Chapter 12
Self-Selected Versus Imposed Exercise Intensities

The traditional method of prescribing the intensity of exercise is based on the scientific evidence that has shaped national PA guidelines regarding the overload training stimulus necessary to elicit health-fitness benefits. In this prescriptive paradigm, the health-fitness professional uses a GXT to determine target HR(s) or RPE(s) corresponding to a specific physiological threshold, such as the VT, or a range based on $\%VO_2max$. The individual is instructed to self-regulate exercise at the prescribed intensity. This procedure can be termed *imposed* exercise because the individual does not choose the intensity. This paradigm ignores an individual's exercise intensity preference and may result in negative emotions that could decrease adherence. Allowing individuals to choose their own exercise intensity (i.e., perform self-selected exercise) has the potential to improve PA participation. In addition, research has shown that many individuals will choose to exercise at an intensity near the VT. Self-selected exercise may be an important link in the chain between the adoption and maintenance of regular PA that elicits both psychological and physiological benefits.

12.1 Background

12.1.1 Traditional Imposed Exercise Intensity Prescription

It is common practice within the health-fitness domain to employ exercise prescription procedures that are based on the scientific evidence approved by national organizations such as the American College of Sports Medicine (ACSM) and the Centers for Disease Control and Prevention (CDC). PA guidelines have been proposed that define the intensity, duration, and frequency of an exercise program designed to elicit health-fitness benefits (ACSM 2013). Traditional exercise programs based on these guidelines set specific intensity prescriptions that target physiological ranges,

L. Haile et al., *Perceived Exertion Laboratory Manual*,
DOI 10.1007/978-1-4939-1917-8_12

often expressed as a $\%VO_2max$, and thresholds such as the VT. It has been suggested that a target RPE can be used to self-regulate exercise intensity to produce optimal health-fitness training outcomes based on physiological criteria. Various methods have been employed to confirm the validity of exercise intensity self-regulation using target RPE's, such as estimation–production paradigms for the assessment of prescription congruence and intensity discrimination.

However, prescribing exercise intensity based on guidelines that impose the intensity to be performed ignores an individual's preference for and tolerance of certain exercise intensities. It has been shown that increases in exercise intensity are associated with decreases in affective responses (AR) (Ekkekakis and Petruzzello 1999). This decrease in the pleasure derived from exercise can lower adherence to the prescribed exercise program (Cox et al. 2003; Lee et al. 1996; Perri et al. 2002). Based on these results, many individuals may not benefit from an initial exercise prescription where an imposed exercise intensity is employed. The goal of an exercise program should not only be health-fitness benefits, but should also include the development of one's willingness to participate in the activity. Therefore, one of the initial goals of an exercise prescription should be to promote program adherence. The adoption and maintenance of regular exercise will facilitate the ultimate goal of attaining the desired health-fitness benefits.

12.1.2 Imposed Versus Self-Selected Exercise Intensity Prescription

Prescribed exercise intensity can also be referred to as *imposed exercise intensity*. In this prescriptive scenario, the individual does not have a choice regarding the exercise intensity that he/she will perform. The imposition of exercise intensity can be seen by some individuals as highly controlling, negatively influencing AR and exercise adherence. Based on the theory of self-determination, engaging in an externally controlled behavior, such as performing imposed exercise intensity, decreases the intrinsic motivation to continue that behavior. Giving an individual the freedom to self-select the exercise intensity that will be performed may increase motivation for continued participation (Ryan and Deci 2000; Lind et al. 2008). Increased control over exercise intensity can lead to a greater enjoyment associated with exercise (Wankel 1993). This is important because of the positive link between exercise enjoyment and program adherence (Ryan and Deci 2000; Ryan et al. 1997; Caserta and Gillett 1998).

It has been proposed that a causal chain exists, linking (a) the intensity of PA (not only its level but whether it is self-selected or imposed), (b) AR to exercise (e.g., measured using Feeling Scale ratings), and (c) regular PA participation and/or adherence to exercise programming. Ekkekakis and Lind (2006) summarized the comparison between SS and imposed exercise intensity. They stated that during self-selected exercise, a sense of control is maintained such that the individual can avoid physical discomfort and fatigue. Therefore, self-selected exercise intensity may seem like a somewhat innocuous concept, negative emotions (e.g., social physique anxiety) may

not arise, and a positive AR results. In contrast, when exercise intensity is imposed, personal control is taken away and overt signs of fatigue and discomfort may occur. The imposition of exercise intensity may be seen as posing a potential evaluative threat where negative emotions may arise, leading to decreased AR (Ekkekakis and Lind 2006). Studies have shown that imposed exercise intensities elicit a more negative (or comparatively less positive) AR when compared to self-selected exercise intensities (Ekkekakis and Lind 2006; Lind et al. 2008; Parfitt et al. 2000; Parfitt et al. 2006; Rose and Parfitt 2007).

