

**HURDLES RACES**Manuel Sillero Quintana, M^a del Mar Arroyaga Crespo & Diego Martín Martín**HURDLE RACES****1.- INTRODUCTION**

Hurdle races recognized in the current competition regulation of the Spanish Athletics Federation are the followings:

Distancie	Hurdles	Height	Category (MALES)	Start-Hurdle	Hurdle-Hurdle	Hurdle-Finish
60	5	1,067	Sen-U23-U20	13,72	9,14	9,72
60	5	1,00	U17	13,35	8,90	11,05
60	5	0,914	U15	13	8,50	13
60	5	0,84	U13	12,3	8,20	14,90
80	8	0,84	U13	12,30	8,20	10,30
100	10	0,914	U15	13	8,50	10,50
110	10	1,00	U17	13,35	8,90	16,55
110	10	1,067	Sen-U23-U20	13,72	9,14	14,02
220	5	0,762	U13	40	35	40
300	7	0,84	U15	50	35	40
400	10	0,84	U17	45	35	40
400	10	0,914	Sen-U23-U20	45	35	40

Table 1.- Men's hurdles races indoor (upper part) and outdoor (lower part). (Distances in metres).

Distancie	Hurdles	Height	Category (FEMALES)	Start-Hurdle	Hurdle-Hurdle	Hurdle-Finish
60	5	0,84	Sen-U23-U20	13	8,50	13
60	5	0,762	U15-U17	13	8,50	13
60	5	0,762	U13	12,30	8,20	14,90
80	8	0,762	U13	12,30	8,20	10,30
100	10	0,762	U15-U17	13	8,50	10,50
100	10	0,84	Sen-U23-U20	13	8,50	10,50
220	5	0,762	U13	40	35	40
300	7	0,762	U15	50	35	40
400	10	0,762	U17	45	35	40
400	10	0,762	Sen-U23-U20	45	35	40

Table 2.- Women's hurdles races indoor (upper part) and outdoor (lower part).

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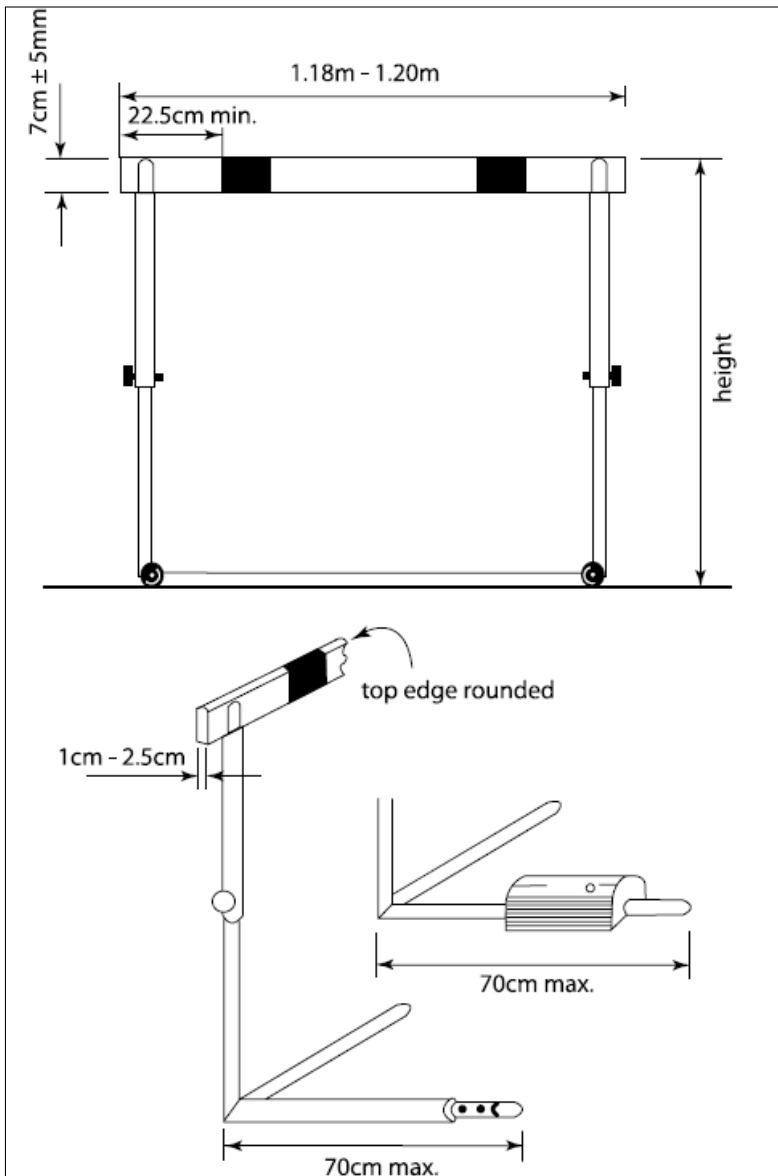


