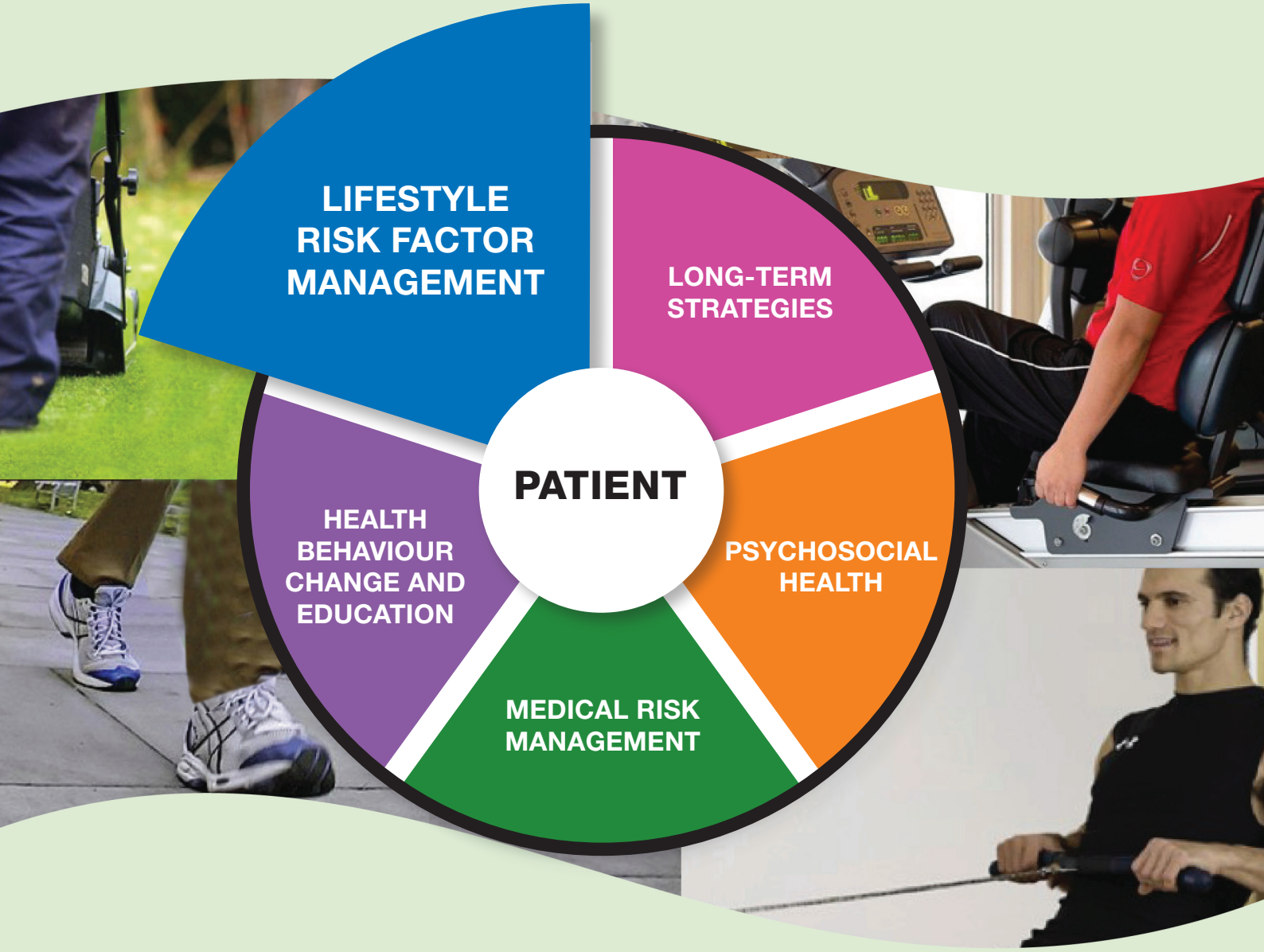
BACPR
BRITISH ASSOCIATION
FOR CARDIOVASCULAR
PREVENTION AND REHABILITATION

Reference tables for assessing, monitoring and guiding physical activity and exercise intensity

for Cardiovascular Disease Prevention and Rehabilitation



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Preface

Welcome to this resource, ***Reference tables for assessing, monitoring and guiding physical activity and exercise intensity***. It is designed for use with all of the BACPR physical activity and exercise courses and specifically for day-to-day front-line practice. Not only is it aimed to help you set individualised exercise prescriptions but also to assist you in giving physical activity guidance.

It covers the use of the three main practical means of setting exercise intensity – heart rate (HR), ratings of perceived exertion (RPE) and metabolic equivalents (METs). It is important to respect that in practical (non-lab) settings, these means of measurement are based on theoretical estimates that have been derived from actual measures of oxygen uptake (VO_2 or METs) and $\%VO_2max$; maximal heart rate (HRmax) and % maximum heart rate reserve (HRR), blood lactic acid levels and numerous pulmonary measures. In light of the HR, RPE and METs values being estimates of actual lab measures, it is always important to respect that there will be a certain amount of error in the accuracy of these measures. Accommodation for such error is explored in all the BACPR physical activity and exercise courses.

A key aim of the *ready reckoner*-tables is to have quick access to determining target heart rates and MET values all in one document, as opposed to having to refer to various calculations and guidelines from difference sources.

We wish you well in your professional development both in knowledge and skills related to the physical activity and exercise component of cardiovascular disease management, prevention and rehabilitation.

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Table 1: Guidelines

Recommended aerobic exercise intensities relative to the percentage of maximal oxygen uptake (%VO_2max), maximal heart rate reserve (%HRRmax) and maximal heart rate (%HRmax)

Guideline	ACSM (2013)	BACPR (2016)
%VO_2max*	40% – 85%	40% - 70%**
% HRRmax	40% – 85%	40% - 70%**
% HRmax	55% – 90%	60% – 80%**

* The term VO_2max is used in this case for reasons of simplicity but it must be noted that guidelines vary in the use of VO_2peak or maximal VO_2reserve.

**In the UK the upper intensity limit is lower than that for the USA because UK programs do not require a pre-programme *maximal exercise ECG stress test,* which is able to determine a more precise "actual" HRmax.

Table 2:
The relative relationship between heart rate, oxygen uptake and ratings of perceived exertion using Borg's RPE and CR10 scales

% VO_2max % METs max % HRRmax	% HRmax *NB	Perceived exertion descriptor	Borg RPE (6-20)	Borg CR10
28	**50**	**Very light**	**9**	**1**
42	**60**	**Light**	**11**	**2**
56	**70**	**Somewhat hard**	**12 - 13**	**3.0 – 3.5**
70	**80**	**Somewhat hard**	**13 - 14**	**3.5 – 4.5**
83	**90**	**Hard**	**15 - 16**	**5.5 – 6.5**
100	**100**	**Maximal**	**19**	**10**

**%HRmax equivalents to %VO_2max or %HRRmax only hold true for individuals who are aged 35 to 50 years and who have a resting HR between 65 and 75 bpm*

Adapted from: Gutman et al. (1981); Brubaker et al 1994; Eston and Connolly 1996; Eston and Thompson (1997); Head et al. (1997); Borg (1998); Robergs & Landwehr (2002); Buckley and Eston (2006); Buckley et al. (2009); Garber et al., (2011), ACSM (2013)

Target Heart Rate Calculation Tables 3 and 4a-4k

The following guidance and tables for determining percentage of one's heart rate reserve (%HRR), have been calculated using the Karvonen (1957) formula. Maximal heart rate for those over age 45 years, are estimated using the Inbar et al. (1994) method (Robergs & Landwehr 2002) and for heart failure, the Keteyian et al (2012) method.