It has been shown that for most individuals, self-selected exercise intensities are adequate to provide an overload training stimulus to promote gains in cardiorespiratory fitness while simultaneously providing a level of effort that results in a positive AR. Previous studies have found that, on average, self-selected exercise intensity is often similar to the VT or LT. Although many subjects chose self-selected intensity near the VT or LT, relatively few exceeded that level (Dishman et al. 1994; Ekkekakis and Lind 2006; Lind et al. 2005; Lind et al. 2008). Therefore, a prescription that employs self-selected exercise intensity may be beneficial for overall health-fitness without negatively affecting mood state or emotions.

12.1.3 RPE During Self-Selected Exercise

RPE has been used to quantify the perception of exertional intensity during self-selected exercise. In a 20-min cycle ergometer exercise bout, both high- and low-active men estimated similar Borg Scale RPE's at 5-min intervals. RPE increased from an average of 10.5 at minute 5 to an average of 14.2 at minute 20 (Dishman et al. 1994). In a 20-min bout of treadmill exercise in which speed was adjusted to produce self-selected intensity, previously sedentary middle-aged women estimated Borg RPE's averaging approximately 11 at minute 5 and increasing to an average of almost 14 at minute 20 (Lind et al. 2005). Using the OMNI Scale during a 20-min bout of cycle ergometer exercise, college-aged males estimated RPE's averaging 2 at minute 5 and increasing to an average of 5 at minute 20 (Haile et al. 2013). In each instance, subjects were allowed to adjust intensity every 5 min. In general, subjects increased intensity throughout the 20-min exercise bouts and, subsequently, RPE increased as well. On average, RPE's measured during the later stages of the exercise bouts were within the perceived exertion range that encompasses the VT in most individuals, i.e., from 11 to 16 using the Borg Scale and from 5 to 7 using the OMNI Scale.

12.1.4 RPE During Self-Selected Versus Imposed Exercise Intensity

Parfitt and colleagues (2000) conducted an investigation in which RPE was compared between self-selected and imposed treadmill exercise in young adult males and females. Imposed exercise intensity was set at 65 % of VO_2max and subjects

self-selected exercise intensity at 71 % VO_2max. Even though exercise intensity was significantly different between trials, RPE's were similar. The exertion associated with the harder work rate during self-selected exercise intensity was perceived to be the same as for the lower, prescribed intensity. These findings indicate a potential positive perception of the self-selected exercise or conversely a negative perception of the imposed exercise (Parfitt et al. 2000).

The similarity in perceptual responses between self-selected and imposed exercise is important to consider when these formats are used for prescriptive purposes. If an individual feels that the level of exertion is lower when self-selected exercise is performed or higher when imposed exercise is performed, the individual may be underestimating or overestimating exertional intensity as it relates to physiological values. However, regardless of these subtle changes in the RPE response, an important aspect of self-selected and imposed exercise to consider is the individual's adherence to the exercise program. Some individuals may have better adherence during an initial exercise program involving self-selected exercise, yet others may prefer that the exercise professional sets a specific intensity based on established PA guidelines. Therefore, it is important to measure perceptual and psychosocial variables (i.e., RPE, pain, affect, enjoyment) during both self-selected and imposed exercise intensities before determining optimal exercise programming, especially in previously sedentary individuals.

12.1.5 Case Study

12.1.5.1 Client Information

A 44-year-old female enters your physical fitness program. She explains that in the past she exercised at home following her own pace but has discontinued the program. Now she feels that advice of a professional is needed in order to restart her exercise program. Recently, she has been attempting to get back into shape using the advice of a personal trainer at a commercial facility, but she complains that the trainer often pushed her too hard. She tells you that the trainer was a nice person, but she could not enjoy exercising when the trainer kept telling her to exercise at a higher intensity than she preferred.

12.1.5.2 Assessments, Results and Analysis

Have the subject perform a load-incremented estimation trial to determine the VT. Then, have the subject perform two submaximal exercise trials: one at self-selected exercise intensity and one at imposed exercise intensity. Measure VO_2 and RPE during each trial to determine the mode of exercise intensity most suitable for the subject based on perceived exertion responses and personal preference.

Using the estimation trial, determine VO_2, HR and RPE at the VT.
Using the imposed exercise intensity trial, determine the average VO_2, HR and RPE.
Using the self-selected exercise intensity trial, determine average VO_2, HR, and RPE.