Figure 1.- Example of a standard hurdle (IAAF, 2011)



2.- HURDLE TECHNIQUE.

The objective of the hurdle race is to minimize deviations from normal sprinting. In fact, hurdles are not jumped, but they are passed over. In order to achieve this, the athlete should try to reduce the time of the flying phase. The center of gravity (CG) should not rise nor fall too much, and stepping over the hurdle should just look like a wider stride than normal.

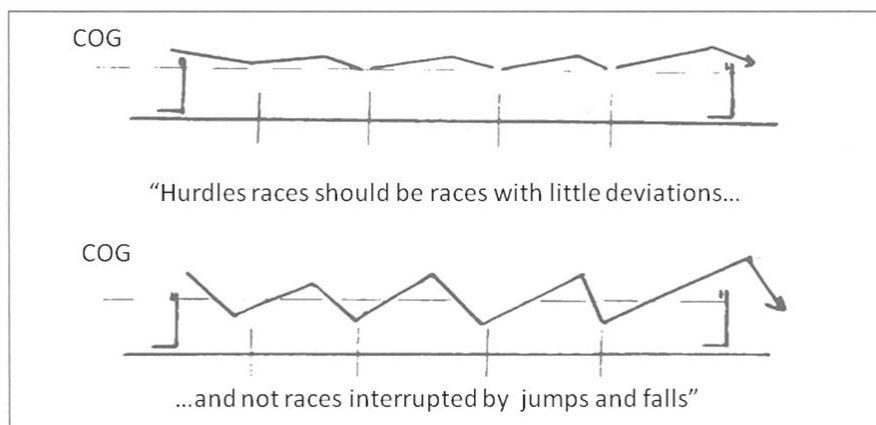


Figure 2.- Right and wrong path of the CG in a hurdle race.

On the other hand, the foot- and the whole leg in general – must firmly contact the ground to prevent a big cushioning phase that slows down the speed in the gap between hurdles. A hurdler is a sprinter who loses not much time in hurdling.

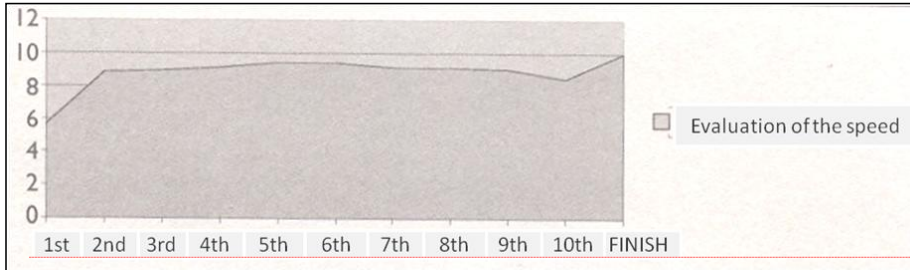
We will call **impulse leg** the leg that does the last support before hurdling. The impulse leg becomes the **trail leg** when we are on the clearance. The **free leg** in the last support before hurdling is called **leading leg** and it will be the first one hitting the ground after the clearance.

The pace of a hurdles race (see Figure 3), is usually compound of:

- A strong acceleration from the start to the first hurdle,
- A moderate acceleration until the fourth or fifth hurdle,
- A plateau at maximum speed until the eighth hurdle,
- A deceleration until the tenth hurdle,
- A final acceleration in the last metres until the finish.



