

Data-Based Interval Throwing Programs for Little League, High School, College, and Professional Baseball Pitchers

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Summary: An injured baseball pitcher must pitch to return to competition. A data-based interval throwing program for Little League baseball was previously defined by the authors. In that program, children 9 to 12 years old pitch 19.53 pitches per inning; 2.58 innings per outing; and 52.34 pitches per outing from a 46-foot mound distance. Children 13 or 14 years old pitch 19.15 pitches per inning; 2.65 innings per outing; and 58 pitches per outing from a 60-foot 6-in mound distance. Starting pitchers and high school, college, and professional team players pitch 14.93 to 16.45 pitches per inning; 5 to 6 innings per outing; and 76 to 94 pitches per outing. The integration of pitching statistics, field dimensions, performance restrictions, biomechanical studies, and a basic understanding of healing tissue have reduced the myriad of available pitchers' programs to just three programs. They are for the following groups: children 12 years old and younger; children 13 to 14 years old; and high school, college, and professional players. These programs can be used for training and conditioning and can be applied across a wide range of pathologies. **Key Words:** Baseball pitching—College—High school—Interval throwing—Little league—Professional.

Baseball is a popular sport with more than 19,000,000 amateur players in the United States alone.¹ Thousands more play collegiate and professional baseball. Catastrophic injuries (death, paralysis) in organized baseball are rare and rule modifications have further improved the safety of the game. Less severe injuries do occur, however, and frequently result in time lost from practice and/or competition. The reported incidence of injury in collegiate baseball is 3.34 to 5.83 per 1000 athlete exposures. (An exposure is defined as one player participating in a single practice or game session.²) The upper extremity of the body is the site of most baseball injuries, and pitchers are at the greatest risk for sustaining a throwing injury to the arm. Of the 599 injuries to baseball players reported for the 1997-1998 baseball season in the National Collegiate Athletic Association (NCAA) injury surveillance report, 156 (26%) of the injuries in-

involved the pitcher.³ In a 3-year study of a Division I college baseball program, McFarland and Wasik² reported 277 total injuries. Of these injuries, 140 (51%) involved the upper extremity. Despite a lower exposure rate, pitchers sustained 69% of the shoulder injuries resulting in lost practice or game time.²

Traditional rehabilitation exercises for the shoulder and elbow are designed to increase strength and endurance of the dynamic stabilizers in an effort to decrease the stresses placed on the passive restraints. Rehabilitation programs after shoulder injury include posterior capsule stretch, strengthening exercises for the rotator cuff and scapular muscles, dynamic stabilization, concentric and eccentric exercises, open and closed kinetic chain activities, and plyometrics.⁴⁻¹¹ Rehabilitation after elbow injury includes strengthening the elbow and wrist flexors and forearm pronators.¹² One difficulty with the rehabilitation exercises is that it is impossible to approximate the forces and torques placed on the joints without actually throwing the baseball. The only way to mimic the joint forces of a baseball throw is to actually throw the ball. However, allowing the injured pitcher to throw

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too much too soon will slow the rehabilitation process by over stressing the healing tissue. Although many of the rehabilitation programs for throwers suggest that an interval throwing program (ITP) should be implemented before returning to competition,¹²⁻¹⁴ there are few published throwing programs in the literature and only one that is based on data.¹⁵ The ITP modifications for each pathology encountered by pitchers also abound.^{16,17}

Coleman et al.¹⁸ defined criteria to determine a professional pitcher's readiness to return to play based on data collected from three professional baseball seasons. They advocated the use of a simulated game that included the average number of pitches per inning, innings pitched per game, time between innings and the pre-injury pitch type by percentage of the pitchers they studied. This information can help determine the pitcher's game worthiness. However, it does not provide a step-wise progression to prepare the injured athlete for the simulated game.

Most pitching programs have long and short toss components and begin with throwing from level ground. Biomechanics of pitching are very similar on the mound and on level ground, except the shoulder joint torques are lower.¹⁹ Axe et al.¹⁵ developed an ITP for younger pitchers (ages 9-12 years), but this program cannot be used with older baseball pitchers. This is because the program is based on the average number of innings pitched as dictated by Little League Baseball rules and the dimensions of the Little League Baseball field, both of which are different from those of organized baseball at all other levels. In Little League play, 9 to 12-year-old players are allowed to pitch up to 6 innings per calendar week and the pitchers mound is 46 ft from home plate. Conversely, 13 to 14-year-old players are allowed to pitch up to 9 innings per calendar week, and adult players are allowed to pitch an unlimited number of innings. Most pitchers older than 12 years pitch from a standard Major League mound that is 60 ft 6 in from home plate. With the exception of the Little League program, the interval throwing programs (ITP) currently used by rehabilitation professionals are not based on data of the actual demands that will be placed on the pitcher's arm in a game. Instead, the programs are based on personal experiences and intuition regarding how quickly the athlete should return to pitching.¹²

The purpose of this article is to describe interval throwing programs for progressive training or graded return of an injured pitcher to competition across the spectrum from Little League to Major League. The programs are based on game data, and rules for progression are universal and easy to apply.