Instructions for setting a target heart rate

1. Determine the participant's maximal heart rate from one of the following methods:

    a. From maximal exercise test (rare but the only way to truly determine)
    b. If over 45 years use 206 – (0.7 x age); *subtract 30 bpm if *beta-blocked*
    c. Under 45 years use 220 – age; *subtract 30 bpm if beta-blocked*
    d. Ready reckoner Table 3 using Inbar calculation method (HRmax from age category)

Table 3

Age	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
HR max	192	189	185	182	178	175	171	168	164	161	157	154	150	147	143	140
B-blocked HR max	162	159	155	152	148	145	141	138	134	131	127	124	120	117	113	110

    e. For Heart failure; Keteyian method: 119 + (0.5 x resting HR) – (0.5 x age) – (5, if using a stationary cycle test)

2. Determine resting heart rate and then go to Tables 4a-k to set %heart rate reserve (%HRR)
    a. Find table for resting HR; b. read across top to HRmax; c. read down left hand column to desired %HRR

* Davies & Sargeant (1979); Liu et al. (1999); Wonisch et al. (2003)

Table a

40 Resting Heart Rate																			
HR max - read across	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**160**	**165**	**170**	**175**	**180**	**185**	**190**	**195**	**200**
%HRR max - read down																			
30%	61	63	64	66	67	69	70	72	73	75	76	78	79	81	82	84	85	87	88
35%	65	66	68	70	72	73	75	77	79	80	82	84	86	87	89	91	93	94	96
40%	**68**	**70**	**72**	**74**	**76**	**78**	**80**	**82**	**84**	**86**	**88**	**90**	**92**	**94**	**96**	**98**	**100**	**102**	**104**
45%	**72**	**74**	**76**	**78**	**81**	**83**	**85**	**87**	**90**	**92**	**94**	**96**	**99**	**101**	**103**	**105**	**108**	**110**	**112**
50%	**75**	**78**	**80**	**83**	**85**	**88**	**90**	**93**	**95**	**98**	**100**	**103**	**105**	**108**	**110**	**113**	**115**	**118**	**120**
55%	**79**	**81**	**84**	**87**	**90**	**92**	**95**	**98**	**101**	**103**	**106**	**109**	**112**	**114**	**117**	**120**	**123**	**125**	**128**
60%	**82**	**85**	**88**	**91**	**94**	**97**	**100**	**103**	**106**	**109**	**112**	**115**	**118**	**121**	**124**	**127**	**130**	**133**	**136**
65%	**86**	**89**	**92**	**95**	**99**	**102**	**105**	**108**	**112**	**115**	**118**	**121**	**125**	**128**	**131**	**134**	**138**	**141**	**144**
70%	**89**	**93**	**96**	**100**	**103**	**107**	**110**	**114**	**117**	**121**	**124**	**128**	**131**	**135**	**138**	**142**	**145**	**149**	**152**
75%	93	96	100	104	108	111	115	119	123	126	130	134	138	141	145	149	153	156	160
80%	96	100	104	108	112	116	120	124	128	132	136	140	144	148	152	156	160	164	168
85%	100	104	108	112	117	121	125	129	134	138	142	146	151	155	159	163	168	172	176
90%	103	108	112	117	121	126	130	135	139	144	148	153	157	162	166	171	175	180	184
95%	107	111	116	121	126	130	135	140	145	149	154	159	164	168	173	178	159	187	192
100%	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200

Table b

45 Resting Heart Rate																			
HR max - read across	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**160**	**165**	**170**	**175**	**180**	**185**	**190**	**195**	**200**
%HRR max - read down																			
30%	65	66	68	69	71	72	74	75	77	78	80	81	83	84	86	87	89	90	92
35%	68	70	71	73	75	77	78	80	82	84	85	87	89	91	92	94	96	98	99
40%	**71**	**73**	**75**	**77**	**79**	**81**	**83**	**85**	**87**	**89**	**91**	**93**	**95**	**97**	**99**	**101**	**103**	**105**	**107**
45%	**74**	**77**	**79**	**81**	**83**	**86**	**88**	**90**	**92**	**95**	**97**	**99**	**101**	**104**	**106**	**108**	**110**	**113**	**115**
50%	**78**	**78**	**83**	**85**	**88**	**90**	**93**	**95**	**98**	**100**	**103**	**105**	**108**	**110**	**113**	**115**	**118**	**120**	**123**
55%	**79**	**84**	**84**	**89**	**92**	**95**	**97**	**100**	**103**	**106**	**108**	**111**	**114**	**117**	**119**	**122**	**125**	**128**	**130**
60%	**84**	**87**	**90**	**93**	**96**	**99**	**102**	**105**	**108**	**111**	**114**	**117**	**120**	**123**	**126**	**129**	**132**	**135**	**138**
65%	**87**	**91**	**94**	**97**	**100**	**104**	**107**	**110**	**113**	**117**	**120**	**123**	**126**	**130**	**133**	**136**	**139**	**143**	**146**
70%	**89**	**94**	**98**	**101**	**105**	**108**	**112**	**115**	**119**	**122**	**126**	**129**	**133**	**136**	**140**	**143**	**147**	**150**	**154**
75%	94	96	100	105	109	113	116	120	124	128	131	135	139	143	146	150	154	158	161
80%	96	101	105	109	113	117	121	125	129	133	137	141	145	149	153	157	161	165	169
85%	100	105	109	113	117	122	126	130	134	139	143	147	151	156	160	164	168	173	177
90%	104	108	113	117	122	126	131	135	140	144	149	153	158	162	167	171	176	180	185
95%	107	112	116	121	126	131	135	140	145	150	154	159	164	169	173	178	160	188	192
100%	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200

Table c

50 Resting Heart Rate																			
HR max - read across	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**160**	**165**	**170**	**175**	**180**	**185**	**190**	**195**	**200**
%HRR max - read down																			
30%	68	70	71	73	74	76	77	79	80	82	83	85	86	88	89	91	92	94	95
35%	71	73	75	76	78	80	82	83	85	87	89	90	92	94	96	97	99	101	103
40%	**74**	**76**	**78**	**80**	**82**	**84**	**86**	**88**	**90**	**92**	**94**	**96**	**98**	**100**	**102**	**104**	**106**	**108**	**110**
45%	**77**	**79**	**82**	**84**	**86**	**88**	**91**	**93**	**95**	**97**	**100**	**102**	**104**	**106**	**109**	**111**	**113**	**115**	**118**
50%	**80**	**83**	**85**	**88**	**90**	**93**	**95**	**98**	**100**	**103**	**105**	**108**	**110**	**113**	**115**	**118**	**120**	**123**	**125**
55%	**84**	**86**	**84**	**91**	**94**	**97**	**100**	**102**	**105**	**108**	**111**	**113**	**116**	**119**	**122**	**124**	**127**	**130**	**133**
60%	**86**	**89**	**92**	**95**	**98**	**101**	**104**	**107**	**110**	**113**	**116**	**119**	**122**	**125**	**128**	**131**	**134**	**137**	**140**
65%	**89**	**92**	**96**	**99**	**102**	**105**	**109**	**112**	**115**	**118**	**122**	**125**	**128**	**131**	**135**	**138**	**141**	**144**	**148**
70%	**92**	**96**	**99**	**103**	**106**	**110**	**113**	**117**	**120**	**124**	**127**	**131**	**134**	**138**	**141**	**145**	**148**	**152**	**155**
75%	95	98	100	106	110	114	118	121	125	129	133	136	140	144	148	151	155	159	163
80%	98	102	106	110	114	118	122	126	130	134	138	142	146	150	154	158	162	166	170
85%	101	105	110	114	118	122	127	131	135	139	144	148	152	156	161	165	169	173	178
90%	104	109	113	118	122	127	131	136	140	145	149	154	158	163	167	172	176	181	185
95%	107	112	117	121	126	131	136	140	145	150	155	159	164	169	174	178	161	188	193
100%	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200