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Comentario [m1]: Rehacer con Excel.

Figure 3.- Sprint hurdle's race pace (100 or 110 mh).

Paco Gil suggests that, in order to obtain a good hurdler, first we need to make him run well, and later run with hurdles. If we compare the flat running technique and the hurdle running technique, we should only study the modifications that appear in the hurdle clearance, and in the gap between the hurdles.

2.1.- THE START.

As stated above, there are no differences between a flat race start and a hurdle race start. The main goal is to reach the first hurdle at full speed.

To cover the 13,72 metres of the 110 metres hurdles (men) and the 13,00 metres of the 100 metres hurdles (women), athletes usually take 7 or 8 steps (see Figure 4). Elite hurdlers take 7 steps to the first hurdle so they start with the impulse leg in the advanced block. Lower level athletes can do 8 steps before the first hurdle, which will make them start with the impulse leg in the delayed block (leading leg in front). Finally it is remarkable how some really powerful athletes (for example the Cuban Dayron Robles, WR 12,87 seconds) only use 6 steps before the first hurdle, starting with the leading leg in front.

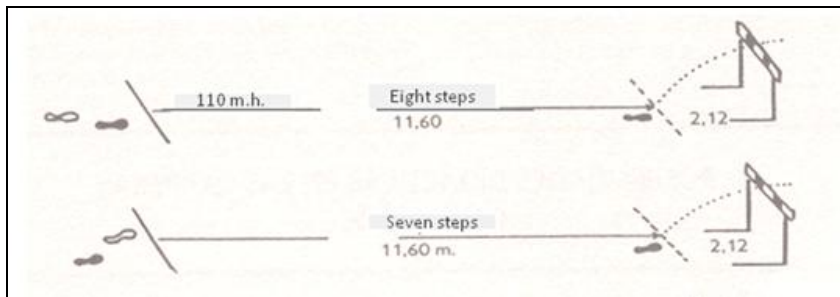


Figure 4.- Supports from the start to the first hurdle.



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Gil (2005) studied the length of the supports of the eight steps from the start (see Table 3).

	110 m.h		100 m.h	
1st Step	0,65	0,65	0,60	0,60
2nd Step	1,05	1,70	1,10	1,70
3rd Step	1,35	3,05	1,35	3,05
4th Step	1,40	4,45	1,50	4,55
5th Step	1,50	5,95	1,65	6,20
6th Step	1,65	7,60	1,80	8,00
7th Step	1,75	9,35	1,90	9,90
8th Step	1,70	11,05	1,80	11,70
Take off distance	1,95	13,00	2,02	13,72

The variability is much higher in long hurdle races. There are many combinations in between the 40 metres from the starting line to the first hurdle of the 220 metres hurdles U13, or the 50 metres of the 300 metres hurdle U15 (See tables 1 and 2).

Within the 45 metres of the 400 metres hurdles, male runners usually take 21 to 22 steps, while girls usually take 23 to 24 steps.

Table 3.- Length of the steps in the 100 and 110 mh races.

The number of steps is not crucial in the 400 hurdles. What really matters is not to get to the first hurdle with the hip delayed, and do it at a proper distance, that allows the runner to take off correctly.

2.2.- HURDLING.

We can differentiate between 4 parts in the hurdling technique:

2.2.1.- APPROACHING THE HURDLE (LAST STEP BEFORE THE HURDLE).

In the Table 3, we see how the last step before taking off is, both in the 100 and the 110 m.h., shorter than the previous. In the 110 m.h. is usually 10 cm shorter, and this enables:

- To move the CG forward with respect to the support.
- To bend the body forward.
- To improve the action of the foot against the ground, making it quicker and more active, and generating an upward and forward movement to “attack” the hurdle.

Many beginners in hurdling extend this last step, moving the CG back and losing horizontal speed, having an adverse effect in the subsequent attack of the hurdle.