METHODS

Data Acquisition

Pitching data for children 9 to 12 years old were collected over 70 games (400 half innings) of Little League baseball during a single baseball season. Number of pitches per inning, number of warm up pitches per inning, and innings and number of pitches thrown by each pitcher per game were recorded. These data and the Little League rules for field dimensions were used to construct the short toss component of the program.

Pitching data for 13 year olds were collected over 30 games (203 half innings) of Senior League baseball during a single baseball season. Number of pitches per inning, number of warm-up pitches per inning, and innings and number of pitches thrown by each pitcher per game were recorded. These data and the Senior League rules²⁰ were used to construct the short toss component of the program.

Pitching data for players 15 to 18 years old were collected over a single summer league season (234 innings). Pitching data were also collected over a single season (440 innings) for collegiate pitchers at a Division I school. Innings pitched and pitches per outing were counted separately for starting, relief, and closing pitchers. In addition, the average number of pitches per inning for all pitchers was recorded. The time between pitches, time per half inning, and number of pick-off attempts recorded for a professional baseball team were verified during the college games but were not recorded over the entire season.

Data for professional pitchers of the Houston Astros and their opponents had been gathered previously between 1983 and 1985.¹⁸ For verification, the average number of pitches per game for all 89 pitchers in the Major League Baseball's American League who started more than 8 games in the 1987 season were calculated from available data. For comparison, the average number of pitches per game for all 90 pitchers in the Major League Baseball's American League who started more than 8 games in the 1999 season were also calculated from available statistics. The American League was used because it uses the designated hitter rule (like the youth, high school, and college leagues) that could affect utilization of pitchers.

Data for pitches per inning and innings per outing that had been collected previously for Little League age players were also included in the analysis.

Data Analysis

Number of innings per outing and pitches per inning for starting pitchers were compared across groups using

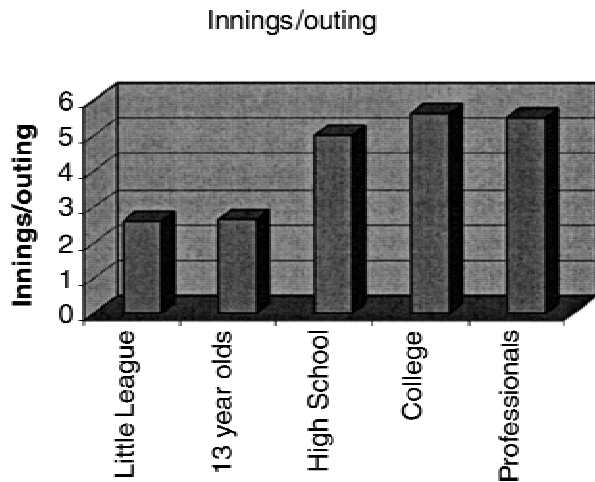


FIG. 1. Number of innings per outing compared among 13-year-old, high school, collegiate, and professional groups ($P < 0.05$).

an analysis of variance (ANOVA). Post-hoc testing was performed using a Tukey test. Significance was accepted if $P < 0.05$. All other data were analyzed descriptively because of differences in rules and game duration.

RESULTS AND PROGRAM DESIGN

The 13-year-old players and the Little League players pitched significantly fewer innings per outing than the other three groups (Fig. 1). They pitched a few more pitches per inning, but these differences were not statistically significant (Fig. 2). There were no significant differences between any of the other groups. The data for the 13-year-old players are summarized in Table 1.

The percent of fastballs in the pitch mix decreased

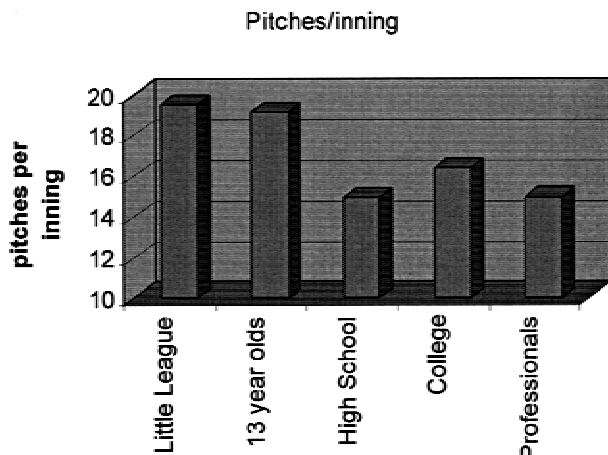


FIG. 2. Number of pitches per inning compared among 13-year-old, high school, collegiate, and professional groups ($P < 0.05$).

TABLE 1. Baseball pitching data for 13-year-old players

	Average	Range	SD
Pitches/inning	19.15	2-42	7.42
Innings/outing	2.65	0.33-6	1.23
Pitches/outing	58.09	2-110	26.41

Pitch type was not recorded.
Data on 30 games, 203 half innings.

from 81% in the high school pitchers to 55.7% in the professionals. The data for the high school, college, and professional pitchers are summarized in Tables 2-4.

