



# STANDARD QUALITY

GLOBAL CONNECTION



# PHYSICAL PERFORMANCE IN BASKETBALL OFFICIATING

## NATIONAL INSTRUCTORS CLINIC, MAY 2015



1. Goals of the Presentation.
2. Main factors in physical performance of basketball refereeing.
3. Studies & analyses of 2014 FIBA Competitions
4. Conclusions & Further actions.
5. Designated additional projects.
6. 1<sup>st</sup> practical application: Warm up Project.

# GOALS OF THE PRESENTATION



1. To understand why it was important to analyze physical demands of modern basketball officiating .
2. To show methodology used in 2014 FIBA Competitions
3. To explain data obtained and main results.
4. To define further actions in physical training of the basketball refereeing.





# PRESENTATION OF MAIN FACTORS IN PHYSICAL PERFORMANCE OF BASKETBALL REFEREEING



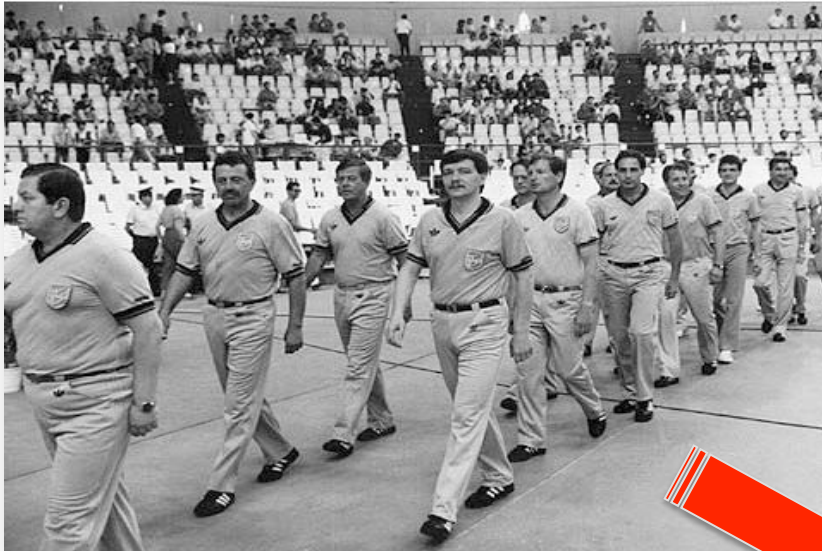
- ✓ Physical appearance
- ✓ Physical abilities
- ✓ Physical demands
- ✓ Invisible training

# PHYSICAL ABILITIES FOR BASKETBALL REFEREES



**FIBA**

We Are Basketball





# PHYSICAL ABILITIES FOR BASKETBALL REFEREES



**SPEED**  
**(SPRINTS)**

**STRENGTH**  
**(PHYSICAL APPEARANCE)**

**ENDURANCE**  
**(RECOVERY)**

**FLEXIBILITY**  
**(INJURY PREVENTION)**

- ✓ 117 FIBA Referees were analyzed during the 2014 FIBA Competitions (WC Men, WC Women, U17 WC Men and U17 WC Women) including 96 male and 21 females active FIBA Referees.
- ✓ By FIBA Regions: 10 Africa, 33 Americas, 14 Asia, 55 Europe and 5 Oceania
- ✓ 633 individuals games and 2532 game periods were collected during the 4 Competitions and analyzed afterwards.
- ✓ In 4 Competitions, all referees received a manual training and specific training plan for their Competition. They were requested to send their personal physical information and 3-4 training records from fitness tests.
- ✓ 10 referees (5 male and 5 female) followed an additional Polar project



We collected data from:

1. Fitness tests
2. Body measurements
3. Official Games



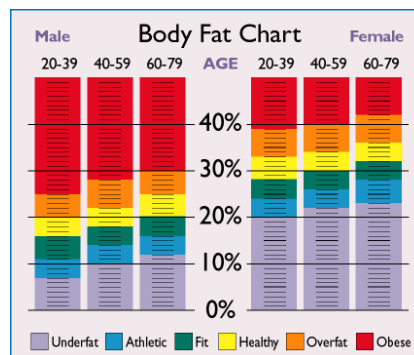
All Referees had pedometer during the test obtaining the following information;

- ✓ Minimum heart rate
- ✓ Medium heart rate
- ✓ Maximum heart rate
- ✓ Recovery Index (1' and 3' after the test)
- ✓ Intensity zones
  - Very low (0-34%),
  - Low (35-54%)
  - Medium (55-69%)
  - Hard (70-89%)
  - Really hard (90-100%)



All Referees were measured with a Body Composition Monitor (Omron)

- ✓ Height
- ✓ Weight
- ✓ BMI (Body Mass Index)
- ✓ Body Fat %



Each Referee was analyzed during the 1<sup>st</sup> phase of the Competitions.

During all the Games in all the Competitions, Referees were using a pedometer in order to have all their physical information from their games (analyzing also every periods)

Information obtained;

- ✓ Minimum heart rate
- ✓ Medium heart rate
- ✓ Maximum heart rate
- ✓ Intensity zones
  - Very low (0-34%),
  - Low (35-54%)
  - Medium (55-69%)
  - Hard (70-89%)
  - Really hard (90-100%)