12.2 Methods

12.2.1 Treadmill Procedures

12.2.1.1 Equipment

1. Adult OMNI-Walk/Run RPE Scale (Fig. A.2)
2. Treadmill
3. HR monitor
4. Respiratory-metabolic measurement system

12.2.1.2 Pre-exercise Procedures

1. Measure height (cm) and weight (kg) of subject.
2. Perform the memory anchoring procedure as described in Chap. 5. Read the standard instructions to the subject for the Adult OMNI-Walk/Run RPE Scale to measure RPE-O (Appendix B.1). If measurement of differentiated RPE (RPE-L and RPE-C) is desired, read the standard instructions for the Adult OMNI-Walk/Run RPE Scale for undifferentiated and differentiated RPE (Appendix B.2).

12.2.1.3 Graded Exercise Test

1. Position the HR monitor and respiratory-metabolic mouthpiece (with head support unit and nose clip if applicable) on the subject.
2. Instruct the subject to step onto the treadmill and review exercise termination procedures: When the subject cannot continue exercise due to exhaustion or discomfort, he/she should grasp the treadmill hand rails, at which time the test administrator will gradually slow the treadmill down for performance of a cool-down. The subject should be reminded not to step off the treadmill belt while it is still in motion.
3. Bruce Multistage Treadmill Test Protocol: this can be performed by manually adjusting treadmill speed and grade or using a program on a computer that is interfaced to the treadmill.

   (a) Begin the warm-up at 1.5 miles $\cdot h^{-1}$ and 0 % grade for 3 min.
   (b) Each exercise test stage will last for 3 min. The stages progress as follows:

Stage 1—1.7 miles · h^{-1} and 10 % grade
Stage 2—2.5 miles · h^{-1} and 12 % grade
Stage 3—3.4 miles · h^{-1} and 14 % grade
Stage 4—4.2 miles · h^{-1} and 16 % grade
Stage 5—5.0 miles · h^{-1} and 18 % grade
Stage 6—5.5 miles · h^{-1} and 20 % grade
Stage 7—6.0 miles · h^{-1} and 22 % grade
Stage 8—6.5 miles · h^{-1} and 24 % grade

(c) When the subject cannot continue any longer owing to exhaustion, terminate the exercise test by initiating the cool-down period at 1.5 miles · h^{-1} and 0 % grade. The cool-down should be 5 min in duration.
(d) Ask the subject to estimate RPE starting at 2:30 of each exercise stage using the OMNI Scale (RPE-O). Because the position of the respiratory-metabolic mouth piece inhibits a verbal response, instruct the subject to point to the numbers on the RPE scale, which should be conveniently positioned within the subject's arm reach. State aloud the numerical ratings for each momentary assessment to which the subject pointed and request a confirmatory nod that the number stated was correct. If incorrect, allow the subject to point to the appropriate rating on the RPE scale once more. Ask the subject to hold his or her finger on the appropriate number on the scale for approximately 1 s.
(e) Record HR ($b \cdot min^{-1}$) at 2:55 of each exercise stage.
(f) Record the final 15-s VO_2 ($ml \cdot kg^{-1} \cdot min^{-1}$) for each exercise stage.
(g) Record HRmax as the highest HR value recorded during the final exercise stage or immediately post-exercise.
(h) Record VO_2max as the highest 15-s VO_2 value recorded at the end of the test.
(i) Determine the VO_2 ($ml \cdot kg^{-1} \cdot min^{-1}$) and %$VO_2$max associated with the VT using the respiratory-metabolic measurement system automatic VT calculator.

12.2.1.4 Estimation Protocol: Data Organization and Analysis

1. In a Microsoft Excel spreadsheet, label columns of data for the following variables: Exercise Stage, VO_2 ($ml \cdot kg^{-1} \cdot min^{-1}$), OMNI RPE-O, HR ($b \cdot min^{-1}$). Include columns for OMNI RPE-L and OMNI RPE-C if applicable.
2. If the respiratory-metabolic measurement system does not automatically calculate VT or if instruction on manual calculation and visual identification of the VT is desired, refer to Appendix D for a detailed explanation for the following:

   (a) Calculation of $V_E \cdot VO_2^{-1}$ and $V_E \cdot VCO_2^{-1}$.
   (b) Plot of $V_E \cdot VO_2^{-1}$ and $V_E \cdot VCO_2^{-1}$ for visual identification of the VT using the ventilatory equivalent method.
   (c) Adjustment of automatic VT calculation using a respiratory-metabolic measurement system.