The number of pitches per outing for starting pitchers in Major League Baseball has decreased by an average of nearly 1 inning: number of pitches per outing was 6.33 in 1985 and 5.47 in 1999. In addition, the percent of complete games has decreased from 15% of starts in 1985 and 1987 to just 5.4% of starts in 1999.

The pitching volume for the 13-year-old players was significantly different from that of the older age groups. The pitching volume was very similar to that of the Little League athletes we studied previously. However, the rules and field dimensions and the need to progress to the high school volume within 2 years rendered the Little League program useless in addressing the demands placed on the 13-year-old pitcher. Therefore, two additional interval throwing programs for pitchers were developed from these data, including guidelines for progression through the programs. The high school, college, and professional pitching data closely matched. Thus, a single interval throwing program was created for these groups.

Starting pitchers pitched an average of more than three additional innings per game than the relief pitchers or closing pitchers at the high school, collegiate, or professional levels. The relief pitchers and closing pitchers pitched a similar average number of innings.

TABLE 2. Data for high school age players

	Mean	Range	SD
Innings per outing			
Starter	5.0	2-7	1.6749
Reliever	2.0	1-7	1.3274
Closer	11/3	1-2	0.4629
Pitches per outing			
Starter	76.9	33-130	22.345
Reliever	34.9	9-81	20.947
Closer	12.8	8-19	4.0859
Pitches per inning			
All pitchers	14.93	3-32	

Data on 234 innings, 3494 total pitches; 657 pitches other than fastballs or 18.8%; 2837 fastballs or 81.2%.

TABLE 3. 1997 University of Delaware Blue Hens versus opponents

	Mean	Range
Innings per outing		
Starter	5.58	1–9
Reliever	1.97	0.33–5.33
Closer	1.35	0.33–3
Pitches per outing		
Starter	90.24	29–136
Reliever	34.79	4–114
Closer	19.08	3–35
Pitches per inning		
All pitchers	16.45	4–48

Foul balls included in pitches/inning; pitch type was not recorded. Data on 440 innings.

Program Design

The throwing programs must help the athlete progress from no throwing to throwing at game volume. The program is divided in four phases: return to throwing, return to pitching, intensified pitching, and simulated game that progressively increase the loads on the throwing arm.¹⁸ The pitching program begins with short throws at 50% effort and longer tosses from level ground to build arm strength and endurance (return to throwing). Once a base of long distance throwing is established, the pitcher begins pitching from level ground (return to pitching). The pitcher eventually advances to pitching while standing on the pitcher's mound (intensified pitching). Initially, the pitcher throws only fastballs at self-perceived intensities of 50% and 75% of maximum effort. Off-speed pitches (e.g., curve, change-up, slider) are incorporated after the pitcher has advanced to 75% of the expected game volume. The pitcher chooses the type of off-speed pitch based on preinjury pitch preference. Total throwing volume (number of throws times distance times intensity; exclusive of warm up and long tosses) increases in most steps (see Appendix 1). The program for relief and closing pitchers can end several steps earlier than the program for starting pitchers, because the expected game demands are lower for relief and closing pitchers.

The long-toss portion of the Little League program was designed based on maximum throwing distance. Pre-

TABLE 4. Data from the 1983–1985 Houston Astros and opponents and 1999 American League pitchers with 9 or more starts

Years	Pitchers (n)	Games	Innings/outing	Pitches/inning	Pitches/outing
1983–1985	98	486	6 1/3	15	94.55†
1999	90	162	5.47	15*	82.05†

* Estimated.

† Calculated.

injury maximum throwing distance, when known, is used as the maximum throwing distance for the program (Appendix 1). If only pitch speed and age are known, the long toss maximum distance can be found in Table 5.

Program Progression

Soreness rules

Soreness rules (Table 6) play an important part in the progression of the ITP. These rules are used to determine how rapidly the pitcher can progress through the program and return to pitching in a game. The pitcher who is healing more slowly experiences soreness in the throwing arm (indicative of over stressing the soft tissues). The soreness rules base whether the pitcher will remain at the same step, progress to the next step, or drop down to the previous step on the presence and timing of the onset of pain.

Injuries

For the purposes of progression of the ITP, pitchers' injuries can be categorized into four groups. These include injuries that occur to areas of the body other than the throwing arm (e.g., back, knee), injuries to the throwing arm that do not involve the joints (e.g., hit by a ball), mild injuries to the joints (e.g., tendinitis), and severe injury to the joints (e.g., rotator cuff tear, postoperative injuries). First, the physician and rehabilitation professional must determine that the pitcher is sufficiently well healed and rehabilitated to withstand the demands of the lower steps of the ITP.²¹ The ITP instructions base the step at which the pitcher begins throwing on the location and severity of the injury. Additionally, the time between throwing days is based on the type of injury (Tables 7, 8). After initiation of the ITP, progression is based on the soreness rules.