Table d

55 Resting Heart Rate																			
HR max - read across	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**160**	**165**	**170**	**175**	**180**	**185**	**190**	**195**	**200**
%HRR max - read down																			
30%	72	73	75	76	78	79	81	82	84	85	87	88	90	91	93	94	96	97	99
35%	74	76	78	80	81	83	85	87	88	90	92	94	95	97	99	101	102	104	106
40%	**77**	**79**	**81**	**83**	**85**	**87**	**89**	**91**	**93**	**95**	**97**	**99**	**101**	**103**	**105**	**107**	**109**	**111**	**113**
45%	**80**	**82**	**84**	**87**	**89**	**91**	**93**	**96**	**98**	**100**	**102**	**105**	**107**	**109**	**111**	**114**	**116**	**118**	**120**
50%	**83**	**85**	**88**	**90**	**93**	**95**	**98**	**100**	**103**	**105**	**108**	**110**	**113**	**115**	**118**	**120**	**123**	**125**	**128**
55%	**85**	**88**	**84**	**94**	**96**	**99**	**102**	**105**	**107**	**110**	**113**	**116**	**118**	**121**	**124**	**127**	**129**	**132**	**135**
60%	**88**	**91**	**94**	**97**	**100**	**103**	**106**	**109**	**112**	**115**	**118**	**121**	**124**	**127**	**130**	**133**	**136**	**139**	**142**
65%	**91**	**94**	**97**	**101**	**104**	**107**	**110**	**114**	**117**	**120**	**123**	**127**	**130**	**133**	**136**	**140**	**143**	**146**	**149**
70%	**93**	**97**	**101**	**104**	**108**	**111**	**115**	**118**	**122**	**125**	**129**	**132**	**136**	**139**	**143**	**146**	**150**	**153**	**157**
75%	96	100	104	108	111	115	119	123	126	130	134	138	141	145	149	153	156	160	164
80%	99	103	107	111	115	119	123	127	131	135	139	143	147	151	155	159	163	167	171
85%	102	106	110	115	119	123	127	132	136	140	144	149	153	157	161	166	170	174	178
90%	105	109	114	118	123	127	132	136	141	145	150	154	159	163	168	172	177	181	186
95%	107	112	117	122	126	131	136	141	145	150	155	160	164	169	174	179	161	188	193
100%	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200

Table e

60 Resting Heart Rate																			
HR max - read across	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**160**	**165**	**170**	**175**	**180**	**185**	**190**	**195**	**200**
%HRR max - read down																			
30%	75	77	78	80	81	83	84	86	87	89	90	92	93	95	96	98	99	101	102
35%	78	79	81	83	85	86	88	90	92	93	95	97	99	100	102	104	106	107	109
40%	**80**	**82**	**84**	**86**	**88**	**90**	**92**	**94**	**96**	**98**	**100**	**102**	**104**	**106**	**108**	**110**	**112**	**114**	**116**
45%	**83**	**85**	**87**	**89**	**92**	**94**	**96**	**98**	**101**	**103**	**105**	**107**	**110**	**112**	**114**	**116**	**119**	**121**	**123**
50%	**85**	**88**	**90**	**93**	**95**	**98**	**100**	**103**	**105**	**108**	**110**	**113**	**115**	**118**	**120**	**123**	**125**	**128**	**130**
55%	**87**	**90**	**93**	**96**	**99**	**101**	**104**	**107**	**110**	**112**	**115**	**118**	**121**	**123**	**126**	**129**	**132**	**134**	**137**
60%	**90**	**93**	**96**	**99**	**102**	**105**	**108**	**111**	**114**	**117**	**120**	**123**	**126**	**129**	**132**	**135**	**138**	**141**	**144**
65%	**93**	**96**	**99**	**102**	**106**	**109**	**112**	**115**	**119**	**122**	**125**	**128**	**132**	**135**	**138**	**141**	**145**	**148**	**151**
70%	**95**	**99**	**102**	**106**	**109**	**113**	**116**	**120**	**123**	**127**	**130**	**134**	**137**	**141**	**144**	**148**	**151**	**155**	**158**
75%	98	101	105	109	113	116	120	124	128	131	135	139	143	146	150	154	158	161	165
80%	100	104	108	112	116	120	124	128	132	136	140	144	148	152	156	160	164	168	172
85%	103	107	111	115	120	124	128	132	137	141	145	149	154	158	162	166	171	175	179
90%	105	110	114	119	123	128	132	137	141	146	150	155	159	164	168	173	177	182	186
95%	108	112	117	122	127	131	136	141	146	150	155	160	165	169	174	179	162	188	193
100%	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200

Table f

65 Resting Heart Rate																			
HR max - read across	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**160**	**165**	**170**	**175**	**180**	**185**	**190**	**195**	**200**
%HRR max - read down																			
30%	79	80	82	83	85	86	88	89	91	92	94	95	97	98	100	101	103	104	106
35%	81	83	84	86	88	90	91	93	95	97	98	100	102	104	105	107	109	111	112
40%	**83**	**85**	**87**	**89**	**91**	**93**	**95**	**97**	**99**	**101**	**103**	**105**	**107**	**109**	**111**	**113**	**115**	**117**	**119**
45%	**85**	**88**	**90**	**92**	**94**	**97**	**99**	**101**	**103**	**106**	**108**	**110**	**112**	**115**	**117**	**119**	**121**	**124**	**126**
50%	**88**	**90**	**93**	**95**	**98**	**100**	**103**	**105**	**108**	**110**	**113**	**115**	**118**	**120**	**123**	**125**	**128**	**130**	**133**
55%	**90**	**93**	**96**	**98**	**101**	**104**	**106**	**109**	**112**	**115**	**117**	**120**	**123**	**126**	**128**	**131**	**134**	**137**	**139**
60%	**92**	**95**	**98**	**101**	**104**	**107**	**110**	**113**	**116**	**119**	**122**	**125**	**128**	**131**	**134**	**137**	**140**	**143**	**146**
65%	**94**	**98**	**101**	**104**	**107**	**111**	**114**	**117**	**120**	**124**	**127**	**130**	**133**	**137**	**140**	**143**	**146**	**150**	**153**
70%	**96**	**100**	**104**	**107**	**111**	**114**	**118**	**121**	**125**	**128**	**132**	**135**	**139**	**142**	**146**	**149**	**153**	**156**	**160**
75%	99	103	106	110	114	118	121	125	129	133	136	140	144	148	151	155	159	163	166
80%	100	105	109	113	117	121	125	129	133	137	141	145	149	153	157	161	165	169	173
85%	103	108	112	116	120	125	129	133	137	142	146	150	154	159	163	167	171	176	180
90%	106	110	115	119	124	128	133	137	142	146	151	155	160	164	169	173	178	182	187
95%	108	113	117	122	127	132	136	141	146	151	155	160	165	170	174	179	163	189	193
100%	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200

Table g

70 Resting Heart Rate																			
HR max - read across	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**160**	**165**	**170**	**175**	**180**	**185**	**190**	**195**	**200**
%HRR max - read down																			
30%	82	84	85	87	88	90	91	93	94	96	97	99	100	102	103	105	106	108	109
35%	84	86	88	89	91	93	95	96	98	100	102	103	105	107	109	110	112	114	116
40%	**86**	**88**	**90**	**92**	**94**	**96**	**98**	**100**	**102**	**104**	**106**	**108**	**110**	**112**	**114**	**116**	**118**	**120**	**122**
45%	**88**	**90**	**93**	**95**	**97**	**99**	**102**	**104**	**106**	**108**	**111**	**113**	**115**	**117**	**120**	**122**	**124**	**126**	**129**
50%	**90**	**92**	**95**	**98**	**100**	**103**	**105**	**108**	**110**	**113**	**115**	**118**	**120**	**123**	**125**	**128**	**130**	**133**	**135**
55%	**79**	**95**	**98**	**100**	**103**	**106**	**109**	**111**	**114**	**117**	**120**	**122**	**125**	**128**	**131**	**133**	**136**	**139**	**142**
60%	**94**	**97**	**100**	**103**	**106**	**109**	**112**	**115**	**118**	**121**	**124**	**127**	**130**	**133**	**136**	**139**	**142**	**145**	**148**
65%	**96**	**99**	**103**	**106**	**109**	**112**	**116**	**119**	**122**	**125**	**129**	**132**	**135**	**138**	**142**	**145**	**148**	**151**	**155**
70%	**98**	**102**	**105**	**109**	**112**	**116**	**119**	**123**	**126**	**130**	**133**	**137**	**140**	**144**	**147**	**151**	**154**	**158**	**161**
75%	100	104	108	111	115	119	123	126	130	134	138	141	145	149	153	156	160	164	168
80%	102	106	110	114	118	122	126	130	134	138	142	146	150	154	158	162	166	170	174
85%	104	108	113	117	121	125	130	134	138	142	147	151	155	159	164	168	172	176	181
90%	106	111	115	120	124	129	133	138	142	147	151	156	160	165	169	174	178	183	187
95%	108	113	118	122	127	132	137	141	146	151	156	160	165	170	175	179	163	189	194
100%	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200