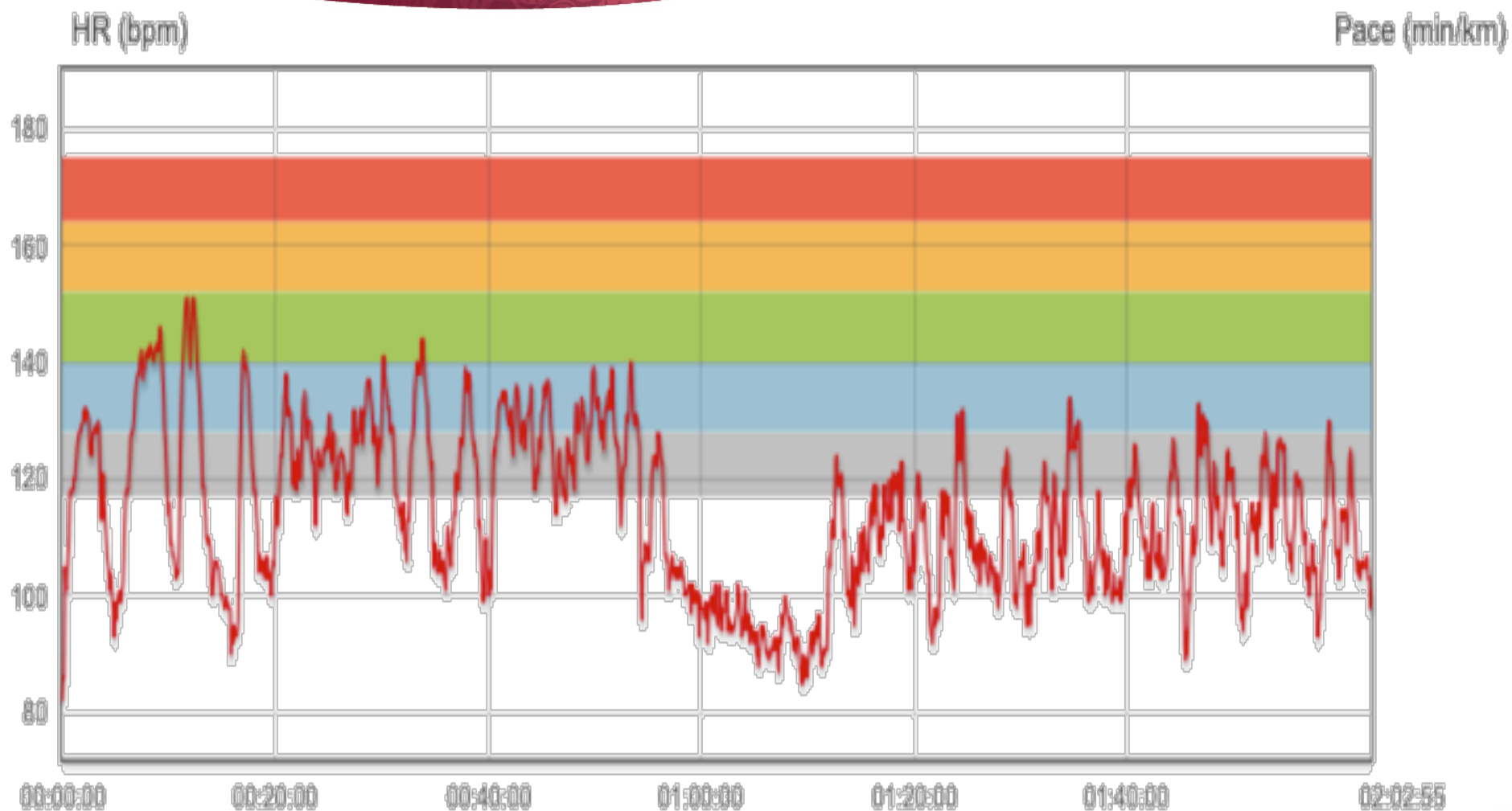
- ✓ Once all the data was available following data analysis were completed:
  - Gender (Male, Female)
  - Age group (20-30, 31-40, 41-50)
  - FIBA Region (Africa, America, Asia, Europe, Oceania)
  - Competition Phases (1<sup>st</sup>, Final)
  - Competition (WC Men, WC Women, U17 WC Men, U17 WC Women)
  
- ✓ After collecting the data from 2014 Competitions an Individual Report for each Referee was created and send to respective Referee.
  
- ✓ The target is to create a FIBA Referees Database in order to have this information available for the future and see individual and collective changes or trends.



# MAIN RESULTS



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# FIBA REFEREE DPT PHYSICAL REPORT 2014

**NAME:** LOTTERMOSER  
**AGE:** 38  
**GENDER:** MALE  
**FIBA ZONE:** EUROPE  
**TOURNAMENT:** WC



## BODY MEASUREMENT

<b>HEIGHT:</b>	<b>186</b>
<b>WEIGHT:</b>	<b>83</b>
<b>BODY FAT %:</b>	<b>14,9</b>
<b>BMI:</b>	<b>24</b>

## BODY MEASUREMENT (GENDER/TOURNAMENT AVERAGE)

<b>HEIGHT:</b>	<b>182,17</b>	<b>182,77</b>
<b>WEIGHT:</b>	<b>82,60</b>	<b>84,49</b>
<b>BODY FAT %:</b>	<b>20,83</b>	<b>20,73</b>
<b>BMI:</b>	<b>24,81</b>	<b>25,11</b>

BMI (Body Mass Index)		
Men	Women	Status
< 20.7	< 19.1	Underweight
20.7 - 26.4	19.1 - 25.8	Normal
26.4 - 27.8	25.8 - 27.3	Marginally overweight
27.8 - 31.1	27.3 - 32.3	Overweight
> 31.1	> 32.3	Obese



**BODY MASS INDEX;**  
 IS A MEASURE FOR HUMAN BODY SHAPE  
 BASED ON AN INDIVIDUAL'S MASS AND  
 HEIGHT. THE BMI IS USED AS A SIMPLE  
 METHOD TO ASSESS HOW MUCH AN  
 INDIVIDUAL'S BODY WEIGHT DEPARTS FROM  
 WHAT IS NORMAL OR DESIRABLE FOR A  
 PERSON OF HIS/ HER HEIGHT.

