A FRAMEWORK FOR ANNUAL PLANNING AND PROGRAMMING FOR DIVISION II WOMEN'S CROSS COUNTRY AND TRACK AND FIELD DISTANCE RUNNERS

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INTRODUCTION

The integration of a strength and conditioning annual plan and program for cross country, distance runners, and track and field athletes may help with improving running economy, course navigation performance, aerobic power, and injury prevention (1,2,4,5,21,26,28,30,33). These athletes often compete in both cross country and the track and field distance events, thus creating a unique situation of limited time in between competitive seasons, as the collegiate cross country season runs August to October, followed by the outdoor track and field season running March to May. The indoor track and field season begins in December and lasts through the beginning of the outdoor season in March. Women cross country athletes must run a six-kilometer outdoor course that has irregular terrain features, incline/decline hills of varying angles, turns, small barriers, and opponents to pass. If these same athletes are competing in the distance events for track and field, they may have to run distances ranging from 800 m, 1,500 m, 3 km steeple, 5 km, 10 km, and the medley relay during the indoor and outdoor season. This article presents the strength and conditioning planning and programming for cross country and track and field distance runners that compete in both seasons, and utilize the indoor track and field season as preparation for the outdoor season.

A challenge working in adequate general preparation and active recovery phases during the academic year is that the seasons for these sports limit the time to build/rebuild these athletes for competition. There is a need to incorporate training that focuses on injury prevention and rebuilding from previous injuries that frequently occur in cross country and track and field distance events. Common injuries and sites among these sports are shin splints, ankle sprains, hamstring strains, medial tibial stress syndrome, iliotibial band (ITB) syndrome, and plantar fascia strain that may be minimized by improving muscular strength and reducing muscle imbalances and asymmetries (11,18,24,37,38). The needs analysis for the top three common injuries establishes a starting point for the strength and conditioning coach that guides programming, which can be further adjusted based on the team's and individual athlete's injury screening. Table 1 provides a sample annual plan for cross country and track and field distance athletes.

The needs of cross country and track and field distance events focus on physical quality objectives of hypertrophy, muscular endurance, strength, power, mobility, and speed. The objective of hypertrophy is to increase muscle mass during the off-season period and can translate to improved running performance while mitigating injury risk (31). Furthermore, greater muscle mass may also increase the amount of muscle glycogen the athlete could store, thus improving running performance with sustained energy (20). Sport coaches and strength and conditioning coaches may choose to monitor changes in muscle mass by examining body fat percentage with female athletes ranging between 15 – 28% using skin fold measurements or handheld bioelectric impedance analysis devices, if more precise equipment is not available to monitor muscle cross sectional area (17,24,31). By increasing muscular endurance, strength, and power, these endurance running athletes could see improvements in running economy, stride frequency, and their ability to apply force into the ground (1,2,4,5,21,23,36). Further improvements to the runners' speed can be achieved not only through sprint training but also by including exercises that require high contraction velocity such as repeat horizontal jumps and rapid low box toe touches (14). Programs that include exercises to improve athletes' muscular ability to produce speed via faster contraction-relaxation may improve step rate that can translate to reduced ground reaction forces (27). The program should also include mobility exercises (e.g., instep lunge, overhead squat), which may be emphasized during the competitive phases to assist in physical restoration and allow for improved leg motions. Other areas that should be addressed in cross country and track and field distance runners' training are the calf muscles, ITB, and quadriceps and hip flexor muscle groups, which will be discussed in the testing, annual plan, and programming sections. This article presents testing options that have been used to assess these female endurance athletes, planning of training program phases, and programming of exercises, methods, and volume.