3. Plot of VO_2 as a function of OMNI RPE-O for determination of OMNI RPE-VT.
   (a) Click on the **INSERT** tab and in the **CHARTS** section click on **SCATTER**. Select the first available chart option. A blank or example scatter plot will appear on your screen.
   (b) Click on the **SELECT DATA** tab. Remove any entries found in the **LEGEND ENTRIES** text box then click **ADD**. Under **SERIES NAME**, enter VO_2 and OMNI RPE-O. Then click on the icon to the right of the **SERIES X VALUES** text box and highlight the VO_2 values. After the values are highlighted click the icon on the box that appeared. Then click on the icon to the right of the **SERIES Y VALUES** text box and highlight the OMNI RPE-O values. After the values are highlighted click the icon on the box that appeared. Click **OK** on the next two screens.
   (c) You should now have a scatter plot with OMNI RPE-O on the *y*-axis and VO_2 on the *x*-axis. Create a title for the plot and enter the appropriate axis labels and units of measure.
   (d) To determine OMNI RPE-VT, click on one of the data points to highlight the entire data series. Right click on one of the data points and a menu will appear. Click **ADD TRENDLINE** and the **FORMAT TRENDLINE** menu will appear. Select **LINEAR** and **DISPLAY EQUATION ON CHART** then click **CLOSE**. The trendline and equation will be displayed on the chart.
   (e) Use this linear equation to calculate RPE-VT. Use the previously determined VO_2 ($ml \cdot kg^{-1} \cdot min^{-1}$) corresponding to the VT as the "x" value in the equation and solve for "y." The calculated "y" value, once rounded to the nearest whole integer, is the OMNI RPE-VT.
4. Repeat the above steps for VO_2 and HR to determine HR-VT.
5. An example of these procedures with a screenshot depicting each step as performed using Microsoft Excel 2013 can be found in Appendix D.

12.2.1.5 Imposed Exercise Intensity Trial

1. Position the HR monitor and respiratory-metabolic mouthpiece (with head support unit and nose clip if applicable) on the subject.
2. Instruct the subject to step onto the treadmill and review exercise termination procedures: When the subject cannot continue exercise due to exhaustion or discomfort, he/she should grasp the treadmill hand rails, at which time the test administrator will slow down or stop the treadmill. The subject should be reminded not to step off the treadmill belt while it is still in motion.
3. Start the treadmill at 3 $miles \cdot h^{-1}$ and 0 % grade for a 2-min warm-up.
4. Following the warm-up, instruct the subject that he/she will exercise for 10 min at the predetermined target VO_2 corresponding to the VT, which will be achieved by adjusting the treadmill speed.
   (a) Increase the speed of the treadmill to 5 $miles \cdot h^{-1}$ immediately following the warm-up. Then monitor every 15-s average VO_2 ($ml \cdot kg \cdot min^{-1}$) on the computer display.

(b) If VO_2 remains below the VT after 1 min, increase the treadmill speed by 0.5 miles $\cdot h^{-1}$. Continue to increase speed by 0.5 miles $\cdot h^{-1}$ every 30 s until VO_2 is within 2–3 ml $\cdot kg^{-1} \cdot min^{-1}$ of VO_2 corresponding to the VT.
(c) If VO_2 increases to a level above the VT, make adjustments by decreasing treadmill speed in increments of 0.1 miles $\cdot h^{-1}$ every 30 s to fine-tune exercise intensity.

5. Record treadmill speed every minute.
6. Record HR ($b \cdot min^{-1}$) every 2 min.
7. Record the final 15-s VO_2 in ml $\cdot kg^{-1} \cdot min^{-1}$ for each 2-min segment of exercise.
8. Instruct the subject to estimate RPE starting at 1:30 of each 2-min segment of exercise using the OMNI Scale (RPE-O).
9. Following the 10-min exercise, the treadmill should be set to 3 miles $\cdot h^{-1}$ and 0 % grade for a 2-min cool-down period.