**BODY FAT %:**  
 IS THE TOTAL MASS OF FAT DIVIDED BY  
 TOTAL BODY MASS. THE BODY FAT  
 PERCENTAGE IS A MEASURE OF FITNESS  
 LEVEL, SINCE IT IS THE ONLY BODY  
 MEASUREMENT WHICH DIRECTLY  
 CALCULATES A PERSON'S RELATIVE BODY  
 COMPOSITION WITHOUT REGARD TO  
 HEIGHT/WEIGHT.

# BODY COMPOSITION & FITNESS TEST ALL REGIONS



	N	Height	Weight	BMI	% Body Fat	Max HR	T Max HR
Africa	10	178,90	77,85	23,91	21,36	181,89	182,70
America	33	179,97	80,39	24,88	22,58	187,52	183,15
Asia	14	178,57	73,29	23,11	22,02	194,71	182,86
Europe	55	182,24	80,97	24,27	20,98	184,76	181,04
Oceania	5	175,60	76,40	24,54	21,40	186,20	180,60

	N	Max HR	0-34%	35-54%	55-69%	70-89%	90-100%	R1'	R3'	%Rec 1	%Rec3
Africa	10	181,89	0,36	0,32	3,70	46,21	49,41	154,44	122,00	15,08	34,37
America	33	178,18	0,23	1,34	4,49	26,78	66,83	160,17	128,04	14,99	33,58
Asia	14	194,79	0,03	0,41	2,76	23,64	73,16	169,00	135,92	13,37	31,34
Europe	55	184,22	0,51	1,50	6,42	37,36	54,19	150,12	117,07	18,19	36,78
Oceania	5	186,20	0,00	0,18	5,14	27,86	66,82	162,20	134,75	12,84	28,24

- ✓ Americas has higher BMI and higher body fat % with Asia.
- ✓ Highest intensity in Fitness Test; Americas, Asia & Oceania referees.
- ✓ Europe: better 1-3' recovery in Fitness Test.

# GAMES PER PERIODS / REGIONS



**FIBA**  
We Are Basketball

		Q1				
	N	0-34%	35-54%	55-69%	70-89%	90-100%
Africa	10	0,00	5,67	43,15	48,34	2,83
America	33	0,14	6,25	34,41	55,91	3,23
Asia	14	0,00	2,01	23,90	68,56	5,53
Europe	55	0,00	5,21	35,27	56,85	2,67
Oceania	5	0,00	3,93	36,75	58,44	0,88

		Q2				
	N	0-34%	35-54%	55-69%	70-89%	90-100%
Africa	10	0,00	7,05	42,57	48,90	1,49
America	33	0,01	4,02	36,54	55,69	3,74
Asia	14	0,00	1,25	26,06	67,74	4,95
Europe	55	0,00	5,28	37,14	54,44	3,15
Oceania	5	0,00	3,35	37,84	58,19	0,62

		Q3				
	N	0-34%	35-54%	55-69%	70-89%	90-100%
Africa	10	0,00	11,91	47,39	40,03	0,67
America	33	0,00	6,20	41,82	50,58	1,40
Asia	14	0,00	2,51	32,59	63,12	1,78
Europe	55	0,00	8,24	44,28	46,16	1,32
Oceania	5	0,00	3,32	43,16	53,47	0,04

		Q4				
	N	0-34%	35-54%	55-69%	70-89%	90-100%
Africa	10	0,00	12,34	50,27	36,52	0,87
America	33	0,00	5,93	45,89	46,55	1,63
Asia	14	0,00	1,35	34,99	62,12	1,54
Europe	55	0,00	8,01	45,95	44,76	1,28
Oceania	5	0,00	3,77	44,70	51,32	0,21

	N	Min HR	Med HR	Max HR	0-34%	35-54%	55-69%	70-89%	90-100%
Africa	10	67,40	109,93	159,79	0,49	36,17	37,29	25,32	0,75
America	33	70,98	117,13	165,79	1,53	31,82	35,34	29,91	1,35
Asia	14	77,53	124,58	171,89	0,20	27,68	31,53	38,70	1,89
Europe	55	70,79	115,20	162,45	0,84	30,91	36,22	30,83	1,21
Oceania	5	72,86	117,61	162,36	0,23	29,40	38,85	31,28	0,23

✓ Asia and Americas' referees show higher intensity in the games and in all periods %.

# BODY COMPOSITION & FITNESS TEST ALL COMPETITIONS



	Height	Weight	BMI	% Body Fat	Max HR	T Max HR	Fitness Test	Min HR	Med HR	Max HR	0-34	35-54	55-69	70-89	90-100	R1'	R3'	%Rec1	%Rec3
Male	182,17	82,60	24,81	20,83	186,80	181,27		110,90	164,78	183,22	0,42	1,43	5,88	32,74	59,34	156,24	124,51	16,12	33,63
Female	173,38	64,91	21,89	25,17	185,71	185,19		125,45	168,30	185,71	0,00	0,02	2,03	34,99	62,96	154,65	120,22	16,81	38,89
20-30	177,00	72,11	23,26	22,70	196,11	192,78		127,14	175,00	192,89	0,06	0,63	2,27	28,49	68,56	170,29	132,17	11,96	36,54
30-40	180,80	79,30	24,20	21,19	187,48	183,75		112,26	165,37	182,90	0,54	1,75	6,75	33,34	57,32	155,87	123,56	16,72	34,88
40-50	181,05	81,34	24,67	22,09	182,90	176,33		113,24	163,74	182,90	0,06	0,27	3,02	33,67	62,95	153,35	122,49	16,29	33,89

- A. Female had better 3' recovery in the Fitness Test.
- B. 30-40 age group had less Body Fat % and less intensity in Fitness Test
- C. 30-40 & 40-50 age groups had better 1' recovery in Fitness Test.