In the last step cushioning phase should be reduced by a previous tension of the leg. Also a big drive must be performed because of the action of the foot and leg moving from the front to the back.

When the impulse leg is going down, the leading leg's knee goes up, performing a “scissor” movement.

We should try to approach the hurdle fast and to impulse from the right place, with the right direction, and with the right body position.

2.2.2.- ATTACKING THE HURDLE (THE IMPULSE AND TAKE OFF BEFORE THE HURDLE).

With this action we try to:

- To transform, in a fluid way, the running from flat trajectory to a hurdle one.
- To optimize the CG's parable.
- To accelerate the CG before hurdling.
- To decrease the hurdling time.

The objective will be to contact with the ground as soon as possible after passing the hurdle.

The take off is usually performed 2,20 to 2,30 metres away in the case of the 110 m.h., and at 2,00 metres for girls, U15 and U13. Impulse length must be very short.

The impulse action should be performed with a lift up and forward of the tight, bringing the knee forward. This will allow the hurdler to attack the hurdle with the leg perpendicular to it (see Figure 5).



Figure 5.- Impulse movement.

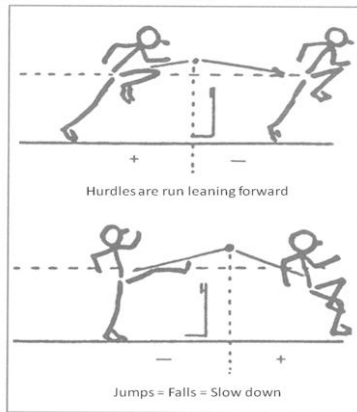


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The trunk is flexed forward while elevating the leg, in order to decrease the elevation of the CG during this action. This flexion is smaller in taller hurdlers because they do not have to raise that much the CG at the hurdle clearance.

At the moment of the impulse, the body and hip should be bent at the right angle (see Figure 6). Failures to do so, will cause an excessive elevation of the body, and the highest point of the trajectory will be after the hurdle, making us to land “sitting down” (cushioning too much on the first support after the hurdle).

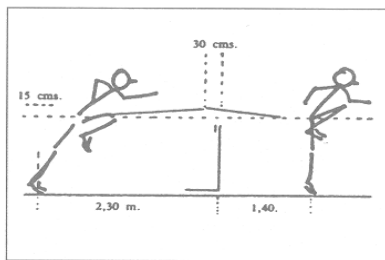


The result is a projection of the CG forward, with an elevation of 15 centimetres in the sprint hurdle races and a little lower in the long hurdle races (See figure 7).

At this time, and throughout the race, we should try to keep looking forward, and not to the ground.

Figure 6.- Right and Wrong attack of the hurdle action.

2.2.3.- HURDLE CLEARANCE.



When the impulse is finished, the thigh should be above the height of the hurdle, with the knee flexed. When we are taking off we start extending the lead leg and we move forward the opposite arm (not only the hand). This action will help us to move the whole body forward.

Figure 7.- Hurdle clearance.



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After the extension, the knee flexes slightly back to make bending the trunk forward easier. However the excessive elevation of the leg causes a rotation of the body backwards that should be compensated leaving the impulse leg backwards until the leading leg starts going down after passing the hurdle.

A big flexion of the trunk forward helps the CG to stay low. At the hurdle clearance the CG is usually 15 cm above the hurdle height.

The lack of impulse, makes the subsequent “recovery” of the trail leg more difficult, so there is a high risk of hitting the hurdle. Also the CG will stay behind, making the highest point of the CG trajectory to be after the hurdle and too high, forcing the hurdler to “sit” in order to cushion the landing (see Figure 7).

After the impulse, both legs should be really separated. The thigh’s angles should be as wide as possible. As said by Gil, the leading leg’s hand and the impulse leg’s feet should be felt really far away.

In Figure 7, we can see how the highest point in the trajectory of the CG should be 30 cm before the hurdle. The hurdle should be cleared going down, as if we were running downhill.

The most important thing while clearing the hurdle, apart from the action of legs and arms, is that the hips and shoulders should rotate as little as possible, facing forward the whole race.

2.2.4.- DESCENT AND LANDING.

