

ORIGINAL ARTICLE

IJPHY

Motor and Cardiovascular Distinctions among genders in Hispanic-Latinx People Living with HIV

¹Martín G. Rosario, PT, Ph.D., CSFI, ATRIC¹Leah Jamison, DPT²Gabriel Gines, BS, MPH, CSFI, CPT

ABSTRACT

Background: HIV can lead to a plethora of health-related complications, such as cardiovascular and gait deficiencies. Some of the HIV obstacles are related among individuals; however, various facets come into play when considering and designing interventions for this population, like gender profile. This study aim to interpret the impact of HIV on distinct individuals; the present inquiry proposes to inspect the cardio-motor tendency on male versus female in Hispanics-Latinx living with HIV.

Methods: Cardio-motor data was gathered from members' records enrolled in La Perla de Gran Precio HIV Community Center in Puerto Rico.

Results: The data analyzed in this examination were compiled from 262 participants, further allocated into 190 for the males and 72 for the females. Both groups were similar in age and CD4 count. An ANOVA comparison indicated variations in the male group with an increase ($P < 0.05$) in heart rate frequency, SBP after the cardiovascular evaluation, and prolonged duration during the treadmill test distinguished the female group. The female group displayed distinct motor components with a considerable ($P < 0.05$) reduction in gait velocity, and treadmill inclination pertained to the male counterpart.

Conclusion: Hispanic Latino living with HIV displayed a distinctive cardio-motor profile applied to gender. We encourage healthcare providers to incorporate the specific cardio-motor items alluded to in this investigation to identify the cardiovascular system and gait process that further alters the quality of life in those with HIV.

Keywords: Cardio-motor Profile, HIV deficiencies, HIV gender distinction, HIV-related alterations, Cardio-motor alterations, Ross Test in HIV.

Received 30th November 2020, accepted 13th February 2021, published 09th March 2021



www.ijphy.org

DOI: 10.15621/ijphy/2021/v8i1/909

CORRESPONDING AUTHOR

¹Martín G. Rosario PT, Ph.D., CSFI, ATRIC

Texas Woman's University, Physical Therapy Program, Dallas Campus; 5500 Southwestern Medical Ave. Dallas, TX 75235-7299.

Email: mrosario1@twu.edu

¹Texas Woman's University, Physical Therapy Program, Dallas Campus; Texas.

²Ponce Health Science University School, Texas.



INTRODUCTION

Bestowing on the HIV Surveillance Summary distributed by the Centers for Disease Control and Prevention (CDC) in February 2019, the human immunodeficiency virus (HIV) involves millions of individuals worldwide. Within the U.S., Texas and Puerto Rico are among the areas with the highest incidence rates, which have increased in the last few years, making HIV an enduring problem [1].

HIV is an infection that propagates within the brain's immune cells, contributing to significant cognitive and motor disorders. These motor-cognitive disturbances interfere with everyday activities and are correlated to a lower quality of life, thus increasing demand for caretakers and the healthcare organization [2]. Despite advances in antiretroviral therapy (ART), HIV still affects gait and stability, contributing to an intensified risk for falls, trauma, and premature mortality [3-5]. The added complication with living longer with HIV is that the greater the imperiling of developing negative HIV-related repercussions on the disease's long-term effects [6].

Based on gender groups, the number of individuals diagnosed with HIV is more prevalent among the male population than females in the United States [7]. Although there are parallels in HIV risk factors and behaviors across genders, distinctions remain, and same-gender groups are further affected than others. People diagnosed with HIV are not proportionately arranged and are exceedingly clustered in some geographic territories [1]. Therefore, unique difficulties and clinical attributes may emerge.