# PERIODS / ALL COMPETITIONS



	Min HR	Med HR	Max HR	0-34	35-54	55-69	70-89	90-100
Q1	84,50	126,00	161,00	0,00	14,10	52,95	31,95	1,00
Q2	96,50	123,50	157,00	0,00	13,75	53,15	33,10	0,00
Q3	88,50	121,00	144,50	0,00	18,10	55,20	26,70	0,00
Q4	97,50	121,50	143,50	0,00	17,30	55,75	26,95	0,00

1<sup>st</sup> & 2<sup>nd</sup> periods more intense than 3<sup>rd</sup> & 4<sup>th</sup> period (5-7%)

# ALL COMPETITIONS



	Q1			Q2			Q3			Q4		
	Min HR	Med HR	Max HR	Min HR	Med HR	Max HR	Min HR	Med HR	Max HR	Min HR	Med HR	Max HR
Male	106,00	134,50	158,50	107,00	129,50	154,00	100,00	125,50	154,50	99,50	122,50	150,50
Female	103,18	139,81	165,89	108,21	138,26	164,92	100,53	132,59	160,17	103,95	131,85	159,17

	Q1					Q2					Q3					Q4				
	0-34	35-54	55-69	70-89	90-100	0-34	35-54	55-69	70-89	90-100	0-34	35-54	55-69	70-89	90-100	0-34	35-54	55-69	70-89	90-100
Male	0,00	0,45	49,25	50,30	0,00	0,00	0,00	67,45	32,55	0,00	0,00	13,30	63,85	22,85	0,00	0,00	7,55	78,00	14,45	0,00
Female	0,22	4,05	25,73	64,02	5,98	0,01	3,88	30,22	60,34	5,55	0,00	7,11	37,05	53,62	2,21	0,00	6,19	40,17	51,31	2,33

Female referees proved to have higher intensity in all periods.

# PERIODS / ALL COMPETITIONS



	Q1					Q2					Q3					Q4				
	0-34	35-54	55-69	70-89	90-100	0-34	35-54	55-69	70-89	90-100	0-34	35-54	55-69	70-89	90-100	0-34	35-54	55-69	70-89	90-100
20-30	0,43	8,62	35,36	52,84	2,75	0,03	7,23	38,97	50,43	3,35	0,00	9,23	41,46	48,37	0,94	0,00	10,10	46,37	42,70	0,83
30-40	0,01	4,95	35,30	56,16	3,55	0,00	4,74	36,56	54,84	3,86	0,00	8,02	42,59	47,85	1,55	0,00	7,34	44,89	46,14	1,63
40-50	0,00	4,50	32,39	60,68	2,42	0,00	3,29	34,54	59,73	2,38	0,00	4,70	42,25	52,07	0,98	0,00	4,80	44,60	49,61	1,00

	Q1					Q2					Q3					Q4				
	0-34	35-54	55-69	70-89	90-100	0-34	35-54	55-69	70-89	90-100	0-34	35-54	55-69	70-89	90-100	0-34	35-54	55-69	70-89	90-100
1 Round	0,00	4,35	33,21	59,52	2,92	0,00	3,85	34,61	58,45	3,08	0,00	5,66	41,74	51,42	1,18	0,00	5,99	43,67	49,08	1,25
Final Round	0,10	6,24	35,87	54,40	3,35	0,01	5,35	38,18	52,83	3,63	0,00	8,90	43,25	46,39	1,46	0,00	7,77	46,69	44,07	1,47

- A. 40-50 age group less intense in all periods
- B. 1<sup>st</sup> phase of competitions was a little bit more intense (3%) in the games and all periods
- C. Exception: Final Round in WC Men Spain was more intense than 1<sup>st</sup> round (almost 10%)

# CONCLUSIONS & FURTHER ACTIONS



- ✓ 1<sup>st</sup> & 2<sup>nd</sup> periods are always more intense; not appropriate specific warm up?
- ✓ Less calls on 1<sup>st</sup> & 2<sup>nd</sup> period (Euroleague stats 2013-14)
- ✓ Americas & Asia's referees proved to have the highest intensity in fitness test, games and all periods
- ✓ They should focus more on their preparation about aerobic training.
- ✓ Oceania referees proved to have lower 1-3' recovery in fitness test, good aerobic levels and the ability to repeat sprints should help to increase recovery.

	Calls	%
1Q	3008	22,2
2Q	3397	25,1
3Q	3375	24,9
4Q	3661	27,1
OT	88	0,7

# CONCLUSIONS & FURTHER ACTIONS



- ✓ 1<sup>ST</sup> phase of competitions were more intense in all competitions except in WC Men Spain.
- ✓ Higher and psychological stress in WC Men final rounds?
- ✓ 30-40 age group proved to have really good results in body composition, intensity.
- ✓ 20-30 age group were not the best ones??????



# ADDITIONAL PROJECT



10 referees (5 male and 5 female) were selected to follow an specific protocol at the same time that they were realizing the training plan of their respective Competitions.



SOLO RUNNING



- ✓ Regions to have specific training plans focusing in their weaknesses (Americas: cardio, Europe: strength)
- ✓ Future training (Polar project 2.0): GPS+Pedometer with on-line solution
- ✓ Games: more information (speed, distance, number & intensity of sprints)

## PRACTICAL APPLICATION: WARM UP PROJECT



- ✓ The target of this project was to evaluate if a specific warm-up that will help in a later physical performance during the game.
- ✓ The Initiative came from the summer 2014 Competitions as they showed that some referees did not execute a proper warm-up and also proved that 1<sup>st</sup> & 2<sup>nd</sup> periods were higher in intensity than 3<sup>rd</sup> & 4<sup>th</sup> periods.

- ✓ 6 referees (5 male & 1 female) were selected to take part in a warm-up project.
- ✓ All referees had a heart rate monitor during 4 games recording their personal warm-up data.
- ✓ After the 1st phase referees received a specific warm-up procedure prior to the games and their physical data was recorded in the next 4 games (see warm-up timeline in the next slide).
- ✓ The goal of this project was to compare both warm-up procedures and to see if the warm-up procedure reflects to the intensity during the periods in the game.
- ✓ Level of the all games were Euroleague, Eurocup, VTB, BBL & ACB.