12.2.1.6 Self-Selected Exercise Intensity Trial

1. Position the HR monitor and respiratory-metabolic mouthpiece (with head support unit and nose clip if applicable) on the subject.
2. Instruct the subject to step onto the treadmill and review exercise termination procedures: When the subject cannot continue exercise due to exhaustion or discomfort, he/she should grasp the treadmill hand rails, at which time the test administrator will slow down or stop the treadmill. The subject should be reminded not to step off the treadmill belt while it is still in motion.
3. Read the following instructions to the subject for self-selected exercise (Dishman et al. 1994; Parfitt et al. 2000): "You will be allowed to select an intensity you prefer to perform on the treadmill. This should be an intensity that you would choose for a 10-min workout if you were participating in a fitness program. The intensity should be high enough that you would get a good workout, but not so high that you would not prefer to exercise at that intensity daily or at least every other day. It should be an intensity that is appropriate for you."
4. Start the treadmill at 3 miles $\cdot h^{-1}$ and 0 % grade for a 2-min warm-up.
5. Following the warm-up, instruct the subject to exercise for 10 min at a SS exercise intensity by adjusting treadmill speed whenever desired.
6. Record treadmill speed every minute.
7. Record HR ($b \cdot min^{-1}$) every 2 min.
8. Record the final 15-s VO_2 in ml $\cdot kg^{-1} \cdot min^{-1}$ for each 2-min segment of exercise.
9. Ask the subject to estimate RPE starting at 1:30 of each 2-min segment of exercise using the OMNI Scale (RPE-O).
10. Following the 10-min exercise, the treadmill should be set to 3 miles $\cdot h^{-1}$ and 0 % grade for a 2-min cool-down period.

12.2.1.7 Imposed and Self-Selected Exercise Intensity Trials: Data Organization and Analysis

1. For the imposed exercise intensity trial:
   (a) Calculate the average treadmill speed (miles $\cdot$ h^{-1}) using the data from each minute of exercise.
   (b) Calculate the average HR (b $\cdot$ min^{-1}) using each 2-min HR response.
   (c) Calculate the average OMNI RPE-O using each 2-min RPE response.
   (d) Calculate the average VO_2 (ml $\cdot$ kg^{-1} $\cdot$ min^{-1}) using each 2-min VO_2.
2. For the self-selected exercise intensity trial:
   (a) Calculate the average treadmill speed (miles $\cdot$ h^{-1}) using the data from each minute of exercise.
   (b) Calculate the average HR (b $\cdot$ min^{-1}) using each 2-min HR response.
   (c) Calculate the average OMNI RPE-O using each 2-min RPE response.
   (d) Calculate the average VO_2 (ml $\cdot$ kg^{-1} $\cdot$ min^{-1}) using each 2-min VO_2.

12.2.2 Cycle Ergometer Procedures

12.2.2.1 Equipment

1. Adult OMNI-Cycle RPE Scale (Fig. 2.4)
2. Cycle ergometer
3. Metronome
4. HR monitor
5. Respiratory-metabolic measurement system

12.2.2.2 Pre-exercise Procedures

1. Measure height (cm) and weight (kg) of subject.
2. Read the standard instructions for the Adult OMNI-Cycle RPE Scale for RPE-L to the subject (Appendix B.4). If the measurement of undifferentiated (RPE-O) and differentiated RPE for chest/breathing (RPE-C) is desired, read the standard instructions for the Adult OMNI-Cycle RPE Scale for undifferentiated and differentiated RPE (Appendix B.5). Perform the memory anchoring procedure as described in Chap. 5.

12.2.2.3 Graded Exercise Test

1. Position the HR monitor and respiratory-metabolic mouthpiece (with head support unit and nose clip if applicable) on the subject.

2. Set the proper seat height on the cycle ergometer according to leg length. When the foot is flat on the right pedal and the pedal is in the extreme down position, the right knee should be in approximately 5 degrees of flexion.
3. Load-incremented protocol for electronically braked and friction-braked cycle ergometers:
   (a) Instruct the subject to maintain a 50 rev · min^{-1} pedal cadence. Set the metronome to 100 beats · min^{-1} so each downward movement of each foot is synchronized with a beat of the metronome. The subject may also use the digital monitor on the cycle control panel to regulate pedal cadence.
   (b) For electronically braked cycle ergometers (e.g., Lode), begin stage 1 at 50 W then increase the resistance 25 W every 2 min.
   (c) For friction-braked cycle ergometers (e.g., Monark), begin stage 1 at 1 kg resistance then increase the resistance 0.5 kg every 2 min.
   (d) When the subject cannot maintain the pedal cadence for 10 consecutive seconds owing to fatigue, terminate the exercise test.
   (e) Instruct the subject to estimate RPE starting at 1:30 of each exercise stage using the OMNI Scale (RPE-L). Because the position of the respiratory-metabolic mouth piece inhibits a verbal response, instruct the subject to point to the numbers on the RPE scale, which should be conveniently positioned within the subject's arm reach. State aloud the numerical ratings for each momentary assessment to which the subject pointed and request a confirmatory nod that the number stated was correct. If incorrect, allow the subject to point to the appropriate rating on the RPE scale once more. Ask the subject to hold his or her finger on the appropriate number on the scale for approximately 1 s.
   (f) Record HR (b · min^{-1}) at 1:55 of each exercise stage.
   (g) Record the final 15-s VO_2 in l · min^{-1} for each exercise stage.
   (h) Record HRpeak as the highest HR value recorded during the final exercise stage or immediately post-exercise.
   (i) Record VO_2peak as the highest 15-s VO_2 value recorded at the end of the test.
   (j) Determine the VO_2 (l · min^{-1}) and %VO_2peak associated with the VT using the respiratory-metabolic measurement system automatic VT calculator.