DISCUSSION

The ITP is not designed to replace other shoulder and elbow strengthening exercises but rather is a complement to the conditioning and rehabilitation programs.^{7,8,10} Progression to sport specific activities is the final phase of rehabilitation of athletes with injuries. Upper extremity injuries in overhead throwing athletes primarily occur in the shoulder and elbow joints. Shoulder injuries include impingement,^{4,22–24} instability,²⁵ undersurface rotator cuff tears,^{26–28} glenoid labrum tears,²⁹ and proximal humeral epiphyseal injuries in the skeletally immature thrower.³⁰ Common elbow injuries seen in overhead throwers include hypertrophy of the medial epicondyle, medial epicondyle avulsions, osteochondral defects of the capitellum, ulnar collateral ligament (UCL) laxity or

TABLE 5. Interval throwing program target distance, velocity/age

Velocity (mph)	Age and target distance (feet)			
	9	10	11	12
35	69.4	80.4	OR	OR
35.5	70.9	81.9	OR	OR
36	72.3	83.2	83.0	OR
36.5	73.8	84.4	84.4	77.0
37	75.3	85.7	85.8	78.6
37.5	78.4	88.2	88.6	81.9
38	78.4	88.2	88.6	81.9
38.5	79.9	89.5	90.1	83.6
39	81.5	90.8	91.5	85.3
39.5	83.0	92.1	93.0	86.9
40	84.6	93.4	94.5	88.7
40.5	86.2	94.7	96.0	90.4
41	87.7	96.1	97.5	92.2
41.5	89.3	97.4	99.0	93.9
42	90.9	98.8	100.5	95.6
42.5	92.5	100.2	102.1	97.4
43	94.2	101.6	103.6	99.2
43.5	95.8	103.0	105.2	101.0
44	97.4	104.4	106.8	102.8
44.5	99.1	105.9	108.4	104.6
45	100.7	107.3	110.0	106.4
45.5	102.4	108.8	111.6	108.2
46	104.1	110.2	113.3	110.0
46.5	105.8	111.7	114.9	111.9
47	107.5	113.2	116.6	113.7
47.5	109.2	114.7	118.3	115.6
48	110.9	116.2	120.0	117.4
48.5	112.6	117.8	121.7	119.3
49	114.3	119.3	123.4	121.3
49.5	116.1	120.9	125.2	123.2
50	117.8	122.5	126.9	125.1
50.5	119.6	124.1	128.7	127.0
51	121.4	125.7	130.5	128.9
51.5	123.24	127.3	132.3	130.9
52	124.9	128.9	134.1	132.8
52.5	126.7	130.5	135.9	134.8
53	128.6	132.2	137.8	136.8
53.5	130.4	133.9	139.6	138.7
54	132.2	135.5	141.5	140.7
54.5	OR	137.2	143.4	142.7
55	OR	138.9	145.3	144.7
55.5	OR	140.7	147.2	146.8
56	OR	142.4	149.1	148.8
56.5	OR	144.1	151.0	150.8
57	OR	145.9	153.0	152.9
57.5	OR	147.6	154.9	155.0
58	OR	OR	156.9	157.0
58.5	OR	OR	158.9	159.0
59	OR	OR	160.9	161.2
59.5	OR	OR	162.9	163.3
60	OR	OR	164.9	165.4
60.5	OR	OR	167.0	167.5
61	OR	OR	OR	169.7
61.5	OR	OR	OR	171.8
62	OR	OR	OR	174.0
62.5	OR	OR	OR	176.1
63	OR	OR	OR	178.3
63.5	OR	OR	OR	180.5
64	OR	OR	OR	182.7
64.5	OR	OR	OR	184.9
65	OR	OR	OR	OR

OR, out of range.

Data shown at 90% statistical model predicted distance.

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TABLE 6. Soreness rules

1. If no soreness, advance one step every throwing day.
2. If sore during warmup but soreness is gone within the first 15 throws, repeat the previous workout. If shoulder becomes sore during this workout, stop and take 2 days off. Upon return to throwing, drop down one step.
3. If sore more than 1 hour after throwing, or the next day, take 1 day off and repeat the most recent throwing program workout.
4. If sore during warmup and soreness continues through the first 15 throws, stop throwing and take 2 days off. Upon return to throwing, drop down one step.

rupture, olecranon osteophytes and loose bodies, and ulnar neuritis.³¹⁻³³

Pitching is the specific activity to which pitchers with injuries wish to return. Pitching requires the arm to produce and withstand enormous forces and torques. Muscles acting across the glenohumeral and elbow joints must generate forces equal to but opposite in direction of momentum to counteract the tendency for the arm to follow the ball toward home plate during the high-speed movement of arm deceleration. Fleisig et al.³⁴ quantified the forces generated by the dynamic stabilizers in healthy elite-level adult pitchers. During arm cocking, an anterior shear force of approximately one-half body weight (380N) is generated at the shoulder while a medial shear force of 300N and valgus torque of 64N are generated at the elbow. During arm deceleration, the shoulder muscles generate a posterior shear force of 400N, an inferior shear force of 310N, and a compressive force of 1090N to hold the humeral head in the glenoid recess. A compressive force of 900N is also generated at the elbow to counterbalance the distractive force after ball release.³⁴ A recent report³⁵ demonstrated similar joint forces and torques in youth, high school, college, and professional pitchers. Repeated exposure to these high stresses may lead to frequently encountered injuries, but these are precisely the forces that must be withstood if the pitcher is to return successfully to pitching after an injury or time off.