# SPECIFIC WARM UP TIMELINE



**20-18 MIN** Coming out to the basketball court, going to the table officials to leave water bottles and to check everything.

## **18-13 MIN**

- ✓ 4-5 Skipping (knees up and kicking backwards)
- ✓ 4-5 karaoke + sprint (<https://www.youtube.com/watch?v=5vNhMmPrZVM>)
- ✓ 4-5 running in the basketball court (BASELINE TO BASELINE 3 times) increasing the intensity EVERYTIME
- ✓ Standing activation exercises (EXERCISES STANDING IN THE HALF COURT)
- ✓ Active stretching in the half court (<https://www.youtube.com/watch?v=dPRUzAFsrl4>)

# WARM UP TIMELINE



## **13-8 MIN**

- ✓ 4-5 defensive steps FROM BASELINE to half court
- ✓ 4-5 turn around + sprint
- ✓ Standing activation exercises
- ✓ Active stretching in the half court
- ✓ WATER INTAKE (IF NEEDED)

## **8-6.30 MIN**

- ✓ 3 x suicide to half court
- ✓ 3 sprints (non looking sprints)
- ✓ Standing activation exercises
- ✓ Active stretching in the half court

# WARM UP TIMELINE



**6.30-6 MIN**      Water intake

**6-3 MIN**          Teams presentation

**3-1.30 MIN**      Last part of the warm up

- ✓ 2 sprints FULL COURT (submaximal intensity)
- ✓ 3 short sprints FROM BASELINE TO HALF COURT (turn around + sprint)

**1.30-0.30 MIN**      Water intake + TAE anthem (JUST IN EUROLEAGUE GAMES)

**0 MIN**             Start of the game

More intensity and more similar heart rate than the intensity found in the different quarters

Similar heart rate in warm up and in the game (that's what we were looking for)

WARM UP	Q1	Q2	Q3	Q4
152,30	166,05	166,55	163,30	162,70
164,64	168,20	167,37	161,93	161,71



Green: before / Yellow: after

More intensity and more similar heart rate than the intensity found in the different quarters. Also in % of their max hr

Similar heart rate % in warm up and in the game (that's what we were looking for)

WARM UP	Q1	Q2	Q3	Q4
84,64	92,41	92,72	90,94	90,60
91,87	93,65	93,20	90,11	90,02



Green: before / Yellow: after



More intensity found in different zones in every quarter and warm up.

Less time during the game in the 90-100% zone. Reducing the time in this zone could reduce the decisions made during high heart rate (if you heart rate is too high more possibilities to make mistakes)

Green: before

Yellow: after

WARM UP	0-34	35-54	55-69	70-89	90-100
	0,03	46,46	39,81	13,65	0,07
	0,00	19,58	40,81	32,73	1,93
Q1	0-34	35-54	55-69	70-89	90-100
	0,00	0,37	25,04	68,69	5,90
	0,00	0,06	15,04	82,64	2,26
Q2	0-34	35-54	55-69	70-89	90-100
	0,00	0,18	25,07	69,71	5,05
	0,00	0,02	16,27	80,76	2,95
Q3	0-34	35-54	55-69	70-89	90-100
	0,00	0,49	32,51	59,76	6,88
	0,00	1,34	30,41	67,41	0,84
Q4	0-34	35-54	55-69	70-89	90-100
	0,00	0,19	34,86	62,52	2,44
	0,00	1,29	33,35	65,03	0,34

# RESULTS



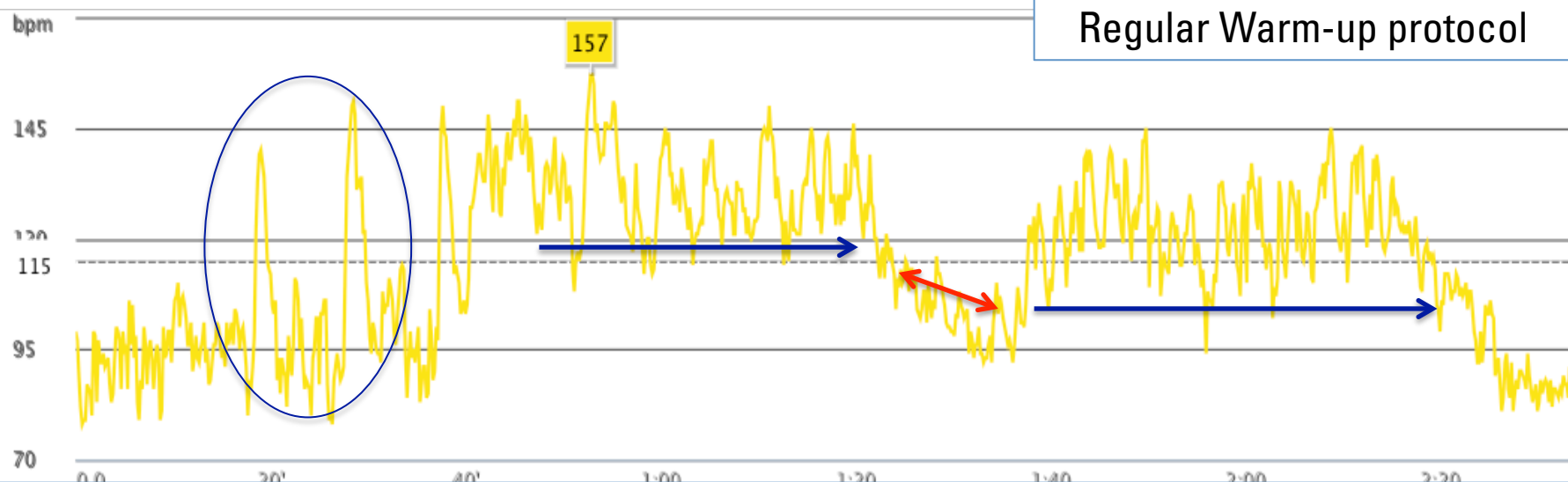
FIBA

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## New specific Warm-up protocol