TESTING

The volume of mobility and specific exercises may be guided by the results from performing the overhead squat for hip and trunk muscle flexibility, the Thomas Test for hip flexor muscle group flexibility and hip joint range of motion (ROM), and hamstring

TABLE 1. ANNUAL PLAN FOR CROSS COUNTRY AND TRACK AND FIELD DISTANCE RUNNERS

Phase	Active rest	GPP – SPP	SPP – COMP	COMP	Active rest – GPP	COMP	COMP
Months	May	June – July	August – September	October – November	December	January – February	March – April
Physical Quality Objectives	1. MEND 2. Injury rebuild	1. HYP 2. STR 3. PWR 4. MOB	1. STR 2. SPD 3. PWR 4. MOB	1. MOB 2. STR 3. SPD 4. PWR	1. PWR 2. STR 3. SPD 4. MOB	1. PWR 2. STR 3. SPD 4. MOB	1. STR 2. MOB 3. PWR 4. SPD

(GPP – General Preparation Phase; SPP – Special Preparation Phase; COMP – Competitive Phase "In-Season"; HYP – Hypertrophy; MEND – Muscular Endurance; MOB – Mobility; PWR – Power; SPD – Speed; STR – Strength)

muscle group flexibility tested by single-leg raise goniometer testing. The overhead squat follows the test protocol of the "deep squat" from the Functional Movement Screen™ (FMS) using the 0 – 3 scoring system that may identify areas in need of additional mobility exercises (3,15,29). The Thomas Test can be used to help direct individualized hip flexor mobility and flexibility planning, while the antagonist test (i.e., the single-leg raise) allows for an objective measurement of hamstring flexibility that may limit athlete leg movement. As a team, symmetrical ROM for the left and right legs with values ranging between 70° – 90° may be used as a guide for determining if additional exercises for mobility and hamstring flexibility are needed.

The muscular performance tests are used for the planning stages of program and can involve the squat jump, countermovement jump, and one-step approach for assessing lower body power development from varying neuromuscular performances. Three unique jump variations allow for assessment of the athletes' ability to concentrically develop power through the squat jump, time to develop force with greater use of the stretch-shortening cycle (SSC) in the countermovement jump, and the ability to use the SSC effectively with a pre-stretch in the one-step approach (6). If the standard deviations of these testing means overlap, this suggests that the athletes' strength and conditioning sessions should pivot to include exercises to increase power while emphasizing SSC activity. Lastly, vertical hops (e.g., "single-leg jump") may be performed to assess if any athletes have asymmetric power production between their legs. A 10% discrepancy between the vertical hop heights can be used to determine if an athlete requires additional attention to unilateral strength and power training.

Collectively, the results of these bilateral and unilateral power tests can guide the planning and progression of exercises such as sumo deadlifts for bilateral strength to step-ups for unilateral strength. The development and maintenance of power is challenged by the amount of repetitive impact the runners experience during their training, so close attention should be paid to any athlete's subjective statements of pain in the lower extremity. To ensure athlete safety and well-being, the strength and conditioning coach has a responsibility to reduce training volume and adjust exercises so athletes can have adequate recovery time.

Lastly, aerobic power (i.e., maximal oxygen consumption [VO_2max]) can be assessed using a modified Bruce Protocol, with the results reported to the sport coach to guide the sport training (16). In general, expectations for athlete VO_2max values should be > 50 ± 3.2 ml/kg/min, which is in line with other reported VO_2max levels of > 800-m runners (32,35). Although the aerobic power test can provide valuable information, it may not be applicable to the strength and conditioning planning as this should be the focus of the sports coach training. Overall, the results of the preceding tests can be assessed and provided to the sports coach with strength and conditioning coach commentary/feedback on areas that require attention and consequently guide how the strength and conditioning annual plan and program will progress throughout the seasons.