12.2.2.4 Estimation Protocol: Data Organization and Analysis

1. In a Microsoft Excel spreadsheet, label columns of data for the following variables: Exercise Stage, VO_2 (l · min^{-1}), OMNI RPE-L, HR (b · min^{-1}). Include columns for OMNI RPE-O and OMNI RPE-C if applicable.
2. If the respiratory-metabolic measurement system does not automatically calculate VT or if instruction on manual calculation and visual identification of the VT is desired, refer to Appendix D for detailed instructions for the following:
   (a) Calculation of $V_E \cdot VO_2^{-1}$ and $V_E \cdot VCO_2^{-1}$.

(b) Plot of $V_E \cdot VO_2^{-1}$ and $V_E \cdot VCO_2^{-1}$ for visual identification of the VT using the ventilatory equivalent method.
(c) Adjustment of automatic VT calculation using a computer application available for most respiratory-metabolic measurement systems.

3. Plot of VO_2 and OMNI RPE-L for determination of OMNI RPE-VT.

(a) Click on the **INSERT** tab and in the **CHARTS** section click on **SCATTER**. Select the first available chart option. A blank or example scatter plot will appear on your screen.
(b) Click on the **SELECT DATA** tab. Remove any entries found in the **LEGEND ENTRIES** text box then click **ADD**. Under **SERIES NAME**, enter VO_2 and OMNI RPE-L. Then click on the icon to the right of the **SERIES X VALUES** text box and highlight the VO_2 values. After the values are highlighted click the icon on the box that appeared. Then click on the icon to the right of the **SERIES Y VALUES** text box and highlight the OMNI RPE-L values. After the values are highlighted click the icon on the box that appeared. Click **OK** on the next two screens.
(c) You should now have a scatter plot with OMNI RPE-L on the *y*-axis and VO_2 on the *x*-axis. Create a title for the plot and enter the appropriate axis labels and units of measure.
(d) To determine OMNI RPE-VT, click on one of the data points to highlight the entire data series. Right click on one of the data points and a menu will appear. Click **ADD TRENDLINE** and the **FORMAT TRENDLINE** menu will appear. Select **LINEAR** and **DISPLAY EQUATION ON CHART** then click **CLOSE**. The trendline and equation will be displayed on the chart.
(e) Use this linear equation to calculate RPE-VT. Use the previously determined VO_2 ($l \cdot min^{-1}$) corresponding to the VT as the "x" value in the equation and solve for "y." The calculated "y" value, once rounded to the nearest whole integer, is the OMNI RPE-VT.

4. Repeat the above steps for VO_2 and HR to determine HR-VT.
5. An example of these procedures with a screenshot depicting each step as performed using Microsoft Excel 2013 can be found in Appendix D.

12.2.2.5 Imposed Exercise Intensity Trial

1. Position the HR monitor and respiratory-metabolic mouthpiece (with head support unit and nose clip if applicable) on the subject.
2. Set the proper seat height on the cycle ergometer according to leg length. When the foot is flat on the right pedal and the pedal is in the extreme down position, the right knee should be in approximately 5 degrees of flexion.
3. Instruct the subject to maintain a 50 $rev \cdot min^{-1}$ pedal cadence. Set the metronome to 100 $beats \cdot min^{-1}$ so each downward movement of each foot is synchronized with a beat of the metronome. The subject may also use the digital monitor on the cycle control panel to regulate pedal cadence.