## Regular Warm-up protocol

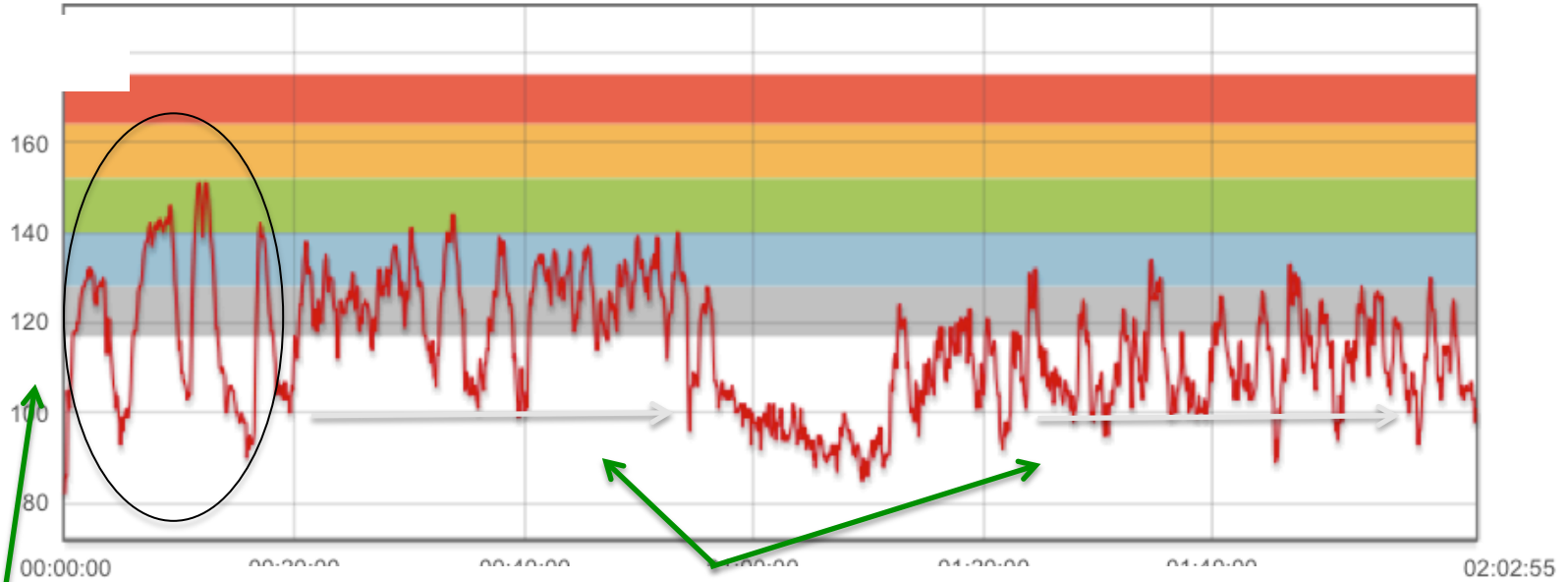


## 2 referees/same game

HR (bpm)

Pace (min/km)

1

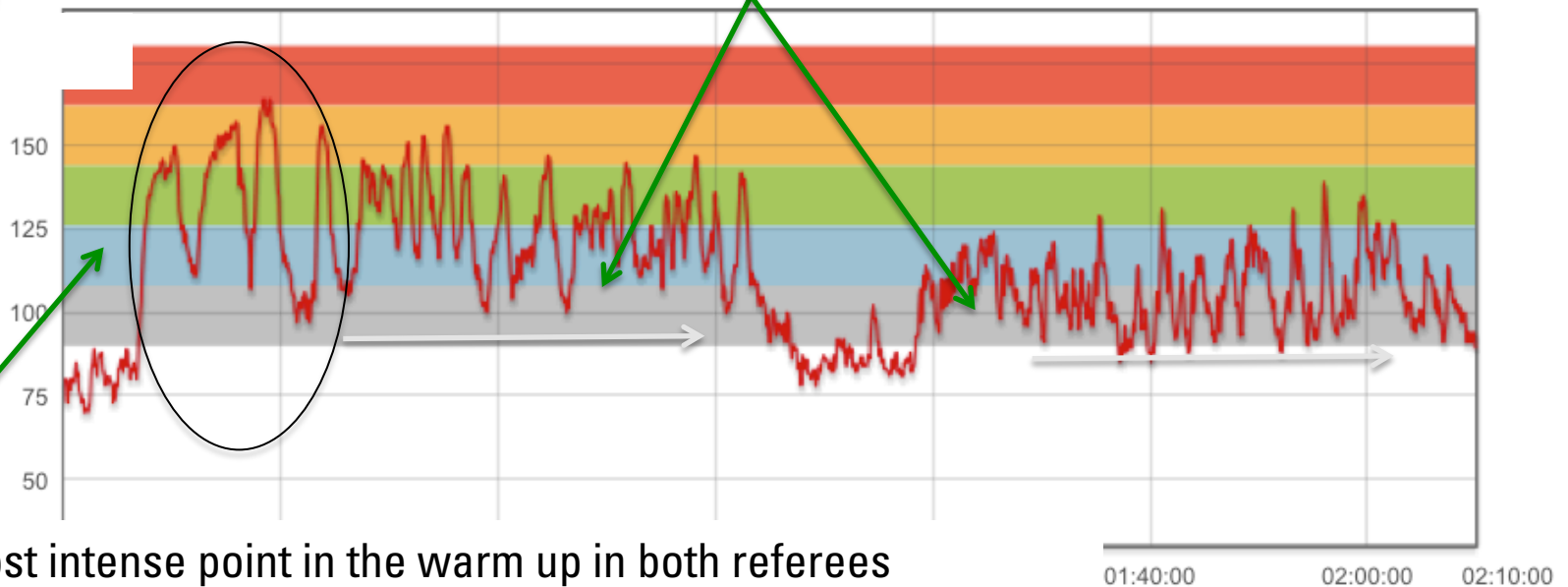


Similar Recovery during the whole game (1st & 2nd half)