When clearing an athlete to begin an ITP, the health professionals must be sure that the healing tissues are strong enough to withstand the forces at the beginning of the program. Pathology and treatment dictate this. The start of an ITP is also influenced by the athlete's healing characteristics. The program begins with throwing from level ground at a 50% effort to decrease the stress on the healing tissue. Recent studies by Fleisig et al.²¹ caution the health professional about an athlete's ability to estimate efforts. Their study of healthy pitchers requested to throw at 50% effort, generated ball speeds of 85% and forces and torques approaching 75% of maximum. A

TABLE 7. *Pitching program instructions for 13- or 14-year-old players*

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- A. Baseline/Preseason
To establish a base for training and conditioning, begin with step 3 and advance one step daily to step 14 following soreness rules.
- B. Non-throwing arm injury
After medical clearance, begin step 3 and advance one step daily to step 16 following soreness rules.
- C. Throwing arm- Bruise or bone involvement
After medical clearance, begin with step 1 and advance program as soreness rules allow throwing no more than every other day.
- D. Throwing arm- Tendon/Ligament injury (Mild)
After medical clearance, begin with step 1 and advance program to step 3 throwing every other day as soreness rules allow.
Throw every third day on steps 4–8 as soreness rules allow.
Return to throwing every other day as soreness rules allow for steps 9–16.
- E. Throwing arm- Tendon/Ligament injury (Moderate, severe, or post op)
After medical clearance, begin throwing at step 1.
For steps 1–3, advance no more than 1 step every 3 days with 2 days of active rest (warmup and long tosses) following each workout.
Steps 4–8 advance no more than 1 step every 3 days with 2 days active rest (see step 11) following each workout.
Advance steps 9–16 daily as soreness rules allow.
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request for a 75% effort achieved speeds of 90% and forces and torques of 85% of maximum.²¹

Although recent evidence suggests pitching mechanics do not differ substantially across age ranges,³⁵ our data suggest that the demands of the game are significantly lower for young pitchers. Unlike high school athletes and older players, young pitchers pitch fewer innings with only a slightly higher frequency of pitches per inning. Although some published interval throwing programs are similar to the one we have developed, to our knowledge, these are the first that are based on data collected systematically across a wide range of playing ages.

Our goal was to develop a data-based ITP for pitchers at all levels of organized baseball, which can be used for training and conditioning and be applied across a wide range of pathologies. To be useful for health professionals, coaches, and parents, the programs require some uniformity and should only vary from a set progression of throwing type (e.g., long toss, short toss) and volume when based on data rather than intuition. The programs described here gradually progress the athlete from no throwing to pitching in a simulated game. Starting points

and progression rate are dependent on the pathology and the soreness rules, but the program itself does not change. The myriad of programs has been reduced to only three data-based programs that comprehensively address the demands of pitchers in organized baseball from Little League to the Major Leagues.

The interval throwing programs described in this article are progressive programs in which the intensity and/or number of pitches are increased each workout. Likewise the programs are practical and can be given to the athlete and coach or trainer to continue upon completion of the formal rehabilitation program. The pitcher can also use the program during the off-season or pre-season to prepare for the return to throwing. The incorporation of an ITP in the rehabilitation of a baseball pitcher better insures the safe return of the athlete to competition after injury. These progressive throwing programs require no special equipment. The use of soreness rules allows each pitcher to progress at an individualized manner to load the healing tissue in a graded fashion. The return to pitching can be initiated while the athlete is involved in a formal rehabilitation program and can be continued by

TABLE 8. *High school, college, professional pitching program instructions*

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- A. Baseline/Preseason
To establish a base for training and conditioning, begin with step 4 and advance one step daily following soreness rules.
- B. Non-throwing arm injury
After medical clearance, begin step 4 and advance one step daily following soreness rules.
- C. Throwing arm- Bruise or bone involvement
After medical clearance, begin with step 1 and advance program as soreness rules allow throwing every other day.
- D. Throwing arm- Tendon/Ligament injury (Mild)
After medical clearance, begin with step 1 and advance program to step 7 throwing every other day as soreness rules allow.
Throw every third day on steps 8–12 as soreness rules allow.
Return to throwing every other day as soreness rules allow for steps 13–21.
- E. Throwing arm- Tendon/Ligament injury (Moderate, severe, or post op)
After medical clearance, begin throwing at step 1.
For steps 1–7, advance no more than 1 step every 3 days with 2 days of active rest (warmup and long tosses) following each workout.
Steps 8–12 advance no more than 1 step every 3 days with 2 days active rest (see step 14) following each workout.
Steps 13–16 advance no more than 1 step every other day with 1 day active rest (see step 14) between steps.
Advance steps 7–21 daily as soreness rules allow.
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the trainer or coach once the athlete is medically cleared. The program also provides the opportunity for coaches to use steps within the programs as work-outs for both in-season and off-season conditioning.