Some of these HIV-related issues that are imperative to address are motor in nature. Decreased walking speed [6], increased sway [8], and impaired postural reflexes [9] are some gait variances people living with HIV (PLHIV) experience compared to Non-HIV subjects. Some researchers linked gender complications related to HIV; as [6] highlighted in their review, HIV-affected older men had a greater endangerment of developing slow gait speed. Additionally, HIV-infected females (mean age 57 years old), showing detrimental deterioration of gait speed. Gait velocity is a crucial component used as a predictive tool to accelerate aging among this population, including a faster rate of functional decay based on gender; therefore, it is essential to assess this population [6].

Attention has been drawn regarding how HIV causes neuromotor and neurocognitive alterations (gait and balance impairments). There are added difficulties represented as aspects that disturb cognitive or motor normal functions based on gender classification. For instance, depression [10] and dementia [11] are two conditions influencing neurocognitive status in PLHIV, but depression is diagnosed among the male category, while dementia is commonly diagnosed throughout the female population.

As stated before, HIV causes several adverse elements, such as cognitive and motor changes that lead to a profound negative impact on the autonomy of PLHIV

[12-13]. Further, taking the HIV-related difficulties out of the equation, distinct gender-related illnesses, and non-modifiable risk factors based on gender difference can develop obstacles that can disturb life quality. For illustration, women have a greater rate of developing hypothyroidism, Crohn's disease, and multiple sclerosis distinguished to men. In contrast, men are at a higher considerable risk of sustaining ailments such as myocardial infarction, diabetes mellitus 2, and stroke when correlated to females [14]. These previous points beseech the query, Are HIV-related issues gender-specific, or does the virus manifest similarly in both genders?

Considering the complications mentioned earlier, prior research has established that those with HIV could endure an overload of neuromotor and neurocognitive alterations that will further impact their balance and gait, decreasing life quality. However, previous researches focused mainly on the consequence of HIV diseases regardless of gender, erring to identify if HIV manifests differently or affects the host distinctly depending on gender.

Therefore, seeking to explore gender distinction, this inquiry examines the gender (male versus female) divergence between the motor (speed and inclination on a treadmill) and cardiovascular (cardio time and H.R.) components in Hispanic-Latinx people living with HIV. We deduce the gender disparity will be highlighted by males exhibiting altered cardiovascular elements, and females reduce motor aspects during a submaximal cardiovascular treadmill test.

METHODS

All subjects were enrolled in a Community-Based Center, La Perla de Gran Precio (LPGP), in Puerto Rico. After being permitted to partake in LPGP services by their chief physician, a licensed physical therapist evaluated each member. The emphasis of the LPGP is the promotion of health and wellness of quality of life through exercise therapy; therefore, after the assessment mentioned above, participants were followed up by a certified exercise fitness instructor for further physical examination.

In the current study, researchers compiled retrospective data from members' records. LPGP Institutional Review Board and Executive Director approved this inquiry. The investigators observed the privacy and confidentiality specification of the LDGP.

As part of the LPGP prerequisites, all participants signed informed authorization, provided their recent lab work, and attended a fitness evaluation sequence. The fitness trainer obtained the cardiovascular and motor aspects of the Ross submaximal cardiovascular assessment. Interview gathered supplementary information and the latest blood work, such as immune (Cd4) data.

The Fitness trainer assessed the vitals of the participants before the cardiovascular test. The Ross treadmill test started at a 2.0 mph speed with 0 inclination. At minute 2, 3, and 4, speed increased to 2.5, 3.0mph, and 3.4mph, respectively, with zero inclination. The inclination

increased 3% every 3 minutes with a constant speed of 3.4 mph., reaching a maximal inclination of 15% at 21 minutes. The Ross test is designed to stop when the time (21mins) and treadmill inclination (15%) is achieved. Nevertheless, when subjects reached maximal cardiac frequency or reported cardiopulmonary or muscle fatigue, the test was concluded, and the velocity, inclination, and vitals were documented.

Researchers retrieved cardiovascular (heart rate and blood pressure) and motor (speed and inclination when the Ross test ended) data from participants' records. All participants enrolled in LPGP 2000-2020, who had completed the Center's enrollment requirement (approximately 600 files), were inspected for data completeness. This study tallied the most current data available in the records for all subjects. Most of the partakers of this HIV clinic are Hispanic/Latinx (in the United States); therefore, this undertaking will give us a favorable cardiovascular and motor profile of their ethnic group.