Table h

75 Resting Heart Rate																			
HR max - read across	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**160**	**165**	**170**	**175**	**180**	**185**	**190**	**195**	**200**
%HRR max - read down																			
30%	86	87	89	90	92	93	95	96	98	99	101	102	104	105	107	108	110	111	113
35%	87	89	91	93	94	96	98	100	101	103	105	107	108	110	112	114	115	117	119
40%	**89**	**91**	**93**	**95**	**97**	**99**	**101**	**103**	**105**	**107**	**109**	**111**	**113**	**115**	**117**	**119**	**121**	**123**	**125**
45%	**91**	**93**	**95**	**98**	**100**	**102**	**104**	**107**	**109**	**111**	**113**	**116**	**118**	**120**	**122**	**125**	**127**	**129**	**131**
50%	**93**	**95**	**98**	**100**	**103**	**105**	**108**	**110**	**113**	**115**	**118**	**120**	**123**	**125**	**128**	**130**	**133**	**135**	**138**
55%	**84**	**97**	**100**	**103**	**105**	**108**	**111**	**114**	**116**	**119**	**122**	**125**	**127**	**130**	**133**	**136**	**138**	**141**	**144**
60%	**96**	**99**	**102**	**105**	**108**	**111**	**114**	**117**	**120**	**123**	**126**	**129**	**132**	**135**	**138**	**141**	**144**	**147**	**150**
65%	**98**	**101**	**104**	**108**	**111**	**114**	**117**	**121**	**124**	**127**	**130**	**134**	**137**	**140**	**143**	**147**	**150**	**153**	**156**
70%	**100**	**103**	**107**	**110**	**114**	**117**	**121**	**124**	**128**	**131**	**135**	**138**	**142**	**145**	**149**	**152**	**156**	**159**	**163**
75%	101	105	100	113	116	120	124	128	131	135	139	143	146	150	154	158	161	165	169
80%	103	107	111	115	119	123	127	131	135	139	143	147	151	155	159	163	167	171	175
85%	105	109	113	118	122	126	130	135	139	143	147	152	156	160	164	169	173	177	181
90%	107	111	116	120	125	129	134	138	143	147	152	156	161	165	170	174	179	183	188
95%	108	113	118	123	127	132	137	142	146	151	156	161	165	170	175	180	164	189	194
100%	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200

Table i

80 Resting Heart Rate																			
HR max - read across	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**160**	**165**	**170**	**175**	**180**	**185**	**190**	**195**	**200**
%HRR max - read down																			
30%	89	91	92	94	95	97	98	100	101	103	104	106	107	109	110	112	113	115	116
35%	91	92	94	96	98	99	101	103	105	106	108	110	112	113	115	117	119	120	122
40%	**92**	**94**	**96**	**98**	**100**	**102**	**104**	**106**	**108**	**110**	**112**	**114**	**116**	**118**	**120**	**122**	**124**	**126**	**128**
45%	**94**	**96**	**98**	**100**	**103**	**105**	**107**	**109**	**112**	**114**	**116**	**118**	**121**	**123**	**125**	**127**	**130**	**132**	**134**
50%	**95**	**97**	**100**	**103**	**105**	**108**	**110**	**113**	**115**	**118**	**120**	**123**	**125**	**128**	**130**	**133**	**135**	**138**	**140**
55%	**97**	**99**	**102**	**105**	**108**	**110**	**113**	**116**	**119**	**121**	**124**	**127**	**130**	**132**	**135**	**138**	**141**	**143**	**146**
60%	**98**	**101**	**104**	**107**	**110**	**113**	**116**	**119**	**122**	**125**	**128**	**131**	**134**	**137**	**140**	**143**	**146**	**149**	**152**
65%	**100**	**103**	**106**	**109**	**113**	**116**	**119**	**122**	**126**	**129**	**132**	**135**	**139**	**142**	**145**	**148**	**152**	**155**	**158**
70%	**102**	**105**	**108**	**112**	**115**	**119**	**122**	**126**	**129**	**133**	**136**	**140**	**143**	**147**	**150**	**154**	**157**	**161**	**164**
75%	103	106	110	114	118	121	125	129	133	136	140	144	148	151	155	159	163	166	170
80%	104	108	112	116	120	124	128	132	136	140	144	148	152	156	160	164	168	172	176
85%	106	110	114	118	123	127	131	135	140	144	148	152	157	161	165	169	174	178	182
90%	107	112	116	121	125	130	134	139	143	148	152	157	161	166	170	175	179	184	188
95%	109	113	118	123	128	132	137	142	147	151	156	161	166	170	175	180	165	189	194
100%	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200

Table j

85 Resting Heart Rate																			
HR max - read across	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**160**	**165**	**170**	**175**	**180**	**185**	**190**	**195**	**200**
%HRR max - read down																			
30%	93	94	96	97	99	100	102	103	105	106	108	109	111	112	114	115	117	118	120
35%	94	96	97	99	101	103	104	106	108	110	111	113	115	117	118	120	122	124	125
40%	**95**	**97**	**99**	**101**	**103**	**105**	**107**	**109**	**111**	**113**	**115**	**117**	**119**	**121**	**123**	**125**	**127**	**129**	**131**
45%	**96**	**99**	**101**	**103**	**105**	**108**	**110**	**112**	**114**	**117**	**119**	**121**	**123**	**126**	**128**	**130**	**132**	**135**	**137**
50%	**98**	**100**	**103**	**105**	**108**	**110**	**113**	**115**	**118**	**120**	**123**	**125**	**128**	**130**	**133**	**135**	**138**	**140**	**143**
55%	**99**	**102**	**104**	**107**	**110**	**113**	**115**	**118**	**121**	**124**	**126**	**129**	**132**	**135**	**137**	**140**	**143**	**146**	**148**
60%	**100**	**103**	**106**	**109**	**112**	**115**	**118**	**121**	**124**	**127**	**130**	**133**	**136**	**139**	**142**	**145**	**148**	**151**	**154**
65%	**101**	**105**	**108**	**111**	**114**	**118**	**121**	**124**	**127**	**131**	**134**	**137**	**140**	**144**	**147**	**150**	**153**	**157**	**160**
70%	**102**	**106**	**110**	**113**	**117**	**120**	**124**	**127**	**131**	**134**	**138**	**141**	**145**	**148**	**152**	**155**	**159**	**162**	**166**
75%	104	107	111	115	119	123	126	130	134	138	141	145	149	153	156	160	164	168	171
80%	105	109	113	117	121	125	129	133	137	141	145	149	153	157	161	165	169	173	177
85%	106	111	115	119	123	128	132	136	140	145	149	153	157	162	166	170	174	179	183
90%	108	112	117	121	126	130	135	139	144	148	153	157	162	166	171	175	180	184	189
95%	109	114	118	123	128	133	137	142	147	152	156	161	166	171	175	180	166	190	194
100%	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200