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Appendix A. Sample interval throwing program.

Little Leaguer
Interval Throwing Program Target Distance

PHASE I

Short Toss ___ Rest between short & long (10 min)
 feet ___ (20')
 rest time ___ (12 sec/throws & 6-8 min/sets)
 throws

Set	1	2	3
Throws	15	15	20

 intensity ___ (work to tolerance)

PHASE II

Short Toss ___ Rest between short & long (10 min)
 feet ___ (30')
 rest time ___ (12 sec/throws & 6-8 min/sets)
 throws

Set	1	2	3
Throws	15	15	20

 intensity ___ (work to tolerance)

PHASE III

Short Toss ___ Rest between short & long (10 min)
 feet ___ (40')
 rest time ___ (12 sec/throws & 6-8 min/sets)
 throws

Set	1	2	3
Throws	15	15	20

 intensity ___ (work to tolerance)

PHASE IV

Short Toss ___ Rest between short & long (10 min)
 feet ___ (46')
 rest time ___ (12 sec/throws & 6-8 min/sets)
 throws

Set	1	2	3
Throws	15	20	20

 intensity ___ (up to 1/2 speed)

PHASE V

Short Toss ___ Rest between short & long (10 min)
 feet ___ (46')
 rest time ___ (12 sec/throws & 6-8 min/sets)
 throws

Set	1	2	3
Throws	15	20	20

 intensity ___ (up to 3/4 speed)

PHASE VI

Short Toss ___ Rest between short & long (10 min)
 feet ___ (46')
 rest time ___ (12 sec/throws & 6-8 min/sets)
 throws

Set	1	2	3
Throws	20	20	20

 intensity ___ (mound, full speed)

PHASE VII

Short Toss ___ Rest between short & long (10 min)
 feet ___ (46')
 rest time ___ (12 sec/throws & 6-8 min/sets)
 throws

Set	1	2	3
Throws	20	20	25

 intensity ___ (mound, full speed:breaking ball 3:1)

PHASE VIII

Short Toss ___ Rest between short & long (10 min)
 feet ___ (46')
 rest time ___ (12 sec/throws & 6-8 min/sets)
 throws

Set	1	2	3
Throws	20	20	25

 intensity ___ (mound up to full speed:breaking ball 3:1)

PHASE IX

___ Simulated Game

PHASE I

Long Toss ___ 65% Target Distance
 feet ___
 rest time ___ (12 sec/throws)
 throws ___ (25)
 intensity ___ (to tolerance)

PHASE II

Long Toss ___ 70% Target Distance
 feet ___
 rest time ___ (12 sec/throws)
 throws ___ (25)
 intensity ___ (to tolerance)

PHASE III

Long Toss ___ 75% Target Distance
 feet ___
 rest time ___ (12 sec/throws)
 throws ___ (25)
 intensity ___ (to tolerance)

PHASE IV

Long Toss ___ 80% Target Distance
 feet ___
 rest time ___ (12 sec/throws)
 throws ___ (25)
 intensity ___ (to tolerance)

PHASE V

Long Toss ___ 85% Target Distance
 feet ___
 rest time ___ (12 sec/throws)
 throws ___ (25)
 intensity ___ (to tolerance)

PHASE VI

Long Toss ___ 90% Target Distance
 feet ___
 rest time ___ (12 sec/throws)
 throws ___ (25)
 intensity ___ (to tolerance)

PHASE VII

Long Toss ___ 95% Target Distance
 feet ___
 rest time ___ (12 sec/throws)
 throws ___ (25)
 intensity ___ (to tolerance)

PHASE VIII

Long Toss ___ 100% Target Distance
 feet ___
 rest time ___ (12 sec/throws)
 throws ___ (25)
 intensity ___ (to tolerance)

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Appendix B.
Interval Throwing Program
for Little League™ Age Athletes

Name _____ Age _____ MPH _____

From age and velocity the target distance is defined and the appropriate Interval Throwing Program is selected. The target distance is 90% of the predicted maximum throwing distance established from data collected from more than 1000 Little League™ age athletes (9–12 years of age) with the assistance of several Delaware based organizations. The Interval Throwing Program (ITP) is functional, practical and progressive:

- Functional** in that a throwing athlete must throw
- Practical** in that only a baseball and field are needed
- Progressive** in that it increases from lower intensity to higher intensity

Throwing Program
Warmup and Cool Down

- 1) Break a sweat
- 2) Shoulder stretches

Then:

- 3) **Throwing program**
- 4) Shoulder strengthening exercises (dumbbells, bands, isometrics)
- 5) Shoulder stretches
- 6) Ice for 20 minutes (Optional)

- In the ITP, the target distances recommended are rounded to the nearest 10 feet.
- To each **Phase** there is a **short toss, a 15 minutes rest, and a long toss** component to be performed at each workout.