Data Analysis

This investigation performed an analysis of variance (ANOVA) with a Bonferroni adjustment using SPSS 25 to compare the female and male groups. Two factors collected and compared were the cardiovascular and motor profile. Motor factors included the treadmill's speed and inclination as values of interest, and the cardiorespiratory components utilized time of test completion and vitals (heart rate and blood pressure) when the Ross test ended. In this inquiry, a P value of 0.05 or less was considered statistically significant.

RESULTS

Table 1 depicts the demographic outlines of the participants in the current study. The data examined in this investigation were collected from 262 participants' records. Then further divided into 190 for the males (Cd4=635.5+/-332.5) and 72 for the females (Cd4=640.8+/-335.7). The female participants showed significantly more years after the HIV diagnosis, as observed in table 1. Both groups were comparable in age (male=54.1+/-10.3 and female 55.0+/-10.2 year) and CD4 count.

Table 1: Demographic data of all participants

| Characteristics | Female n=72 | Male n=190 | P value |
|-----------------|-----------------------|----------------------|---------|
| Age | M= 55.0+/- 10.1 years | M=54.1+/- 10.3 years | P= 0.51 |
| Year of Dx | M= 22.3+/-8.8 | M=19.8+/-8.2 | P= 0.05 |
| Cd4 | M=640.8+/- 335.7 | M= 635.5+/-332.5 | P= 0.91 |

Table 2 portrays the equivalence of the cardiovascular factors between gender groups. The male group exhibits an increase (P<0.05) in heart rate frequency, SBP after the cardiovascular test, and more time during the treadmill test compared to the female group.

The motor components exemplified by the gait velocity and treadmill inclination (Table 2) were significantly reduced

(P < 0.05) in the female groups when compared with the male counterpart.

Table 2: Comparison of Cardiovascular Component of the Ross Submaximal Test. Results of repeated measure ANOVA were performed comparing males and female groups. Significance level set at p<0.05.

| Characteristics | Female n=72 | Male n=190 | F Value | P value |
|--|------------------|------------------|---------|----------|
| Heart Rate (bpm) | M=131.6 +/- 22.9 | M=139.5 +/- 16.1 | 9.9 | P= 0.01 |
| Systolic BP (mmHg) | M=119.4 +/- 16.9 | M=126.7 +/- 16.8 | 10.0 | P= 0.01 |
| Diastolic BP (mmHg) | M=74.6 +/- 11.4 | M=75.3 +/- 10.5 | 0.3 | P= 0.62 |
| Cardio test Time Minutes | M=7.4 +/- 4.2 | M=11.7 +/- 4.2 | 53.9 | P= 0.001 |
| Comparison of Motor Component of the Ross Submaximal Test. Results of repeated measure ANOVA were performed comparing males and female groups. Significance level set at p<0.05. | | | | |
| Velocity (mph) | M=3.2 +/- 0.4 | M=3.4 +/- 0.2 | 19.4 | P= 0.001 |
| Inclination (degrees) | M=2.9 +/- 3.4 | M=6.7 +/- 4.0 | 49.2 | P= 0.001 |

DISCUSSION

The current inquiry aimed to explore and highlight cardiovascular and motor distinction among male and female Hispanic-Latino PLHIV. We defined this project's motor component as the velocity and inclination of the treadmill related to the Ross cardiovascular test at the time of completion. On the other hand, the cardiovascular factors were based upon heart frequency, blood pressure, and time when the examination mentioned above ended. Normality during the inspection was ascertained on completing the test with a heart frequency at normal levels (below/equal 80% maximal heart rate capacity). The Ross test was performed on a treadmill and completed in 21 minutes. Typically, the Ross test should achieve a treadmill inclination of 15 degrees and a speed of 3.4 mph.