The leading leg never stops; after passing the hurdle, it quickly searches the ground going down and backwards. Landing happens with straight leg and hard ankle, trying to avoid cushioning after the support. If we cushion with the knee flexed, we would lose even more horizontal speed than the one lost at the hurdle clearance. Due to the horizontal movement, landing will be done well beyond the hurdle, but we should have the feeling of trying to land really close to it.

The contact while landing usually occurs between 1,00 and 1,25 meters from the hurdle, and under the CG, NEVER AHEAD! If it happened in front the slow down would be too much. When the support is done, there must be a pull back on the ground to speed up again.

The recovery action is complex for a beginner, since it involves a combined action of abduction and external rotation of the thigh, leg and foot while keeping at the same time the knee bent. The higher the hurdle, the larger this movement should be done, and more complex it is to do it successfully. If recovery is done right, the descent of the leading leg will be easier.



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To compensate the rotation generated by the trail leg knee’s movement, we use the trail leg’s arm, which goes outside and does a circular movement, coming back to the running position as if the runner was “putting his hand into his pocket”.

2.3.- PACE BETWEEN THE HURDLES.

The number and width of supports (in a sprint hurdle race) is usually constant, from the medium level athletes to the elite ones (See Table 4). THE ONLY DIFFERENCE BETWEEN NORMAL AND AN ELITE ATHLETE IS THE CADENCE (steps per second)! With average values of strength and technique, it is not difficult to run the 100 or 110 metres hurdles using only three steps; however, while the elite athletes run between 4,0 4,1 steps/second, beginners takes around 2,8 2,9 steps/second.

	100 mh	110 mh
Height	0,84	1,06
Steps from the start	8	8
Steps hurdle-hurdle	3 (x 9)	3 (x9)
# of Hurdles	10	10
Final Steps	5	6
Total Steps	50	51

Table 4.- General specifications of the hurdle races.

In fact, it is recommended for youngsters to run with 4 fast and short steps, better than 3 long and slow steps. We should always avoid jumping while we are running hurdles, since the cushioning in between the jumps means a big loss of speed because the hurdler stays too long in the air without pushing the ground.

In the long hurdle races there is a great variability. The runners who always use the same leg will have to do an even number of steps (usually 13, 15 or 17). It is very difficult to maintain the same number of steps the whole race, since in the last hurdles the runners usually changes legs because of the tiredness.

The step’s distance between hurdles of the 100 and 110 mh can be seen in Figures 8 and 9 respectively.

The race pace between hurdles is characterized by continuous accelerations in the impulse phase and decelerations while cushioning, and especially while the attack of the hurdle is done, as shown on Figure 10.

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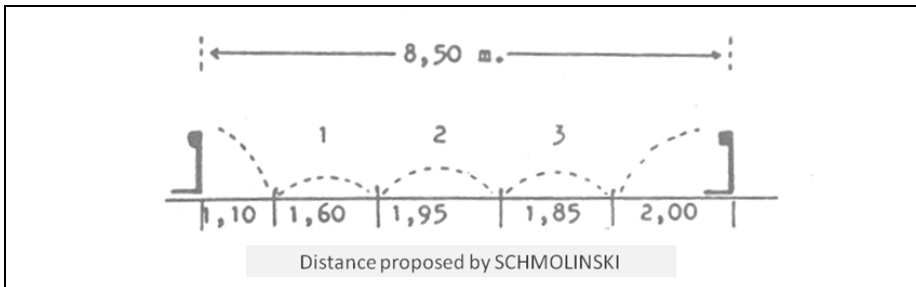


Figure 8.- Ideal distribution of the steps in the 100 m.h.

