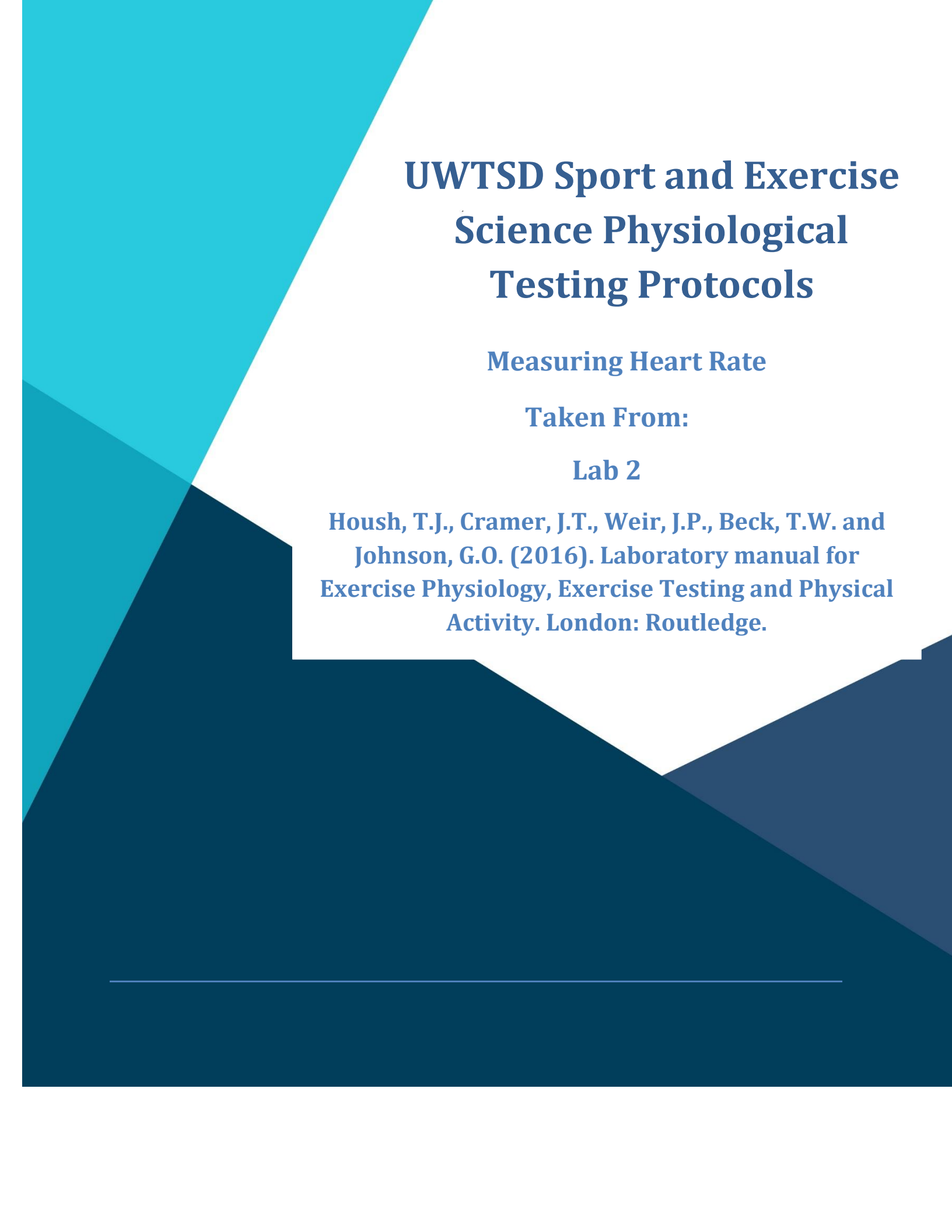




UWTSD Sport and Exercise Science Physiological Testing Protocols

Measuring Heart Rate

Taken From:

Lab 2

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Background

Several different physical fitness assessments may involve the measurement of a basic vital sign: heart rate (HR). Sometimes the measurement is performed at rest, which can help determine the pre-exercise health status of the individual or the return to resting conditions after exercise. During exercise, monitoring HR can be an effective method to estimate the intensity of exercise, especially during aerobic exercise. Heart rate is directly related to exercise intensity, and this relationship is most predictable between 50% and 90% of the maximum HR.¹ In addition, for exercise at the same absolute work rate, the HR of an aerobically trained individual will be lower than that of an untrained or unfit person. Thus, for someone who is less physically fit, the HR will generally be higher after completing a fitness test. For example, the Queens College Step Test (see Lab 9) is based on the assumption that less fit individuals will have a higher HR after the 3-minute step test than subjects who are more physically fit. Therefore, measuring HR before, during, and after exercise is an important aspect of physical fitness testing.