Among the data collected, we observe that only a few participants finalized the test, pointing out the necessity to explore the motor and cardiovascular components mentioned above. We discern the gender distinction will be accentuated by males displaying increased cardiovascular factors and females reducing motor values at the end of the submaximal cardiovascular treadmill test. The two primary outcomes of this study illustrated that males had higher cardiovascular values than females. Secondly, females exhibited a reduction in motor components than males; therefore, we accept our previous assumption.

Motor Profile: The current study illustrates that motor components depicted by the gait velocity and treadmill inclination are significantly reduced in females compared to males. Several studies established that PLHIV exhibited neuromotor alterations in the form of gait and balance difficulties [6, 8-9]. This study identified two specific factors that are affected and distinct in females living with

HIV, treadmill inclination and gait speed.

Treadmill inclination mimics real ground walking; accordingly, the difficulty increases with the increment in the inclination angle [15], making treadmill inclination ideal for engaging and challenging lower limb musculature. Studies focused on the motor components of balance highlight the deficiencies of postural instability and neuromuscular modification in asymptomatic PLHIV [8]. One possible explanation for this study's treadmill angle reduction could be the continuous loss of bone density and muscle mass in this population. Sarcopenia and osteoporosis are commonly associated with PLHIV. Berner et al.'s [9] systematic review (2017) observed that sarcopenia, osteoporosis, among other comorbidities and impairments widely seen in the elderly population, show up much sooner in PLHIV. Hidenori et al. [16] state that osteoporosis and sarcopenia are related to gender difference comorbidities (2017). Authors particularly mentioned that osteoporosis tends to occur in postmenopausal women, while sarcopenia is most likely to develop in males. Since both genders had a close age range, we infer the impact of these complications, osteoporosis and conceivably sarcopenia could partially decipher the female group's motor deficits.

Another account for our findings could be associated with the fact the neurocognitive alteration is causing a reduction in physical activity and therefore provoking the neuromotor alteration observed with reduced speed and inclination. Specifically, depression [10] and dementia [11] are two of the conditions impacting neurocognitive status in PLHIV that affect the quality of life, negatively impacting physical activity. In Banks et al.'s [2] systematic review (2015), it was observed that PLHIV has significantly increased rates of dementia, anxiety, and depression. These findings were confirmed in studies by Shah et al. [12] (2016) and Veeravelli et al. [13] (2016). This is significant, as these disorders considerably contribute to decreased quality of life, heightened fall risk, intensified fear of falling, lessened physical activity, and cognitive decline.

Succeeding justification for our findings is related to the long-term effects of HIV disease. The longer people live with HIV, the less is known about the long-term effects of the disease. Schrack et al. [6] (2015) discovered HIV-infected, however contrary to our above finding, older men had a greater risk of developing clinically slow gait speed, establishing this outcome as a prognostic of accelerated aging amongst this population including the faster rate of functional decline. The researchers observed that participants between the ages of 40-49 had similar gait speed declines regardless of HIV status; however, there was a considerable difference between gait speeds among the two groups, control and HIV after 50. They concluded that gait speed declined, on average, was 0.025m/s more per year in HIV participants over the age of 50 than those who were HIV-negative. Secondly, in their report, they pointed out that the interaction between age and HIV status was also significant, indicating the differences between them

increased with age [6]. Since, on average, none of the groups finished the Ross test, our results showed both groups are exhibiting an onset of gait decline as explained by Schrack et al. [6] (2015); however, for the female group, we deduce that motor difficulties presented as gait alterations emerge at a faster rate than the males explaining the gender difference in our findings.

One final note, prior research by Richert et al. [17] (2011) examining balance, walking ability, functional capacity, and lower limb muscle performance in HIV subjects concluded that one out of two adults with controlled HIV had poor lower limb muscle performance. These previous statements confirm our outcome in terms that both genders fail to complete the Ross test. In our study, considering both genders groups had comparable age range (above 50 years old), HIV status (cd4 count over 600), and proximally the same amount of years after diagnosis, we believe the above motor decline distinction is related and more profound on the female gender compared to males.