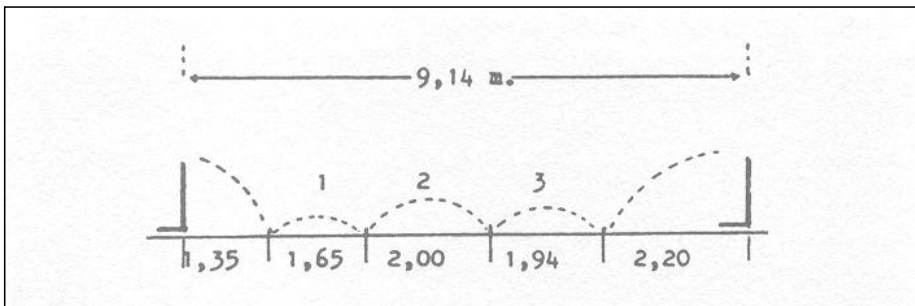


Figure 9.- Ideal distribution of the steps in the 110 m.h.

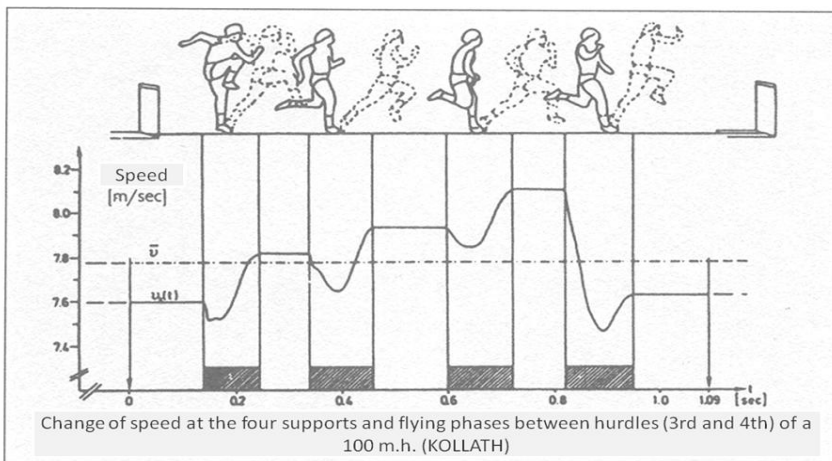


Figure 10.- Illustration of the running speed between hurdles.

2.4.- THE FINAL PART.

The final part of the race is usually done with 5 steps in girls, and 6 in boys at full speed, and with the same technique as in the flat races

Paco Gil (2005) summarized the hurdling technique in a Decalogue, as shown on Figure 11.

Technical Decalogue of the hurdler	
1st	Run fast while approaching the hurdles.
2nd	Shorten slightly the last step.
3rd	Attack the hurdle far (at the right distance), helps to maintain the speed and projection forward.
4th	Impulse strenuous and completely before the hurdle.
5th	Attack the hurdle with the knee high and flexed.
6th	Clear the hurdle with the hips parallel to it and leaving backwards the knee of the trail leg.
7th	Land with the knee extended and the hips high and advanced with respect to the support.
8th	The trail leg brings the knee flexed upwards until it reaches the running line, and then starts going down.
9th	Make only the required arm movements.
10th	Re-accelerate after every hurdle clearance.

Figure 11.- Technical Decalogue of the hurdler.



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To conclude, and as additional information, we attach the summary data of the 100 and 110 metres hurdle races of Berlin 2009 (Biomechanics Project, IAAF)