ANNUAL PLAN

Annual planning for these sports is presented in Table 1, which starts with the summer active rest phase (ARP) beginning mid-May with the primary goal of improving muscular endurance and injury rehabilitation for individual needs. The duration of the ARP is typically only a few weeks with some of the components carried over to the general preparation phase (GPP), that lasts from June to July. The primary objectives of the GPP are in the following priority order: hypertrophy, strength, power, and mobility. There could potentially be two separate GPPs: one for first year or transfer athletes and the other for those athletes returning to the team. The first year or transfer athletes can follow a wave method for the training volume and intensity with repetition and intensity range progression of 12 – 15 repetition maximum (RM) with sets fluctuating between 3 – 4 sets for day one and a 5 – 12 RM for three sets ending with a de-load week at the end of the GPP. As is often typical in collegiate athletics, the strength and conditioning coach will have no prior knowledge of the transfer or first time athletes' previous training practices and experience. Additionally, for some athletes, college athletics or their new school may be their first time participating in a structured training program. To concurrently mitigate injury risk and integrate first year and transfer athletes to a specific strength and conditioning coach's training philosophy and program, it would be prudent to minimize liability and coaching malpractice as much as possible by starting these athletes in a general, baseline training program. The first year and transfer athletes' programming can then be customized accordingly based on the results of the preceding tests and their individual progress and improvements to their prescribed training. Table 2 demonstrates an example exercise order and selections during the GPP for both athlete categories (returning and first year or transfer).

During all phases, training adjustments will need to be made once the program is implemented to adjust for time efficiency, injuries, coaching requests, and team preparation for competitive events. The strength and conditioning weekly session volume can follow a step progression (seen in Figure 1), while other phases may utilize wave training and de-load weeks prior to competitions. Generally, athletes begin the academic year in August with a special preparation phase (SPP) that will quickly transition to the cross country competition phase, lasting to the end of October or beginning of November. The primary objectives of the SPP and competition phases should be in the following priority order: strength, speed, power, and mobility. The preceding phases should then be focused on multi-joint movements such as the sumo-style deadlift, clean jump shrug, box jumps with step down, backward medicine ball throw, fast toe touches on box, and suspension trainer push-ups and rows. The ancillary movements are for the posterior chain, while unilateral movements may mitigate the injury risk from the running mileage accumulated during the season's training. Training volume can progress from 2 – 4 sets with repetitions ranging from 3 – 5 in power and speed exercises and 3 – 5 for the strength exercises, while intensity may appropriately be adjusted based on the progressive overload principle. Following the end of the competition phase, training priorities shift to restoration

TABLE 2. GPP EXERCISE ORDER LAYOUT

SESSION	DAY 1	DAY 2
First Year/Transfer Athletes	**Core Exercises:** Box jumps hold landing for 3 s Dumbbell deadlifts SS1: Push-ups SS1: Inverted rows Step-ups (knee height box) Loaded hip thrusts **Ancillary:** Stability ball leg curls Standing heel raises Abdominal work is the athlete's choice of exercise, 100 – 180 repetitions	**Core Exercises:** Dumbbell deadlifts SS1: Dumbbell pullovers SS1: Tube lateral raises Lateral lunges **Ancillary:** Single-leg dumbbell stiff-leg Romanian deadlifts (RDLs) Seated heel raises Biceps (varies) Triceps (varies) Abdominal work is the athlete's choice of exercise, 100 – 180 repetitions
Returning Athletes	**Core Exercises:** Countermovement jumps Hex bar or dumbbell deadlifts SS1: Dumbbell bench presses SS1: Dumbbell bent over rows or seated rows Dumbbell split squats Hip thrusts Loaded hip thrusts **Ancillary:** Stability ball leg curls Standing heel raises Abdominal work is the athlete's choice of exercise, 60 – 140 repetitions	**Core Exercises:** Dumbbell deadlifts or leg presses SS1: Dumbbell shoulder press (seated or standing) SS1: Wide grip lat pulldown or assisted pull-ups Lateral shuffle lunges with band at knee **Ancillary:** Single-leg dumbbell stiff-leg RDLs Seated heel raises Biceps Triceps Abdominal work is the athlete's choice of exercise, 60 – 140 repetitions