On average, most people have resting HR values between 60 and 80 beats per minute (bpm).⁴ However, the average resting HR for women tends to be 7–10 bpm higher than for men.⁴ Table 2.1 provides specific normative values for resting HR. There are three common clinical classifications of resting HR:

1. Bradycardia, defined as a slow HR of less than 60 bpm
2. Tachycardia, a fast HR of greater than 100 bpm
3. Normal rhythm, a resting HR of 60–100 bpm

Norms for resting heart rate in men and women (age = 18–65+ years).			TABLE	2.1
Classification	Resting heart rate (bpm)			
	MEN	WOMEN		
Low	35–56	39–58		
Moderately low	57–61	59–63		
< Average	62–65	64–67		
Average	66–71	68–72		
> Average	72–75	73–77		
Moderately high	76–81	78–83		
High	82–103	84–104		

Data from Golding, L. A. (2000). *YMCA fitness testing and assessment manual*, 4th ed. Champaign, IL: Human Kinetics.

Two primary methods are used for assessing resting HR: (a) palpation and (b) a heart rate monitor. The most common and cost-effective method for measuring HR is palpation. A more expensive but convenient method that has become increasingly popular is a digital-display HR monitor (photo 2.2). Procedures for both methods are described below.

KNOW THESE TERMS & ABBREVIATIONS

- HR = heart rate, measured in beats per minute (bpm)
- HR monitor = equipment used to measure and monitor heart rate; includes a chest strap (identifies the heartbeats and transmits the signal telemetrically photo 2.2a) and a digital display (displays the signal as a real-time HR value photo 2.2b)
- palpation = the act of examining by touch (photos 2.3 and 2.4)

PROCEDURES

Palpation⁷

1. To palpate the HR (or pulse), use the tips of the index and middle fingers. Avoid using the thumb, since small arteries running through the thumb can be confused with the actual palpable HR.
2. Palpate one of the following anatomical landmarks to find the pulse:
 - a. The radial artery, which is located on the anterior-lateral surface of the wrist, in line with the base of the thumb.⁴ The best location is usually just medial to the styloid process of the radius. The tips of the index and middle fingers should be placed gently on the skin over this area (photo 2.3).
 - b. The carotid artery can be found on the anterior surface of the neck, just lateral to the larynx (photo 2.4).⁴ Care should be taken when palpating the pulse of the carotid artery, because applying too much pressure may artificially lower the resultant HR value.^{5,9} This may be due to negative feedback from the baroreceptors, which sense pressure, in the aortic arch. There is some debate in the literature whether carotid artery palpation elicits enough pressure to trigger the baroreceptors.^{2,6,8}
3. Once the pulse is located, use a stopwatch to keep the time while counting the beats. If the stopwatch is started at the moment the counting begins, count the first beat as “0.” If the stopwatch has been running, count the first beat as “1.”
4. The HR should be counted for a set period of time, such as 10, 15, 30, or 60 seconds. Use one of the following calculations to determine the HR in bpm:
 - a. Counting for 10 seconds: Take the number of beats counted and multiply by 6.
 - b. Counting for 15 seconds: Take the number of beats counted and multiply by 4.
 - c. Counting for 30 seconds: Take the number of beats counted and multiply by 2.
5. Generally, the shorter-duration HR counts (10 and 15 seconds) are used during and after exercise, when it is important to attain a momentary HR. Since HR can increase with exercise intensity and decrease during recovery, it is sometimes necessary to count the beats during short time periods to obtain an accurate representation of HR at a specific moment during exercise or recovery. In contrast, resting HR measurements are often counted for 30 or 60 seconds to reduce the risk of miscounts and error.



PHOTO 2.1 GPS running watch/stop watch.



PHOTO 2.2 A heart rate monitor system: (a) chest strap, (b) digital display.



Photo 2.3 Palpation of the radial artery pulse.



PHOTO 2.4 Palpation of the carotid artery pulse.

Heart Rate Monitor

Generally, a HR monitor consists of a chest strap and a digital display (photo 2.5). The chest strap contains sensors that identify the heartbeats, and the resultant signal is transmitted telemetrically to the digital display as a real-time HR value in bpm. As with all equipment, different HR monitors may function slightly differently, and the manufacturer's directions should be read and followed. However, most HR monitors work in a similar fashion, and the procedure is as follows:

1. Most chest straps require a little moisture (water) applied with a damp cloth over the sensor areas to improve their ability to sense heartbeats.
2. Once the chest strap has been wetted, place the strap just distal to the pectoralis major muscles by adjusting the elastic band (see photo 2.5). The strap should be firm, but not tight enough to indent the skin. For both men and women, the chest strap should be placed in direct contact with the skin.
3. When properly placed, the digital display should provide HR values that update regularly (within seconds).



PHOTO 2.5 Placement of the heart rate monitor strap and the digital display of resting heart rate.

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