100m Hurdles Women*Final*

	Round	Wind	RT	t _{1,H}	t _{2,H}	t _{3,H}	t _{4,H}	t _{5,H}	t _{6,H}	t _{7,H}	t _{8,H}	t _{9,H}	t _{10,H}	t _{end}
Foster-Hylton Brigitte JAM	Fi	0,2	0,157	2,60	3,60	4,59	5,56	6,51	7,46	8,43	9,41	10,39	11,40	12,51
				1,00	0,99	0,97	0,95	0,95	0,95	0,97	0,98	0,98	1,01	1,11
Lopes-Schliep Priscilla CAN	Fi	0,2	0,128	2,56	3,58	4,58	5,57	6,54	7,50	8,47	9,46	10,44	11,46	12,54
				1,02	1,00	0,99	0,97	0,96	0,97	0,97	0,99	0,98	1,02	1,08
Ennis-London Delloreen JAM	Fi	0,2	0,142	2,60	3,60	4,58	5,54	6,50	7,47	8,44	9,43	10,44	11,46	12,55
				1,00	0,98	0,96	0,96	0,97	0,97	0,97	0,99	1,01	1,02	1,09
O'Rourke Derval IRL	Fi	0,2	0,128	2,58	3,57	4,55	5,53	6,52	7,51	8,49	9,50	10,52	11,58	12,67
				0,99	0,98	0,98	0,99	0,99	0,99	0,98	1,01	1,02	1,06	1,09
McLellan Sally AUS	Fi	0,2	0,139	2,55	3,56	4,55	5,52	6,51	7,48	8,46	9,46	10,48	11,51	12,70
				1,01	0,99	0,97	0,99	0,97	0,98	1,00	1,02	1,03	1,19	1,19
Powell Virginia USA	Fi	0,2	0,146	2,60	3,62	4,60	5,56	6,51	7,49	8,50	9,51	10,55	11,63	12,78
				1,02	0,98	0,96	0,95	0,98	1,01	1,01	1,04	1,08	1,15	1,15
Harper Dawn USA	Fi	0,2	0,164	2,58	3,58	4,60	5,61	6,60	7,59	8,58	9,60	10,63	11,68	12,81
				1,00	1,02	1,01	0,99	0,99	0,99	1,02	1,03	1,05	1,13	1,13
Felicien Perdita CAN	SF 2	0,1	0,151	2,62	3,64	4,63	5,60	6,57	7,54	8,51	9,47	10,47	11,50	12,58
				1,02	0,99	0,97	0,97	0,97	0,97	0,97	0,96	1,00	1,03	1,08

110m Hurdles Men*Final*

	Round	Wind	RT	t _{1,H}	t _{2,H}	t _{3,H}	t _{4,H}	t _{5,H}	t _{6,H}	t _{7,H}	t _{8,H}	t _{9,H}	t _{10,H}	t _{end}
Brathwaite Ryan BAR	Fi	0,1	0,157	2,54	3,60	4,61	5,60	6,59	7,60	8,62	9,65	10,70	11,74	13,14
				1,06	1,01	0,99	0,99	1,01	1,02	1,03	1,05	1,04	1,40	1,40
Payne David USA	Fi	0,1	0,122	2,54	3,58	4,61	5,61	6,62	7,64	8,66	9,69	10,74	11,78	13,15
				1,04	1,03	1,00	1,01	1,02	1,02	1,03	1,05	1,04	1,37	1,37
Trammell Terrence USA	Fi	0,1	0,141	2,56	3,60	4,61	5,60	6,60	7,62	8,63	9,66	10,71	11,77	13,15
				1,04	1,01	0,99	1,00	1,02	1,01	1,03	1,05	1,06	1,38	1,38
Sharman William GB R	Fi	0,1	0,150	2,54	3,60	4,62	5,64	6,65	7,68	8,73	9,78	10,84	11,91	13,30
				1,06	1,02	1,02	1,01	1,03	1,05	1,05	1,06	1,07	1,39	1,39
Wignall Maurice JAM	Fi	0,1	0,151	2,61	3,66	4,70	5,72	6,75	7,78	8,81	9,85	10,90	11,98	13,31
				1,05	1,04	1,02	1,03	1,03	1,03	1,04	1,05	1,08	1,33	1,33
Svoboda Petr CZE	Fi	0,1	0,144	2,58	3,62	4,64	5,66	6,69	7,74	8,77	9,82	10,87	11,94	13,38
				1,04	1,02	1,02	1,03	1,05	1,03	1,05	1,05	1,07	1,44	1,44
Dwight Thomas JAM	Fi	0,1	0,145	2,66	3,73	4,77	5,80	6,84	7,88	8,90	9,95	11,00	12,14	13,56
				1,07	1,04	1,03	1,04	1,04	1,04	1,02	1,05	1,05	1,14	1,42
Ji Wei CHN	Fi	0,1	0,144	2,68	3,77	4,80	5,84	6,86	7,92	8,96	10,02	11,09	12,17	13,57
				1,09	1,03	1,04	1,02	1,06	1,04	1,06	1,07	1,08	1,40	1,40



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