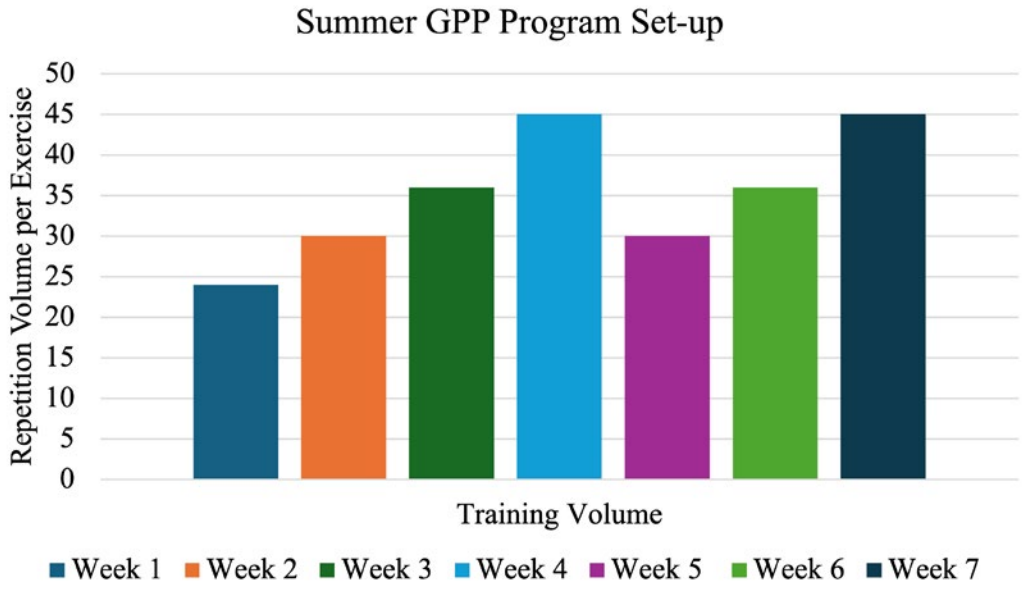

FIGURE 1. TRAINING VOLUME PROGRESSION USING THE STEP METHOD FOR THE GENERAL PREPARATION PHASE

with mobility becoming the focal point. Other aspects of training can be decreased for 2 – 3 weeks, with a gradual increase in attention to power, strength, and speed that carries the athletes' training over winter break until return to campus for the track and field seasons.

The winter session serves as a GPP phase, as the time to the first indoor competition may only be a few weeks after the athletes return to campus. Oftentimes, the team goal of the indoor season is to prepare for the outdoor season, which allows for the strength and conditioing training to emphasize power development that is divided into two groups. Table 3 presents an example of programming during a competition phase while

Table 4 presents example programming for the outdoor track and field season competition 2 phase. The indoor track and field season should then focus on maintaining strength throughout the season, while mobility can serve a prominent role in assisting with physical restoration. A step method progression can be used for intensity and/or volume during these phases, depending on the exercises and timing of competitions. The set and repetition ranges are provided in the table as examples/starting points and may be modified based on the athletes' daily and weekly fatigue and response to training. During the competition phases, communication with the sport coach and athlete will be critical for precisely adjusting training volume and intensity.

TABLE 3. FIRST TRACK AND FIELD COMPETITION PHASE PROGRAMMING FOR THE TWO GROUPS

2-MILE, 5-K, 10-K RUNNERS	800 M, 1500 M, STEEPLES
Box jumps 8 – 12"	Clean jump shrug
Countermovement jumps	**Day 1:**
Fast feet over line	1. Cycle split jumps
Day 1:	2. Fast feet on box
1. Band squats	3. Rear-leg elevated split squats
2. Lateral band walks right and left	4. Step and shoulder presses
Day 2:	**Day 2:**
1. Step-ups 12"	1. Single-leg box push-offs
2. Foward-backward band walks	2. Alternate legs
Ancillary	3. Sprinter step-ups
Push-ups	4. Step and presses
Suspension rows	5. Supine rapid hip extensions
Planks right, center, and left	**Ancillary**
Plate around the world (head) 2 x 8 – 15 each	Bent over rows
	Eccentric Nordic curls or single-leg stiff-leg deadlifts
	Bicycle crunches
Sets range from 2 – 5 depending on the exercise, time before competition, and coach's input.	
Repetitions for power exercises are less than 6, while strength exercises were between 5 – 8 with occasionally challenging athletes to perform 12 – 15.	
Rest time is based on athletes rotating through the group which allows for about a 2-min recovery.	
Cool-down consists of lower body static stretching and foam rolling, with a few upper body exercises for improving mobility.	