Table k

90 Resting Heart Rate																			
HR max - read across	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**160**	**165**	**170**	**175**	**180**	**185**	**190**	**195**	**200**
%HRR max - read down																			
30%	96	98	99	101	102	104	105	107	108	110	111	113	114	116	117	119	120	122	123
35%	97	99	101	102	104	106	108	109	111	113	115	116	118	120	122	123	125	127	129
40%	**98**	**100**	**102**	**104**	**106**	**108**	**110**	**112**	**114**	**116**	**118**	**120**	**122**	**124**	**126**	**128**	**130**	**132**	**134**
45%	**99**	**101**	**104**	**106**	**108**	**110**	**113**	**115**	**117**	**119**	**122**	**124**	**126**	**128**	**131**	**133**	**135**	**137**	**140**
50%	**100**	**102**	**105**	**108**	**110**	**113**	**115**	**118**	**120**	**123**	**125**	**128**	**130**	**133**	**135**	**138**	**140**	**143**	**145**
55%	**101**	**104**	**106**	**109**	**112**	**115**	**118**	**120**	**123**	**126**	**129**	**131**	**134**	**137**	**140**	**142**	**145**	**148**	**151**
60%	**102**	**105**	**108**	**111**	**114**	**117**	**120**	**123**	**126**	**129**	**132**	**135**	**138**	**141**	**144**	**147**	**150**	**153**	**156**
65%	**103**	**106**	**110**	**113**	**116**	**119**	**123**	**126**	**129**	**132**	**136**	**139**	**142**	**145**	**149**	**152**	**155**	**158**	**162**
70%	**104**	**108**	**111**	**115**	**118**	**122**	**125**	**129**	**132**	**136**	**139**	**143**	**146**	**150**	**153**	**157**	**160**	**164**	**167**
75%	105	109	112	116	120	124	128	131	135	139	143	146	150	154	158	161	165	169	173
80%	106	110	114	118	122	126	130	134	138	142	146	150	154	158	162	166	170	174	178
85%	107	111	116	120	124	128	133	137	141	145	150	154	158	162	167	171	175	179	184
90%	108	113	117	122	126	131	135	140	144	149	153	158	162	167	171	176	180	185	189
95%	109	114	119	123	128	133	138	142	147	152	157	161	166	171	176	180	166	190	195
100%	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200

Table 5 for calculating rate pressure products (an index of myocardial work)

Read across the top row to the systolic blood pressure attained and down the left hand column to the corresponding heart rate. The values are represented $x10^2$ (divided by 100 or where two "0s" are taken off for simplicity). For those with coronary artery disease or myocardial dysfunction ischaemia or ventricular dysfunction angina and loss of good function tend to occur at values (in bold) in excess of 200 – 250 (Robinson, 1967; Arsenault et al *Med Sci Sports Exerc*. 2005;37:18-23).

Systolic BP mmHg	90	100	110	120	130	140	150	160	170	180	190	200	210	220
Heart Rate														
50	45	50	55	60	65	70	75	80	85	90	95	100	105	110
55	50	55	61	66	72	77	83	88	94	99	105	110	116	121
60	54	60	66	72	78	84	90	96	102	108	114	120	126	132
65	59	65	72	78	85	91	98	104	111	117	124	130	137	143
70	63	70	77	84	91	98	105	112	119	126	133	140	147	154
75	68	75	83	90	98	105	113	120	128	135	143	150	158	165
80	72	80	88	96	104	112	120	128	136	144	152	160	168	176
85	77	85	94	102	111	119	128	136	145	153	162	170	179	187
90	81	90	99	108	117	126	135	144	153	162	171	180	189	198
95	86	95	105	114	124	133	143	152	162	171	181	190	**200**	**209**
100	90	100	110	120	130	140	150	160	170	180	190	**200**	**210**	**220**
105	95	105	116	126	137	147	158	168	179	189	**200**	**210**	**221**	**231**
110	99	110	121	132	143	154	165	176	187	198	**209**	**220**	**231**	**242**
115	104	115	127	138	150	161	173	184	196	**207**	**219**	**230**	**242**	**253**
120	108	120	132	144	156	168	180	192	**204**	**216**	**228**	**240**	**252**	**264**
125	113	125	138	150	163	175	188	**200**	**213**	**225**	**238**	**250**	**263**	**275**
130	117	130	143	156	169	182	195	**208**	**221**	**234**	**247**	**260**	**273**	**286**
135	122	135	149	162	176	189	**203**	**216**	**230**	**243**	**257**	**270**	**284**	**297**
140	126	140	154	168	182	196	**210**	**224**	**238**	**252**	**266**	**280**	**294**	**308**
145	131	145	160	174	189	**203**	**218**	**232**	**247**	**261**	**276**	**290**	**305**	**319**
150	135	150	165	180	195	**210**	**225**	**240**	**255**	**270**	**285**	**300**	**315**	**330**
155	140	155	171	186	**202**	**217**	**233**	**248**	**264**	**279**	**295**	**310**	**326**	**341**
160	144	160	176	192	**208**	**224**	**240**	**256**	**272**	**288**	**304**	**320**	**336**	**352**
165	149	165	182	198	**215**	**231**	**248**	**264**	**281**	**297**	**314**	**330**	**347**	**363**
170	153	170	187	**204**	**221**	**238**	**255**	**272**	**289**	**306**	**323**	**340**	**357**	**374**
175	158	175	193	**210**	**228**	**245**	**263**	**280**	**298**	**315**	**333**	**350**	**368**	**385**
180	162	180	198	**216**	**234**	**252**	**270**	**288**	**306**	**324**	**342**	**360**	**378**	**396**
185	167	185	**204**	**222**	**241**	**259**	**278**	**296**	**315**	**333**	**352**	**370**	**389**	**407**
190	171	190	**209**	**228**	**247**	**266**	**285**	**304**	**323**	**342**	**361**	**380**	**399**	**418**
200	180	**200**	**220**	**240**	**260**	**280**	**300**	**320**	**340**	**360**	**380**	**400**	**420**	**440**

Tables 6 & 7: Estimation of maximal aerobic capacity (maximum METs) from submaximal heart rate (Table 6) and RPE (Table 7) for METs achieved in a submaximal exercise assessment

Adapted from: Eston and Thompson 1997; Borg, 1998; ACSM Guidelines, 2013; Buckley and Eston (2006); Morris et al., 2009, 2010

Read down left hand column to the METs achieved in submaximal test and across to the column of %HRRmax or RPE

Table 6

METs achieved	40%HRRmax	45%HRRmax	50%HRRmax	55%HRRmax	60%HRRmax	65%HRRmax	70%HRRmax	75%HRRmax
3.0	7.5	6.7	6.0	5.5	5.0	4.6	4.3	4.0
3.5	8.8	7.8	7.0	6.4	5.8	5.4	5.0	4.7
4.0	10.0	8.9	8.0	7.3	6.7	6.2	5.7	5.3
4.5	11.3	10.0	9.0	8.2	7.5	6.9	6.4	6.0
5.0	12.5	11.1	10.0	9.1	8.3	7.7	7.1	6.7
5.5	13.8	12.2	11.0	10.0	9.2	8.5	7.9	7.3
6.0	15.0	13.3	12.0	10.9	10.0	9.2	8.6	8.0
6.5	16.3	14.4	13.0	11.8	10.8	10.0	9.3	8.7
7.0	17.5	15.6	14.0	12.7	11.7	10.8	10.0	9.3
7.5	18.8	16.7	15.0	13.6	12.5	11.5	10.7	10.0
8.0	20.0	17.8	16.0	14.5	13.3	12.3	11.4	10.7
8.5	21.3	18.9	17.0	15.5	14.2	13.1	12.1	11.3
9.0	22.5	20.0	18.0	16.4	15.0	13.8	12.9	12.0
9.5	23.8	21.1	19.0	17.3	15.8	14.6	13.6	12.7
10.0	25.0	22.2	20.0	18.2	16.7	15.4	14.3	13.3
10.5	26.3	23.3	21.0	19.1	17.5	16.2	15.0	14.0
11.0	27.5	24.4	22.0	20.0	18.3	16.9	15.7	14.7
11.5	28.8	25.6	23.0	20.9	19.2	17.7	16.4	15.3
12.0	30.0	26.7	24.0	21.8	20.0	18.5	17.1	16.0
12.5	31.3	27.8	25.0	22.7	20.8	19.2	17.9	16.7
13.0	32.5	28.9	26.0	23.6	21.7	20.0	18.6	17.3
13.5	33.8	30.0	27.0	24.5	22.5	20.8	19.3	18.0
14.0	35.0	31.1	28.0	25.5	23.3	21.5	20.0	18.7
14.5	36.3	32.2	29.0	26.4	24.2	22.3	20.7	19.3
15.0	37.5	33.3	30.0	27.3	25.0	23.1	21.4	20.0
15.5	38.8	34.4	31.0	28.2	25.8	23.8	22.1	20.7
16.0	40.0	35.6	32.0	29.1	26.7	24.6	22.9	21.3