4. Instruct the subject to perform a 2-min warm-up.
   (a) For electronically braked cycle ergometers (e.g., Lode) set the PO at 25 W.
   (b) For friction-braked cycle ergometers (e.g., Monark), set the brake resistance at 0.5 kg.
5. Following the warm-up, inform the subject that he/she will exercise for 10 min at the predetermined target VO_2 corresponding to the VT which will be achieved by adjusting the cycle brake resistance.
6. For electronically braked cycle ergometers (e.g., Lode)
   (a) Increase the cycle brake resistance to 75 W immediately following the warm-up. Then monitor every 15-s average VO_2 ($l \cdot min^{-1}$) on the computer display.
   (b) If VO_2 remains below the VT after 1 min, increase the cycle brake resistance by 25 W. Continue to increase the brake resistance by 25 W every 30 s until VO_2 is within 0.2–0.3 $l \cdot min^{-1}$ of the VO_2 corresponding to the VT.
   (c) If VO_2 increases to a level above the VT, make further adjustments by decreasing the brake resistance in increments of 5–10 W to fine-tune exercise intensity.
7. For friction-braked cycle ergometers (e.g., Monark)
   (a) Increase the cycle brake resistance to 1.5 kg immediately following the warm-up. Then monitor every 15-s average VO_2 ($l \cdot min^{-1}$) on the computer display.
   (b) If VO_2 remains below the VT after 1 min, increase the cycle brake resistance by 0.5 kg. Continue to increase the brake resistance by 0.5 kg every 30 s until VO_2 is within 0.2–0.3 $l \cdot min^{-1}$ of the VO_2 corresponding to the VT.
   (c) If VO_2 increases to a level above the VT, make further adjustments by decreasing the brake resistance in increments of 0.1 kg to fine-tune exercise intensity.
8. Record cycle brake resistance (W or kg) every minute.
9. Record HR ($b \cdot min^{-1}$) every 2 min.
10. Record the final 15-s VO_2 in $l \cdot min^{-1}$ for each 2-min segment of exercise.
11. Ask the subject to estimate RPE-L starting at 1:30 of each 2-min segment of exercise using the OMNI Scale.
12. Following the 10-min exercise, instruct the subject to perform a 2-min cool-down.
    (a) For electronically braked cycle ergometers (e.g., Lode) set the PO at 25 W.
    (b) For friction-braked cycle ergometers (e.g., Monark), set the brake resistance at 0.5 kg.

12.2.2.6 Self-Selected Exercise Intensity Trial

1. Position the HR monitor and respiratory-metabolic mouthpiece (with head support unit and nose clip if applicable) on the subject.

2. Set the proper seat height on the cycle ergometer according to leg length. When the foot is flat on the right pedal and the pedal is in the extreme down position, the right knee should be in approximately 5 degrees of flexion.
3. Instruct the subject to maintain a 50 rev · min^{-1} pedal cadence. Set the metronome to 100 beats · min^{-1} so each downward movement of each foot is synchronized with a beat of the metronome. The subject may also use the digital monitor on the cycle control panel to regulate pedal cadence.
4. Read the following instructions for self-selected exercise to the subject (Dishman et al. 1994; Parfitt et al. 2000): "You will be allowed to select an intensity you prefer to perform on the cycle. This should be an intensity that you would choose for a 10-min workout if you were participating in a fitness program. The intensity should be high enough that you would get a good workout, but not so high that you would not prefer to exercise at that intensity daily or at least every other day. It should be an intensity that is appropriate for you."
5. Instruct the subject to perform a 2-min warm-up.
   (a) For electronically braked cycle ergometers (e.g., Lode) set the PO at 25 W.
   (b) For friction-braked cycle ergometers (e.g., Monark), set the brake resistance at 0.5 kg.
6. Following the warm-up, instruct the subject to exercise for 10 min at a SS exercise intensity by adjusting the cycle brake resistance whenever desired.
7. Record cycle brake resistance every minute.
8. Record HR (b · min^{-1}) every 2 min.
9. Record the final 15-s VO_2 in l · min^{-1} for each 2-min exercise segment.
10. Ask the subject to estimate RPE-L starting at 1:30 of each 2-min segment of exercise using the OMNI Scale.
11. Following the 10-min exercise, instruct the subject to perform a 2-min cool-down.
    (a) For electronically braked cycle ergometers (e.g., Lode) set the PO at 25 W.
    (b) For friction-braked cycle ergometers (e.g., Monark), set the brake resistance at 0.5 kg.

12.2.2.7 Imposed and Self-Selected Exercise Intensity Trials: Data Organization and Analysis

1. For the imposed exercise intensity trial:
   (a) Calculate the average cycle brake resistance using the data from each minute of exercise.
   (b) Calculate the average HR (b · min^{-1}) using each 2-min HR response.
   (c) Calculate the average OMNI RPE-L using each 2-min RPE response.
   (d) Calculate the average VO_2 (l · min^{-1}) using each 2-min VO_2.