Both groups perform the same dynamic warm-up: heel-sweep; step + leg cradle; step + knee hug; inch worm x 10 yd; lunge + overhead reach x 10 yd; lunge + trunk rotation; backward step + open hip reach x 10 yd; scorpions x 10 each; eagles x 10 each; scapular slides x 15

TABLE 4. SECOND TRACK AND FIELD COMPETITION PHASE PROGRAMMING FOR THE TWO GROUPS

2-MILE, 5-K, 10-K RUNNERS	800 M, 1500 M, STEEPLES
Day 1:	**Day 1:**
Squat to chest throws	Sprinter steps-ups
Rear lunge front foot on box	Tube shoulder presses
Walking lunge into knee drive	Barbell bent over row
Suspension push-ups	**Ancillary**
Suspension row	No shoes single-leg heel raises
Ancillary	Eccentric Nordic curls
Barefoot heel/toe raises	Side to side medicine ball slams
Barefoot foot circles (right and left)	**Day 2:**
Barefoot deep squat holds	Countermovement jumps
Band good mornings	Side sprinter step-ups
Day 2:	Stiff-leg RDL
Squat to chest throws	Stations on both days
Side lunge stationary foot on box	1a. Power skaters
Side lunge into knee drives	1b. Push-ups
Suspension push-ups	2a. Split squat to knee drives
Suspension rows	2b. Back extensions
Ancillary	**Ancillary**
Barefoot heel/toe raises	Barefoot single-leg heel raises
Barefoot foot circles (right and left)	Single-arm band rows
Partner medicine ball sit-ups	Partner medicine ball torso twists
Sets range from 2 – 5 depending on the exercise, time before competition, and coaches input.	
Repetitions for power exercises are less than 6, while strength exercises are between 5 – 8 with occasionally challenging athletes to perform 12 – 15.	
Rest time is based on athletes rotating through the group which allows for about a 2-min recovery.	
Cool-down consists of lower body static stretching and foam rolling, with a few upper body exercises for improving mobility.	

Both groups perform the same dynamic warm-up: heel-sweep; step + leg cradle; step + knee hug; inch worm x 10 yd; lunge + overhead reach x 10 yd; lunge + trunk rotation; backward step + open hip reach x 10 yd; scorpions x 10 each; eagles x 10 each; scapular slides x 15

ADJUSTMENTS TO PROGRAMMING

As the competition seasons progress and transitions from one sport to the next, adjustments to programming and training should be made in accordance with the coach's feedback, athletes' requests/comments, and injuries sustained. Examples of team feedback during a season may include complaints of tight calves or knee discomfort, which provides justification to put additional time into foam rolling and stretching of the ITB, calf, and hamstring muscles to assist in restoration. The time spent on addressing muscular tightness comments may help reduce some of the discomfort experienced by the athletes, potentially being included earlier in the program. The occurrence of overuse injuries, such as foot stress fractures, requires individualized programs to work around injured areas while adding in the athlete's return to play (RTP) program. Specific RTP programs are beyond the scope of this article and the strength and conditioning coach is directed to review literature and consult sports medicine staff to develop an effective program (10). Additionally, changes to team travel may provide challenges that necessitate adjustments to exercise selection and volume within the program to assist in competition preparation.

ALTERNATE PROGRAMMING CONSIDERATIONS

The stressors cross country and track and field distance runners experience during their preparatory and competitive phases may also necessitate modified programming structures to provide adequate restoration. One option that may be of benefit is the application of microdosed programming that redistributes training volume across more frequent, shorter duration training sessions, potentially allowing for improved recovery and greater intent during training (13,34). While this programming method increases training frequency, the shorter duration training sessions allow for more time to be spent on recovery (e.g., naps) and recuperative modalities (e.g., ice baths). Previous literature has shown this programming method to be beneficial when used with tactical populations (7,25), female collegiate basketball players (8), and field hockey athletes (12). Furthermore, when compared with a traditional programming model, microdosed programming is reported to produce similar, if not superior, training adaptations in those populations studied. For a more in-depth discussion on the training methods to incorporate with microdosed programming and a list of the physiological qualities that may benefit, readers are directed to Bonder et al. (9). An example microdosed training

template that can be adjusted to meet the demands of cross country and track and field distance runners using the preceding content can be found in Bonder and Shim (8).