Table 7

METs achieved	*11 RPE*	*11-12RPE*	*12RPE*	*12-13RPE*	*13RPE*	*13-14RPE*	*14RPE*	*14-15RPE*
3.0	7.5	6.7	6.0	5.5	5.0	4.6	4.3	4.0
3.5	8.8	7.8	7.0	6.4	5.8	5.4	5.0	4.7
4.0	10.0	8.9	8.0	7.3	6.7	6.2	5.7	5.3
4.5	11.3	10.0	9.0	8.2	7.5	6.9	6.4	6.0
5.0	12.5	11.1	10.0	9.1	8.3	7.7	7.1	6.7
5.5	13.8	12.2	11.0	10.0	9.2	8.5	7.9	7.3
6.0	15.0	13.3	12.0	10.9	10.0	9.2	8.6	8.0
6.5	16.3	14.4	13.0	11.8	10.8	10.0	9.3	8.7
7.0	17.5	15.6	14.0	12.7	11.7	10.8	10.0	9.3
7.5	18.8	16.7	15.0	13.6	12.5	11.5	10.7	10.0
8.0	20.0	17.8	16.0	14.5	13.3	12.3	11.4	10.7
8.5	21.3	18.9	17.0	15.5	14.2	13.1	12.1	11.3
9.0	22.5	20.0	18.0	16.4	15.0	13.8	12.9	12.0
9.5	23.8	21.1	19.0	17.3	15.8	14.6	13.6	12.7
10.0	25.0	22.2	20.0	18.2	16.7	15.4	14.3	13.3
10.5	26.3	23.3	21.0	19.1	17.5	16.2	15.0	14.0
11.0	27.5	24.4	22.0	20.0	18.3	16.9	15.7	14.7
11.5	28.8	25.6	23.0	20.9	19.2	17.7	16.4	15.3
12.0	30.0	26.7	24.0	21.8	20.0	18.5	17.1	16.0
12.5	31.3	27.8	25.0	22.7	20.8	19.2	17.9	16.7
13.0	32.5	28.9	26.0	23.6	21.7	20.0	18.6	17.3
13.5	33.8	30.0	27.0	24.5	22.5	20.8	19.3	18.0
14.0	35.0	31.1	28.0	25.5	23.3	21.5	20.0	18.7
14.5	36.3	32.2	29.0	26.4	24.2	22.3	20.7	19.3
15.0	37.5	33.3	30.0	27.3	25.0	23.1	21.4	20.0
15.5	38.8	34.4	31.0	28.2	25.8	23.8	22.1	20.7
16.0	40.0	35.6	32.0	29.1	26.7	24.6	22.9	21.3

Table 8:
Approximate energy requirements in METs for task of daily living / hobbies / sports
Adapted from Ainsworth et al 2011

TASK	METS *(min)*	METS *(max)*	*Environmental effects*
Walking 2 mph	2	3	Possible
Dressing	2	3	Rarely
Bathing	2	3	Frequent
Washing Dishes	2	3	Rarely
Ironing	2	4	Rarely
Dusting	2	4	Rarely
Bed Making	2	6	Rarely
Walking 3 mph	3	3.5	Possible
Shower	3	4	Frequent
Sexual Intercourse	3	5	Rarely
Raking Leaves	3	5	Possible
Housework gen	3	4	Rarely
Cleaning Windows	3	4	Possible
Walking Upstairs	4	7	Rarely
Washing Car	6	7	Frequent
Sailing(small)	2	5	Frequent
Cycling 5 mph	2	3	Frequent
Croquet	2	3.5	Possible
Fishing (boat)	2	4	Frequent
Billiards	2	3	Rarely
Hand Drilling	2.7	4.6	Possible
Fly Fishing	3	4	Frequent
Cricket	3	7.5	Frequent
Ballroom Dancing	4	5	Rarely
Golf (carrying clubs)	4	5	Frequent
Swimming (slow)	4	5	Frequent
Tobogganing	4	8	Frequent
Figure Skating	4	10	Frequent
Badminton	4	9	Rarely
Roller Skating	5	11	Possible
Judo	6	12	Rarely
Swimming (Crawl)	9	10	Possible

Table 9:

Conversion of Exercise Cycle Watts to Concept II Rowing Speed and METS relative to body mass in kilograms.
Adapted from Lakomy and Lakomy (1993) and ACSM (2013)

Cycle Watts	Rowing 500m split	VO_2 (litres per min)	METS 60kg	METS 65kg	METS 70kg	METS 75kg	METS 80kg	METS 85kg	METS 90kg	METS 95 kg	METS 100 kg
25	4:30	0.44	2.1	1.93	1.8	1.68	1.57	1.48	1.4	1.32	1.26
30	4:15	0.54	2.57	2.37	2.2	2.06	1.93	1.82	1.71	1.62	1.54
40	4:00	0.71	3.38	3.12	2.9	2.7	2.54	2.39	2.25	2.14	2.03
50	3:40	0.9	4.29	3.96	3.67	3.43	3.21	3.03	2.86	2.71	2.57
60	3:25	1	4.76	4.4	4.08	3.81	3.57	3.36	3.17	3.01	2.86
70	3:15	1.1	5.24	4.84	4.49	4.19	3.93	3.7	3.49	3.31	3.14
80	3:05	1.15	5.48	5.05	4.69	4.38	4.11	3.87	3.65	3.46	3.29
90	3:00	1.3	6.19	5.71	5.31	4.95	4.64	4.37	4.13	3.91	3.71
100	2:55	1.5	7.14	6.59	6.12	5.71	5.36	5.04	4.76	4.51	4.29
110	2:45	1.64	7.81	7.21	6.69	6.25	5.86	5.51	5.21	4.93	4.69
120	2:38	1.8	8.57	7.91	7.35	6.86	6.43	6.05	5.71	5.41	5.14
130	2:30	1.86	8.86	8.18	7.59	7.09	6.64	6.25	5.9	5.59	5.31
140	2:28	2	9.52	8.79	8.16	7.62	7.14	6.72	6.35	6.02	5.71
150	2:25	2.1	10.0	9.23	8.57	8	7.5	7.06	6.67	6.32	6
160	2:21	2.28	10.86	10.02	9.31	8.69	8.14	7.66	7.24	6.86	6.51
170	2:18	2.42	11.52	10.64	9.88	9.22	8.64	8.13	7.68	7.28	6.91
180	2:15	2.57	12.24	11.3	10.49	9.79	9.18	8.64	8.16	7.73	7.34
190	2:12	2.7	12.86	11.87	11.02	10.29	9.64	9.08	8.57	8.12	7.71
200	2:10	2.8	13.33	12.31	11.43	10.67	10	9.41	8.89	8.42	8
220	2:07	3.14	14.95	13.8	12.82	11.96	11.21	10.55	9.97	9.44	8.97
250	2:00	3.57	17	15.69	14.57	13.6	12.75	12	11.33	10.74	10.2
300	1:50	4.28	20.38	18.81	17.47	16.3	15.29	14.39	13.59	12.87	12.23

Table 10: Conversion of walking running speeds to METs for cardiac rehabilitation

Buckley et al., (2016); ACSM (2014)