Warm up

- Begin with 3–5 throws at 10 feet, increase 10–15 feet every 3–5 throws until long toss distance is reached.

Soreness Rules

- If sore more than 1 hour after throwing, or the next day, take 1 day off and repeat the most recent throwing program workout.
- If sore during warmup but soreness is gone within the first 15 throws, repeat the previous workout. If shoulder/elbow becomes sore during this workout, stop and take 2 days off. Upon return to throwing, drop down one phase.
- If sore during warmup and soreness continues through the first 15 throws, stop throwing and take 2 days off. Upon return to throwing, drop down one phase.
- If no soreness, advance one phase every throwing day.
- Do not advance more than two phases per week.

Off Season Maintenance Program:

Throw 2–3 times per week at Phase VII or VIII with at least 1 day of rest between workouts.

In Season:

Day 0—Game	Day 2—Throw Phase VII
Day 1—Throw Phase III	Day 3—Throw Phase IV

After an injury (When cleared by doctor):

Begin with Phase I. Take 2–3 days rest between sessions and advance as soreness rules allow.

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Appendix C.
13/14-Year-Old Baseball Pitchers
Interval Throwing Program

Phase I—Return to Throwing

All throws are at 50% effort

- Step 1 Warm-up toss to 60'
 15 Throws at 30'*
 15 Throws at 30'*
 15 Throws at 30'
 20 Long tosses to 60'
- Step 2 Warm-up toss to 75'
 15 Throws at 45'*
 15 Throws at 45'*
 15 Throws at 45'
 20 Long tosses to 75'
- Step 3 Warm-up toss to 90'
 15 Throws at 60'*
 15 Throws at 60'*
 15 Throws at 60'
 20 Long tosses to 90'

Phase III—Intensified Pitching

Pitches are from mound with normal stride

- Step 7 Warm-up toss to 120'
 20 Fastballs (50%)*
 20 Fastballs (75%)*
 20 Fastballs (75%)*
 20 Fastballs (50%)*
 25 Long tosses to 160'
- Step 8 Warm-up toss to 120'
 20 Fastballs (75%)*
 21 Fastballs (50%)*
 20 Fastballs (75%)*
 21 Fastballs (50%)*
 25 Long tosses to 160'
- Step 9 Warm-up toss to 120'
 25 Fastballs (50%)*
 24 Fastballs (75%)*
 24 Fastballs (75%)*
 25 Fastballs (50%)*
 25 Long tosses to 160'

- Step 10 Warm-up toss to 120'
 25 Fastballs (75%)*
 25 Fastballs (75%)*
 25 Fastballs (75%)*
 20 Fastballs (75%)*
 25 Long tosses to 160'

- Step 11 (Active rest)
 Warm-up toss to 120'
 20 Throws at 60' (75%)
 15 Throws at 80' (75%)*

- Step 12 20 Throws at 60' (75%)
 15 Throws at 80' (75%)*
 20 Long tosses to 160'
 Warm-up toss to 120'
 20 Fastballs (100%)*
 20 Fastballs (75%)
 6 Off speed pitches (75%)*
 20 Fastballs (100%)*

Phase II—Return to Pitching

Fastballs are from level ground following crow hop

- Step 4 Warm-up toss to 105'
 20 Fastballs (50%)*
 16 Fastballs (50%)*
 16 Fastballs (50%)*
 25 Long tosses to 105'
- Step 5 Warm-up toss to 120'
 20 Fastballs (50%)*
 20 Fastballs (50%)*
 20 Fastballs (50%)*
 25 Long tosses to 120'
- Step 6 Warm-up toss to 120'
 16 Fastballs (50%)*
 20 Fastballs (50%)*
 20 Fastballs (50%)*
 16 Fastballs (50%)*
 25 Long tosses to 160'

- Step 13 20 Fastballs (75%)
 6 Off speed pitches (75%)*
 25 Long tosses to 160'
 Warm-up toss to 120'
 20 Fastballs (75%)
 4 Throws to 1st (75%)
 15 Fastballs (100%)
 10 Off speed pitches (100%)*
 20 Fastballs (100%)
 5 Off speed pitches (100%)*
 20 Fastballs (75%)
 4 Throws to 1st (75%)*
 25 Long tosses to 160'

- Step 14 Warm-up toss to 120'
 20 Fastballs (100%)
 Throws to 1st (100%)*
 15 Fastballs (100%)
 10 Off speed pitches (100%)*
 20 Fastballs (100%)
 5 Off speed pitches (100%)*
 20 Fastballs (75%)
 5 Throws to 1st (75%)*
 25 Long tosses to 160'

- Step 15 Batting practice
 100–110 Pitches
 10 Throws to 1st field
 Bunts and comebacks

