII era as the total number of middle relief appearances rose rapidly through the 1960s. In 2017 the number of middle relief appearances is more than the number of starts and finishes combined, but middle relief appearances by aces are rare.