Meters/min	kph	mph	mins per mile	METs Cardiac	METs Healthy
30	1.8	1.1	53.9	2.1	2.1
35	2.1	1.3	46.2	2.5	2.2
40	2.4	1.5	40.4	2.8	2.3
45	2.7	1.7	35.9	3.2	2.5
50	3.0	1.9	32.3	3.5	2.6
55	3.3	2.0	29.4	3.7	2.8
60	3.6	2.2	26.9	4	3.0
65	3.9	2.4	24.9	4.3	3.1
70	4.2	2.6	23.1	4.7	3.3
75	4.5	2.8	21.5	5	3.5
80	4.8	3.0	20.2	5.4	3.8
85	5.1	3.2	19.0	5.7	4.0
90	5.4	3.3	18.0	6.1	4.2
95	5.7	3.5	17.0	6.4	4.5
100	6.0	3.7	16.2	6.8	4.8
105	6.3	3.9	15.4	6.9	5.1
110	6.6	4.1	14.7	7.5	5.4

Jog/Run Speed				
meters/min	**kph**	**mph**	**mins per mile**	**METs**
115	6.9	4.3	14.1	7.5
120	7.2	4.5	13.5	7.9
125	7.5	4.7	12.9	8.1
130	7.8	4.8	12.4	8.4
135	8.1	5.0	11.9	8.7
140	8.4	5.2	11.5	9.0
145	8.7	5.4	11.1	9.3
150	9.0	5.6	10.8	9.6
155	9.3	5.8	10.4	9.8
160	9.6	6.0	10.1	10.1
165	9.9	6.1	9.8	10.4
170	10.2	6.3	9.5	10.7
175	10.5	6.5	9.2	11.0
180	10.8	6.7	9.0	11.3
185	11.1	6.9	8.7	11.6
190	11.4	7.1	8.5	11.9
195	11.7	7.3	8.3	12.2
200	12.0	7.4	8.1	12.5

Table 11: Heart Rate Walking Speed Index
Buckley et al., 2010

Walking Speed m/min → / *Heart Rate* ▼	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**	**65**	**70**	**75**	**80**	**85**	**90**	**95**	**100**	**105**	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**
60	40	30.0	24.0	20.0	17.1	15.0	13.3	12.0	10.9	10.0	9.2	8.6	8.0	7.5	7.1	6.7	6.3	6.0	5.7	5.5	5.2	5.0	4.8	4.6	4.4	4.3	4.1	4.0	3.9
65	43	32.5	26.0	21.7	18.6	16.3	14.4	13.0	11.8	10.8	10.0	9.3	8.7	8.1	7.6	7.2	6.8	6.5	6.2	5.9	5.7	5.4	5.2	5.0	4.8	4.6	4.5	4.3	4.2
70	47	35.0	28.0	23.3	20.0	17.5	15.6	14.0	12.7	11.7	10.8	10.0	9.3	8.8	8.2	7.8	7.4	7.0	6.7	6.4	6.1	5.8	5.6	5.4	5.2	5.0	4.8	4.7	4.5
75	50	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5	11.5	10.7	10.0	9.4	8.8	8.3	7.9	7.5	7.1	6.8	6.5	6.3	6.0	5.8	5.6	5.4	5.2	5.0	4.8
80	53	40.0	32.0	26.7	22.9	20.0	17.8	16.0	14.5	13.3	12.3	11.4	10.7	10.0	9.4	8.9	8.4	8.0	7.6	7.3	7.0	6.7	6.4	6.2	5.9	5.7	5.5	5.3	5.2
85	57	42.5	34.0	28.3	24.3	21.3	18.9	17.0	15.5	14.2	13.1	12.1	11.3	10.6	10.0	9.4	8.9	8.5	8.1	7.7	7.4	7.1	6.8	6.5	6.3	6.1	5.9	5.7	5.5
90	60	45.0	36.0	30.0	25.7	22.5	20.0	18.0	16.4	15.0	13.8	12.9	12.0	11.3	10.6	10.0	9.5	9.0	8.6	8.2	7.8	7.5	7.2	6.9	6.7	6.4	6.2	6.0	5.8
95	63	47.5	38.0	31.7	27.1	23.8	21.1	19.0	17.3	15.8	14.6	13.6	12.7	11.9	11.2	10.6	10.0	9.5	9.0	8.6	8.3	7.9	7.6	7.3	7.0	6.8	6.6	6.3	6.1
100	67	50.0	40.0	33.3	28.6	25.0	22.2	20.0	18.2	16.7	15.4	14.3	13.3	12.5	11.8	11.1	10.5	10.0	9.5	9.1	8.7	8.3	8.0	7.7	7.4	7.1	6.9	6.7	6.5
105	70	52.5	42.0	35.0	30.0	26.3	23.3	21.0	19.1	17.5	16.2	15.0	14.0	13.1	12.4	11.7	11.1	10.5	10.0	9.5	9.1	8.8	8.4	8.1	7.8	7.5	7.2	7.0	6.8
110	73	55.0	44.0	36.7	31.4	27.5	24.4	22.0	20.0	18.3	16.9	15.7	14.7	13.8	12.9	12.2	11.6	11.0	10.5	10.0	9.6	9.2	8.8	8.5	8.1	7.9	7.6	7.3	7.1
115	77	57.5	46.0	38.3	32.9	28.8	25.6	23.0	20.9	19.2	17.7	16.4	15.3	14.4	13.5	12.8	12.1	11.5	11.0	10.5	10.0	9.6	9.2	8.8	8.5	8.2	7.9	7.7	7.4
120	80	60.0	48.0	40.0	34.3	30.0	26.7	24.0	21.8	20.0	18.5	17.1	16.0	15.0	14.1	13.3	12.6	12.0	11.4	10.9	10.4	10.0	9.6	9.2	8.9	8.6	8.3	8.0	7.7
125	83	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8	19.2	17.9	16.7	15.6	14.7	13.9	13.2	12.5	11.9	11.4	10.9	10.4	10.0	9.6	9.3	8.9	8.6	8.3	8.1
130	87	65.0	52.0	43.3	37.1	32.5	28.9	26.0	23.6	21.7	20.0	18.6	17.3	16.3	15.3	14.4	13.7	13.0	12.4	11.8	11.3	10.8	10.4	10.0	9.6	9.3	9.0	8.7	8.4
135	90	67.5	54.0	45.0	38.6	33.8	30.0	27.0	24.5	22.5	20.8	19.3	18.0	16.9	15.9	15.0	14.2	13.5	12.9	12.3	11.7	11.3	10.8	10.4	10.0	9.6	9.3	9.0	8.7
140	93	70.0	56.0	46.7	40.0	35.0	31.1	28.0	25.5	23.3	21.5	20.0	18.7	17.5	16.5	15.6	14.7	14.0	13.3	12.7	12.2	11.7	11.2	10.8	10.4	10.0	9.7	9.3	9.0
145	97	72.5	58.0	48.3	41.4	36.3	32.2	29.0	26.4	24.2	22.3	20.7	19.3	18.1	17.1	16.1	15.3	14.5	13.8	13.2	12.6	12.1	11.6	11.2	10.7	10.4	10.0	9.7	9.4
150	100	75.0	60.0	50.0	42.9	37.5	33.3	30.0	27.3	25.0	23.1	21.4	20.0	18.8	17.6	16.7	15.8	15.0	14.3	13.6	13.0	12.5	12.0	11.5	11.1	10.7	10.3	10.0	9.7
155	103	77.5	62.0	51.7	44.3	38.8	34.4	31.0	28.2	25.8	23.8	22.1	20.7	19.4	18.2	17.2	16.3	15.5	14.8	14.1	13.5	12.9	12.4	11.9	11.5	11.1	10.7	10.3	10.0
160	107	80.0	64.0	53.3	45.7	40.0	35.6	32.0	29.1	26.7	24.6	22.9	21.3	20.0	18.8	17.8	16.8	16.0	15.2	14.5	13.9	13.3	12.8	12.3	11.9	11.4	11.0	10.7	10.3
165	110	82.5	66.0	55.0	47.1	41.3	36.7	33.0	30.0	27.5	25.4	23.6	22.0	20.6	19.4	18.3	17.4	16.5	15.7	15.0	14.3	13.8	13.2	12.7	12.2	11.8	11.4	11.0	10.6
170	113	85.0	68.0	56.7	48.6	42.5	37.8	34.0	30.9	28.3	26.2	24.3	22.7	21.3	20.0	18.9	17.9	17.0	16.2	15.5	14.8	14.2	13.6	13.1	12.6	12.1	11.7	11.3	11.0
175	117	87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2	26.9	25.0	23.3	21.9	20.6	19.4	18.4	17.5	16.7	15.9	15.2	14.6	14.0	13.5	13.0	12.5	12.1	11.7	11.3
180	120	90.0	72.0	60.0	51.4	45.0	40.0	36.0	32.7	30.0	27.7	25.7	24.0	22.5	21.2	20.0	18.9	18.0	17.1	16.4	15.7	15.0	14.4	13.8	13.3	12.9	12.4	12.0	11.6