2. For the self-selected exercise intensity trial:
   (a) Calculate the average cycle brake resistance using the data from each minute of exercise.
   (b) Calculate the average HR ($b \cdot min^{-1}$) using each 2-min HR response.
   (c) Calculate the average OMNI RPE-L using each 2-min RPE response.
   (d) Calculate the average VO_2 ($l \cdot min^{-1}$) using each 2-min VO_2.

12.3 Laboratory Discussion Questions

1. Did the imposed trial produce a target intensity similar to the VT? Did the subject exhibit RPE responses similar to those corresponding to the VT as calculated using responses to the estimation trial?
2. Were physiological variables (i.e., VO_2, HR, V_E) similar or dissimilar between the self-selected and imposed exercise trials? Which mode of identifying exercise intensity, self-selected or imposed, would you recommend based on the potential for physiological and health-fitness benefits? Why?
3. Were RPE responses similar or dissimilar between the self-selected and imposed exercise trials? Which mode of identifying exercise intensity, self-selected or imposed, would you recommend based on the potential to promote maximum exercise program adherence? Why?
4. Was there a perceptual-physiological link between RPE responses and physiological responses to self-selected and imposed exercise intensities as predicted by the Effort Continua Model? Would you use a target RPE or target physiological response to set the initial intensity for a sedentary individual's exercise program?
5. How would you progress the intensity of an individual's exercise program if it was based on (a) an imposed protocol or (b) a self-selected protocol?

References

American College of Sports Medicine. ACSM's guidelines for exercise testing and prescription. 9th ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2013.

Caserta MS, Gillett PA. Older women's feelings about exercise and their adherence to an aerobic regimen over time. Gerontologist. 1998;38:602–9.

Cox KL, Burke V, Gorely TJ, Beilin LJ, Puddey IB. Controlled comparison of retention and adherence in home- vs center-initiated exercise interventions in women ages 40–65 years: the S.W.E.A.T. study (sedentary women exercise adherence trial). Prev Med. 2003;36:17–29.

Dishman RK, Farquhar RP, Curetone KG. Responses to preferred intensities of exertion in men differing in activity levels. Med Sci Sports Exerc. 1994;26:783–90.

Ekkekakis P, Petruzzello SJ. Acute aerobic exercise and affect: current status, problems and prospects regarding dose–response. Sports Med. 1999;28:337–74.

Ekkekakis P, Lind E. Exercise does not feel the same when you are overweight: the impact of self-selected and imposed intensity on affect and exertion. Int J Obes. 2006;30:652–60.

Haile L, Goss FL, Robertson RJ, Andreacci JL, Gallagher Jr M, Nagle EF. Session perceived exertion and affective responses to self-selected and imposed cycle exercise of the same intensity in young men. Eur J Appl Physiol. 2013;116:1755–65.

Lee JY, Jensen BE, Oberman A, Fletcher GF, Fletcher BJ, Raczynski JM. Adherence in the training levels comparison trial. Med Sci Sports Exerc. 1996;28:47–52.

Lind E, Joens-Matre RR, Ekkekakis P. What intensity of physical activity do previously sedentary middle-aged women select? Evidence of a coherent pattern from physiological, perceptual, and affective markers. Prev Med. 2005;40:407–19.

Lind E, Ekkekakis P, Vazou S. The affective impact of exercise intensity that slightly exceeds the preferred level: 'pain' for no additional 'gain'. J Health Psychol. 2008;13:464–8.

Parfitt G, Rose EA, Markland D. The effect of prescribed and preferred intensity exercise on psychological affect and the influence of baseline measures of affect. J Health Psychol. 2000;5: 231–40.

Parfitt G, Rose EA, Burgess WM. The psychological and physiological responses of sedentary individuals to prescribed and preferred intensity exercise. Br J Health Psychol. 2006;11: 39–53.

Perri MG, Anton SD, Durning PE, Ketterson TU, Sydeman SJ, Berlant NE, Kanasky Jr WF, Newton Jr RL, Limacher MC, Martin AD. Adherence to exercise prescriptions: effects of prescribing moderate versus higher levels of intensity and frequency. Health Psychol. 2002;21: 452–8.

Rose EA, Parfitt G. A quantitative analysis and qualitative explanation of the individual differences in affective responses to prescribed and self-selected exercise intensities. J Sport Exerc Psychol. 2007;29:335–54.

Ryan RM, Deci EL. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. Am Psychol. 2000;55:68–78.

Ryan RM, Frederick CM, Lepes D, Rubio N, Sheldon KM. Intrinsic motivation and exercise adherence. Int J Sports Psychol. 1997;28:335–54.

Wankel LM. The importance of enjoyment to adherence and psychological benefits from physical activity. Int J Sports Psychol. 1993;24:151–69.