HR (bpm)

Pace (min/km)

2



Most intense point in the warm up in both referees

*Feedbacks from some of the referees involved in the project:*

*"I feel good before and during (especially at the beginning of) the game and I don't know if the specific warm up is the reason for that"*

*"After the new warm up I am more active in the first moments of the game. I felt really good in a physical way. I believe It is good for our mind and body to properly warm up"*

*"It helps a lot, the feeling at the game is different and better"*

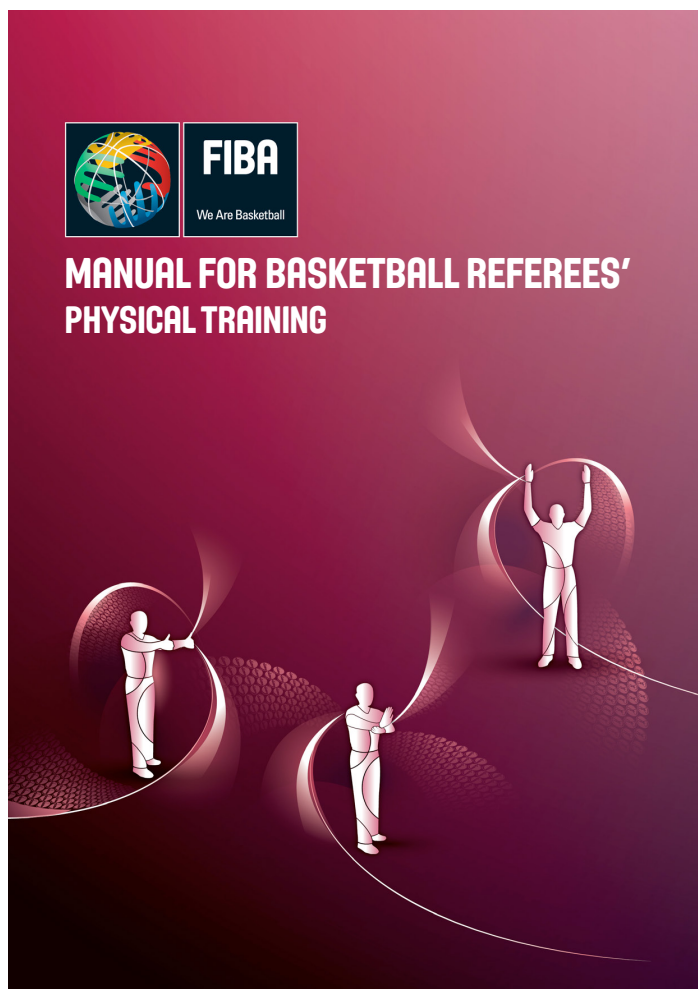
# CONCLUSIONS WARM UP PROJECT




- ✓ From the physiological point of view there is no doubt that reaching a proper intensity in the warm-up will help referees in the game.
- ✓ Some of the referees found difficulties in some courts to execute a proper warm-up (people on the court, not enough space etc...)
- ✓ Some referees suggested small ideas to implement the specific warm-up they felt comfortable with it.
- ✓ Following these studies and analysis we are close to find the correct format and implementation for the proper warm-up in basketball officiating prior the games.




# REFEREES' PHYSICAL TRAINING MANUAL 2.0




# REFEREES' PHYSICAL TRAINING MANUAL 2.0




Day 1




Chest




Quadriceps



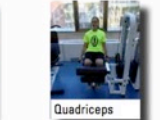
Chest




Sit Ups



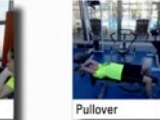
Shoulder



Quadriceps



Triceps




Pullover


**VID**

- >> Chest  
5054
- >> Quadriceps  
5055
- >> Chest  
5055
- >> Sit Ups  
5055
- >> Shoulder  
5057
- >> Quadriceps  
5059
- >> Triceps  
5055
- >> Pullover  
5060


Day 2




Back




Hamstring



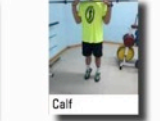
Back



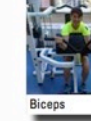
Sit Ups



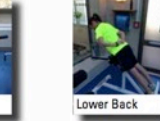
Shoulder



Calf



Biceps



Lower Back

**VID**

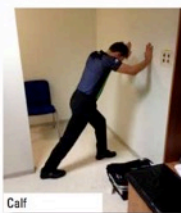
- >> Back  
5062
- >> Hamstring  
5070
- >> Back  
5072
- >> Sit Ups  
5073
- >> Shoulder  
5071
- >> Calf  
5067
- >> Biceps  
5064
- >> Lower Back  
5067

20



## Stretching Drills Sample Workout

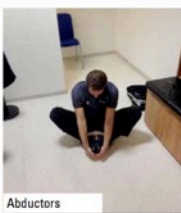
These stretching drills can be done after every workout but especially after every game.  
Takes less than 2 minutes, 10-12 seconds each.