Use of the Heart Rate Walking Speed Index (HRWSI) reported as the number of heart-beats for every 10 meters walked

The HRWSI can be used to determine if an improvement in walking performance during a standardised walking test (e.g. Incremental Shuttle Walk, 6 min or 12 min Walk tests) is related to a true physiological improvement or by an improvement due to familiarisation, motivation, and increased exertional/pain tolerance.

Instruction: At any given point of a walking test, if a heart rate is recorded and a walking speed calculated the HRSWI can be determined by reading down the first column of the table to the nearest heart rate and reading across the table to the column of the nearest walking speed in m/min. If on a second test, the HRWSI has decreased this represents an increase in aerobic fitness or a corresponding decrease in cardiovascular strain for a given walking speed.

Table 12:

Estimated metabolic equivalents (METs) for box stepping on a 6-inch, 8-inch and 10-inch step

*Stepping rate (steps.min^{-1})	**Metronome setting (beats.min^{-1})	METS for a **6-inch step**	METS or an **8-inch step**	METS or an **10-inch step**
14	56	2.8	3.4	3.9
15 (CST1)	**60**	**3.0**	**3.6**	**4.2**
16	64	3.2	3.8	4.4
18	72	3.6	4.3	5.0
20 (CST 2)	**80**	**4.0**	**4.8**	**5.5**
22	88	4.4	5.3	6.1
24	96	4.8	5.8	6.6
25 (CST 3)	**100**	**5.0**	**6.0**	**6.9**
26	104	5.2	6.2	7.2
28	112	5.6	6.7	7.7
30 (CST 4)	**120**	**6.0**	**7.2**	**8.3**
35 (CST 5)	**140**	**7.0**	**7.8**	**9.1**

Adapted from the ACSM (2013)

*One step, commencing from both feet on the ground, constitutes each foot stepping up and then each foot stepping down. Each foot movement is paced with each beat of the **Metronome; four beats of the metronome equal a one-step cycle

Table 13:

Walking speeds and metabolic equivalents (METs) for the Incremental Shuttle Walking Test (ISWT) for cardiac rehabilitation participants

ISWT Stage	meters/min	kph	mph	METS*
1	30.0	1.8	1.1	2.1
2	40.2	2.4	1.5	2.8
3	50.4	3.1	1.9	3.5
4	60.6	3.7	2.3	4.2
5	70.8	4.2	2.6	4.9
6	81.0	4.8	3.0	5.6
7	91.2	5.5	3.4	6.3
8	101.4	6.1	3.8	7.0
9	111.6	6.8	4.2	7.7
10	121.8	7.2	4.5	7.9
11	132.0	7.9	4.9	8.5
12	142.2	8.5	5.3	9.1

Stages 1 to 9 METs derived from Buckley et al. (2016)
Stages 10 to 12 are METs for jogging/running (shaded) based on ACSM (2014)

RATING OF PERCEIVED EXERTION (RPE)

BORG'S RPE 6 – 20 SCALE

6	No exertion at all
7	Extremely light
8	
9	Very light
10	
11	Light
12	
13	Somewhat hard
14	
15	Hard (heavy)
16	
17	Very hard
18	
19	Extremely hard
20	Maximal exertion

BORG'S CR–10 SCALE

0	**Nothing at all (no "P")**
0.3	
0.5	**Extremely weak (just noticeable)**
1	**Very weak**
1.5	
2	
2.5	
3	**Moderate**
4	
5	**Strong (heavy)**
6	
7	**Very strong**
8	
9	
10	**Extremely strong**
11	
∽	
•	**Absolute maximum (highest possible)**

The CR-10 scale was mainly designed for evaluating more specific individualised responses such as breathlessness, muscle soreness and pain.

BORG'S SCALE INSTRUCTIONS

BORG'S RPE SCALE INSTRUCTIONS

While exercising we want you to rate your perception of exertion, i.e. how heavy and strenuous the exercise feels to you. The perception of exertion depends mainly on the strain and fatigue in your muscles and on your feeling of breathlessness or aches in the chest.

Look at this rating scale: we want you to use this scale from 6 to 20, where 6 means 'no exertion at all' and 20 means 'maximal exertion'.

9 corresponds to 'very light' exercise. For a normal, healthy person it is like walking slowly at his or her own pace for some minutes.

13 on the scale is 'somewhat hard' exercise, but it feels OK to continue

17 'very hard' is very strenuous. A healthy person can still go on, but he or she really has to push him – or herself. It feels very heavy, and the person is very tired.

19 on the scale is an extremely strenuous exercise level. For most people this is the most strenuous exercise they have ever experienced.

Try to appraise your feeling of exertion as honestly as possible, without thinking about what the actual physical load is. Don't underestimate it either. It's your feeling of effort and exertion that's important, not how it compares to other people's. What other people think is not important either. Look at the scale and the expressions and then give a number.

Any questions?

BORG'S SCALE INSTRUCTIONS

BORG'S CR10 SCALE INSTRUCTIONS

Basic instruction: 10, 'Extremely strong – Max' is the main anchor. It is the strongest perception (P) you have ever experienced. It may be possible, however, to experience or imagine something even stronger. Therefore, 'Absolute Maximum' is placed somewhat further down the scale without a fixed number and marked with a dot '•'. If you perceive an intensity stronger than 10 you may use a higher number.

Start with a verbal expression and then choose a number. If your perception is 'Very weak', say 1; if 'Moderate', say 3; and so on. You are welcome to use half values (such as 1.5, or 3.5 or decimals, for example, 0.3, 0.8 or 2.3). It is very important that you answer what you perceive and not why you believe you ought to answer. Be as honest as possible and try not to overestimate or underestimate the intensities.

Scaling perceived exertion: We want you to rate your perceived (P) exertion, that is, how heavy and strenuous the exercise feels to you. This depends mainly on the strain and fatigue in your muscles and on your breathlessness or aches in the chest. But you must also attend to your subjective feelings and not the physiological cues or what the actual physical load is.

1 **Is 'very light' like walking slowly at your own pace for several minutes.**

3 **Is not especially hard; it feels fine, and it is no problem to continue.**

5 **You are tired, but you don't have any difficulties.**

7 **You can still go on but have to push yourself very much. You are very tired.**

10 **This is as hard as most people have ever experienced before in their lives.**

- **This is 'Absolute maximum', for example 11 or 12 or higher.**

Scaling pain:

What are your worst experiences of pain? If you use 10 as the strongest exertion you have ever experienced or can think of, how strong would you say that your worst pain experiences have been?

10 **'Extremely strong – Max P is your main point of reference. It is anchored in your previously experienced worst pain, which you described, the 'Max P'.**

- Your worst pain experienced, the 'Max P', may not be the highest possible level. There may be pain that is still worse; if that feeling is somewhat stronger, you will say 11 or 12. If it is much stronger, 1.5 times 'Max P' you will say 15

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