- Step 16 Simulated game

SIMULATED GAME

- 1) 10 Minutes Warm-up of 50–80 Pitches With Gradually Increasing Velocity
- 2) 5 Innings
- 3) 22–27 Pitches Per Inning, Including 15–20 Fastballs
- 4) 6 Minutes Rest Between Innings

* Rest 6 minutes after these sets

Appendix D.
High School College And Professional Baseball Pitchers
Interval Throwing Program

Phase I—Return to Throwing Throws at 50% Effort	Phase II—Return to Pitching† Throws at Effort Level Given	Step 15 20 Fastballs (75%)* 20 Fastballs (100%) 5 Off speed pitches* 15 Fastballs (100%) 5 Off speed pitches* 20 Fastballs (100%) 5 Off speed pitches* Field bunts & comebacks <i>(Reliever's and Closing pitchers can go to step 21 on the next throwing day after completing this step.)</i>
Step 1 Warm-up toss to 60' 15 Throws at 30'* 15 Throws at 30'* 15 Throws at 30'* 20 Long tosses to 60'	Step 8 15 Throws at 60'6" (75%)* 20 Throws at 60'6" (75%)* 20 Throws at 60'6" (75%)* 15 Throws at 60'6" (75%)*	Step 16 20 Fastballs (100%)* 15 Fastballs (100%) 5 Off speed pitches 5 Pickoff throws to 1 st * 20 Fastballs (100%) 5 Off speed pitches* 20 Fastballs (100%) 5 Off speed pitches*
Step 2 Warm-up toss to 75' 15 Throws at 45'* 15 Throws at 45'* 15 Throws at 45'* 20 Long tosses to 75'	Step 9 20 Throws at 60'6" (75%)* 20 Throws at 60'6" (75%)* 20 Throws at 60'6" (75%)* 20 Throws at 60'6" (75%)*	Step 17 15 Fastballs (100%) 5 Off speed pitches* 15 Fastballs (100%) 3 Pickoff throws to 1 st * 20 Fastballs (100%) 5 Off speed pitches* 15 Fastballs (100%) 3 Pickoff throws to 2 nd * 15 Fastballs (100%) 5 Off speed pitches*
Step 3 Warm-up toss to 90' 15 Throws at 60'* 15 Throws at 60'* 15 Throws at 60'* 20 Long tosses to 90'	Step 10 20 Fastballs (50%)* 20 Fastballs (50%)* 20 Fastballs (50%)* 25 Throws at 60'6" (75%)*	Step 18 (Active rest) Repeat step 14
Step 4 Warm-up toss to 105' 15 Throws at 75'* 15 Throws at 75'* 15 Throws at 75'* 20 Long tosses to 105'	Step 11 20 Fastballs (50%)* 20 Fastballs (75%)* 20 Fastballs (50%)* 15 Fastballs (75%)* 25 Throws at 60'6" (75%)*	Step 19 20 Fastballs (100%) 5 Off speed pitches* 20 Fastballs (100%) 3 Pickoff throws to 1 st * 20 Fastballs (100%) 3 Pickoff throws to 2 nd * 15 Fastballs (100%) 5 Off speed pitches* 15 Fastballs (100%) 5 Off speed pitches*
Step 5 Warm-up toss to 120' 15 Throws at 90'* 20 Throws at 90'* 15 Throws at 90'* 20 Long tosses at 120'	Step 12 25 Fastballs (50%)* 20 Fastballs (75%)* 20 Fastballs (75%)* 20 Fastballs (75%)* 20 Fastballs (75%)	Step 20 Batting practice 110–120 Pitches Field bunts and comebacks
Step 6 Warm-up toss to 120' 20 Throws at 105'* 20 Throws at 105'* 15 Throws at 105'* 20 Long tosses at 120'	Phase III‡ Intensified Pitching	Step 21 Simulated game
Step 7 Warm-up toss to 120' 20 Throws at 120'* 20 Throws at 120'* 20 Throws at 120'* 20 Long tosses at 120'	Step 13 25 Fastballs (75%)* 20 Fastballs (100%)* 10 Fastballs (75%) 15 Fastballs (100%)* 25 Fastballs (75%)*	
	Step 14 (Active rest) 20 Throws at 80'* 20 Throws at 80'* 20 Throws at 80'* 20 Throws at 80'*	

Simulated Game

- 1) 10 Minutes warm-up of 50–80 pitches with gradually increasing velocity.
- 2) 5–8 Innings for starters, 3–5 innings for relievers, 2–3 innings for closers.
- 3) 15–20 Pitches per inning, including 10–15 fastballs.
- 4) 9 Minutes rest between innings.

* Rest 9 minutes after these sets.

† Begin steps in this phase with warm-up toss to 120'. All fastballs are from level ground after a crow hop. Finish steps in this phase with 25 long tosses to 160'.

‡ Begin all steps in this phase with warm-up toss to 120'. Finish steps in this phase with 25 long tosses to 160'.