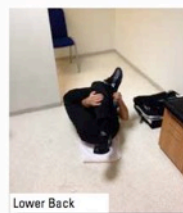
Calf



Hamstrings



Abductors



Lower Back



Quadriceps



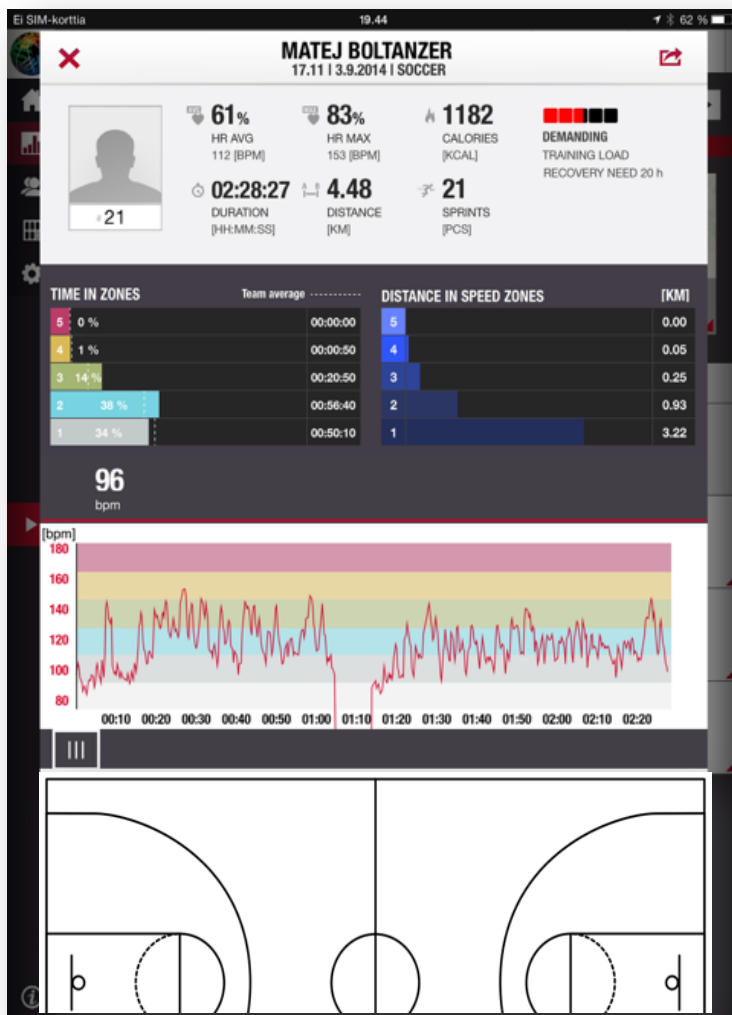
# REFEREES' PHYSICAL TRAINING MANUAL 2.0



**FIBA**  
We Are Basketball

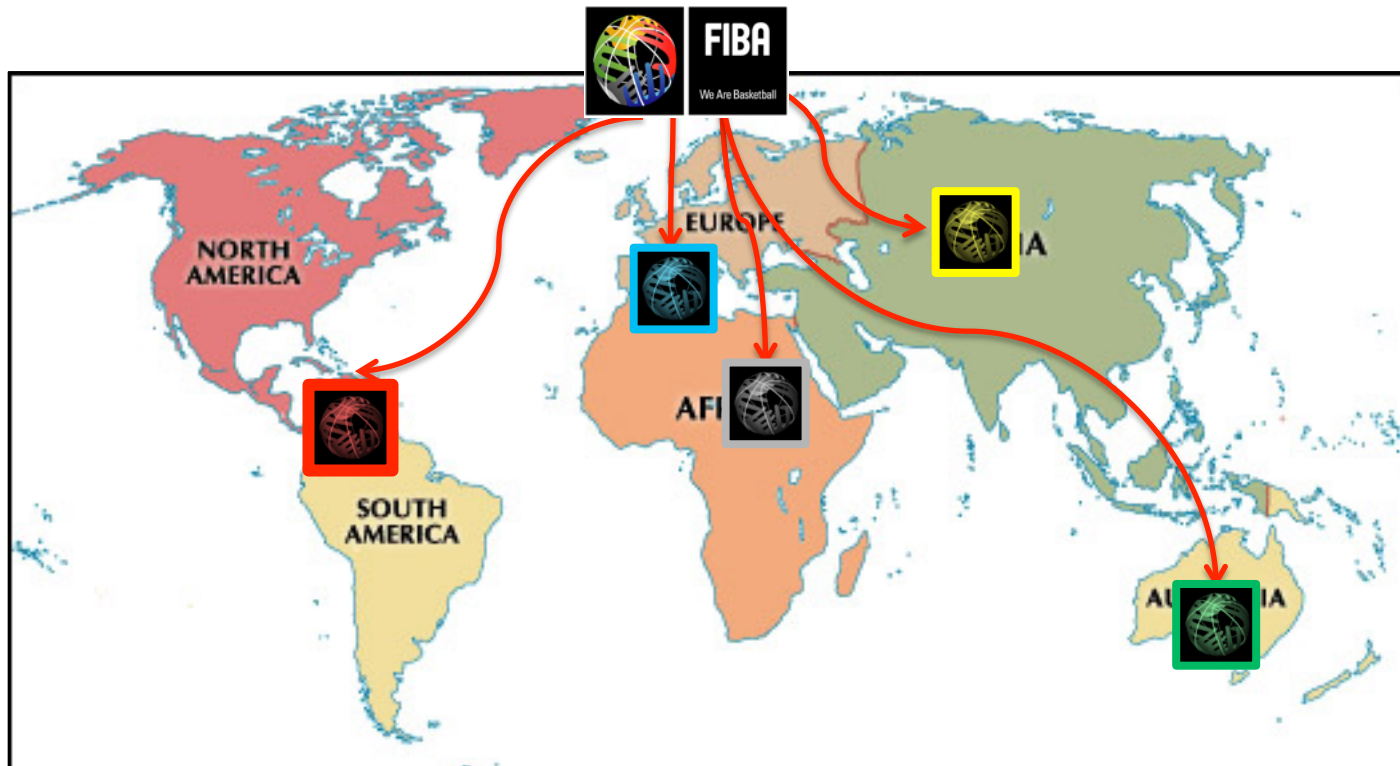


# INNOVATION & FUTURE





# FIBA GLOBAL REFEREEING STRUCTURE



# STANDARD QUALITY

## GLOBAL CONNECTION

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