The physical qualities that cross country and track and field distance runners must maintain across two competitive seasons in an annual plan may find block periodization a particularly useful planning principle for strategizing programming. Block periodization sequences specialized meso-cycles with a focus on minimal physical qualities and motor control abilities that can transition from cross country to track and field with multiple shorter phases (19). This planning concept relies on the theory of residual super-compensatory training effects whereby training adaptations are sustained for a specific time frame so separate physical qualities may be focused on with programming. For example, aerobic power has a residual training effect of 30 ± 5 days while speed has a residual training effect of 5 ± 3 days (19). A full list of residual training effects by physical quality can be found in Issurin (19). Thus, speed should be programmed into training once per week, while aerobic power does not need to be the focus of training as often, especially because the athletes will train this quality sufficiently while practicing their given sport. By strategically training for one or two similar physical qualities at a time, the possibility of a training interference effect and the use of similar repetitive movements may be minimized, while systematically improving performance and enhancing physical recovery. As cross country and track and field distance runners typically complete a high weekly volume of aerobic training, block periodization within a microdosed programming model may be the ideal choice to incorporate resistance and plyometric training modalities for this population (20). Dozens of set and repetition scheme possibilities to adapt and successfully incorporate block periodization can be found in Jovanović (22).

PRACTICAL APPLICATIONS

There are several challenges cross country and track and field distance runners face when attempting to perform optimally, including competing in two consecutive seasons with minimal downtime between each. The need to maintain or improve several competing physical qualities further compounds the challenges faced by strength and conditioning coaches working with this group. Additionally, the concurrent training of aerobic performance and power and strength training requires the appropriate application during training and planning during programming, as the goals are sustained cyclic performance instead of short duration (< 10 s) skill execution. Planning athletes' training over the two seasons, programming for sport specificity, and adjusting as seasons progress will ultimately allow for overcoming many common obstacles encountered when training this population. Table 5 provides a summary of the testing and programming methods used as part of the example annual plan provided in Table 1. These suggestions may be incorporated and modified to fit the unique demands of different cross country and track and field distance teams, coaching philosophies, sport coach requests, athlete needs, and training environments that a strength and conditioning coach could encounter when training this population.

TABLE 5. SUMMARY OF RECOMMENDED TESTS AND PROGRAMMING METHODS FOR CROSS COUNTRY AND TRACK AND FIELD DISTANCE ATHLETES

SELECTED TESTS FOR CROSS COUNTRY AND TRACK AND FIELD DISTANCE ATHLETES
• **Overhead Squat (FMS Protocol)** – Hip and trunk muscle flexibility
• **Thomas Test** – Hip flexor flexibility and hip joint ROM
• **Single-Leg Raise (via Goniometer)** – Hamstring flexibility
• **Squat Jump** – Concentric power development
• **Countermovement Jump** – Rate of force development via SSC activity
• **One-Step Approach Jump** – Efficiency in using SSC via a "pre-stretch"
• **Vertical Hop (Single-Leg Jumps)** – Power asymmetry assessment
• **Bruce Protocol** – Aerobic power/capacity (VO_2max) assessment
TRAINING METHODS AND PROTOCOLS
• **Wave Loading** – Training volume and intensity progression for first year or transfer athletes during GPP
• **Step Progression** – Weekly session training volume planning
• **Microdosed Programming** – Increase training frequency and shorter training session duration to improve athlete recovery and subsequent training intent (recommended especially for in-season competitive training phases)
• **Block Periodization** – Use theory of training residual effects of supercompensation to plan training block based on test results and athlete training needs

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