Hurdles

- Due to the positioning of the legs, it is desirable to have the high point of the center of mass of the athlete before the barrier (Horz pos of high point in Image 1).
- Most athletes need to accelerate into the barrier to reach the optimal combination of speed and economy. The faster a runner is, the less they need to adjust their speed.
- The faster a runner goes, the lower he or she needs to jump since less time is required above the barrier.

Water Jump

The forces from the ground in landing from the water jump are up to two times greater than regular running (7 times body weight upon landing compared with about 3 times body weight in running).
- Use a gradual progression using drills and water jumps in practice to strengthen the body to handle these forces.

The most important performance factor in a successful water jump is approach velocity.
- A high approach velocity allows for a greater landing distance and smaller loss of velocity.
- Sighting in the barrier is critical to avoid stuttering and losing velocity during the approach.
- Avoid jumping too high off the barrier. This causes losses in horizontal velocity at landing and a greater impact force.

Energy Cost of Obstacles

Running at race pace with the water jump and barriers costs 2.5% more energy than running without any obstacles. That explains some of why a 3000m steeplechase race is slower than an open 3000m race. However, along with the greater energy cost of the steeplechase, the energy use is not constant due to the obstacles. So, a steeplechaser needs to have the ability (naturally or through training) of adjusting effort back and forth throughout the race. They must:
- Include hurdling and water jumping during interval training near race pace.
- Avoid sudden changes in training that might lead to injury.
- Work through a gradual adaptation to stress to handle the required training.

Trends in Hurdling

A greater exit velocity relative to approach velocity in hurdling is accomplished through:
- Taking off farther back (Women - Graph 3, Men – Graph 6)
- Landing closer to the hurdle (Women – Graph 4, Men – Graph 7)
- Greater lead knee extension above the barrier (Women – Graph 5, Men – Graph 8)

Care should be taken in how to interpret these results since there is clearly a lot of variability around the best fitting lines. This is because 1) factors related to hurdling technique interact with other factors and 2) anatomy and flexibility varies from athlete to athlete, so different optimal positions are required.

Since men must clear a greater height, the trends become more apparent. Knee extension for women is less critical since they do not need to raise their foot as high.

Ambidexterity

The ability to lead with either leg can make seconds of difference over the course of a race. When someone forces one lead leg for a preferred leg, extra energy is used and more horizontal velocity is lost during the takeoff.

The slower a runners race pace is, the more they should accelerate into the barriers. This is less important for women.
- Knee extension should be around 150 deg (30 deg from straight) while clearing the barriers.
- Greater lead knee extension above the barrier.
- The slower a runners race pace is, the more they should accelerate into the barriers.

Graph 1 – Common measurements of hurdling mechanics.

Graph 2 – Distance from toe-off of penultimate step to foot contact of the step following landing versus jump number.

References


Key Points / Coaching Cues

Men & Women

- Women lose more horizontal velocity through the water jump than men.
- Men lose more horizontal velocity through the barriers mostly due to the takeoff.

“Hurdling is an art for animals.” – Kip Keino

Water Jump

- A high approach velocity is critical.
- Jump forwards rather than upwards.
- Utilize a smooth steady step rhythm in the final steps.
- Use a high approach velocity to get a good landing distance rather than a large push off the barrier.
- Find an optimal crouch above the barrier for you. We all have different positions that generate the best power around our hip and knee. It is possible to be too high or too low.

Hurdling

- At 5:30 pace, women should take off around 1.65m (5’ 3”) from the hurdles.
- At 8:23 pace, men should take off around 1.95m (6’ 3”) from the hurdles.
- Minimal vertical force at takeoff is a good thing, but make sure you get enough to safely clear the barrier.
- Men and women should land as close to the barrier as reasonable.
- Knee extension should be around 150 deg (30 deg from straight) while clearing the barriers. This is less important for women.
- The slower a runners race pace is, the more they should accelerate into the barriers.
- Focus on trail leg flexibility to avoid needing a higher jump than is necessary.
- Hit your high point prior to clearing the barrier to land closer to the barrier and get horizontal velocity back.
- Land with your foot underneath you to avoid excessive braking upon landing.

STEEPLECHASE MECHANICS

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