Cardiovascular Profile: The study's second primary outcome showed that males have greater cardiovascular values in heart rate frequency and SBP at test culmination than the female group. Our study demonstrates the cardiovascular components represented by the heart rate variables are compensating differently on males compared to females.

PLHIV is at a heightened risk of cardiovascular disturbance than the general population [18]. Prevedel Let al. 2017 [18] also mentioned that PLHIV is at substantial risk of acquiring myocardial infarction (MI); however, the Authors asserted that males have a greater chance of cardiovascular disorder than females. Because of this preceding finding, the cardiac component results may be because of underlying risk factors associated with HIV on top of the sequels from post-cardiac issues such as the severity from an MI leading to a poor prognosis.

The Ross test's objective was to measure the cardiovascular response in a total of 21 minutes with healthy cardiovascular feedback that entails a below 85% of the target heart rate. The Ross test was stopped when participants reached an unsafe zone defined as above moderate intensity, 50-70% of maximum heart rate, or vigorous physical activity, which is approximately 70-85% of maximum. According to the established formula, the target heart rate zone is customized for every client's age, 220 minus the participant's age. The average test completion for both groups was lowered in the current study than the 21-minute target, suggesting a compromised or unhealthy cardiopulmonary system, as previously explained by Oursler, KK et al., 2019 [19].

One of the known complications of those living with HIV is cardiovascular dysfunction, particularly diastolic dysfunction [19]. Erqou, S. et al., 2019 [20], mentioned in their study that with a lower cd4, or an AIDS diagnosis, the most advanced part of the disease, the cardiovascular complication could start to emerge, even with the use of ART. Contrary to Erqou, S. et al. (2019) [20] study, our investigation participants had a near-normal cd4 count;

nevertheless, we observed some cardiovascular alterations with the Ross protocol.

We agree with the findings of Oursler, KK et al., 2019 [19], in the notion that even with an adequate regimen of ART medication to treat the condition with no history of cardiovascular disease, cardiovascular alteration could merge in this population; however, more pronounced in the male gender. Comparable to prior authors, our outcomes prove that it is imperative to develop and utilize cardiovascular testing tailored to heart rate zones and frequencies during all disease stages with those living with HIV [20-21-22]. Regardless, our study ushers in that the male group, compared to the female group, exhibits further cardiovascular alteration. Accordingly, we suggested performing similar protocols like the one presented in this work; however, with maximal cardiovascular assessment combined with vo2 max testing for a more detailed analysis.

CONCLUSION

The interference with PLHIV causes several adverse elements, such as cognitive and motor changes, on HIV alone. In addition to this disease, genders have been characterized to have different gender-related illnesses, such as, dementia which is more common in females, and type two diabetes in men. However, this study intended to scrutinize the gender distinction (male versus female) between the motor and cardiovascular components in PLHIV.

From our examination, we were able to find two particular outcomes specific to each gender. Both conclusions involved comparing the motor factor and cardiovascular components in the submaximal treadmill test (Ross test). The first finding included a reduction in motor elements in females more than males. We conclude this motor reduction could be related to gender-related complications, such as dementia, osteoporosis, and sarcopenia, causing a decline in muscle strength and balance strategies. The second outcome showed an alteration in cardiovascular components in males compared to females. We speculate the cardiovascular distinction in the male group could be related to the virus itself rather than comorbidities in addition to being a male, such as MIs.

We encountered several limitations in the current study. First, only a few participants completed the Ross test. The lack of completion means the cardio-motor components are affected. However, not completing the Ross test hampers the ability to observe the test's impact on both systems. Secondly, most of the participant's information was recorded based on past medical records withheld at the La Perla De Gran Precio HIV clinic in Puerto Rico. This could result in a constraint in the study by not fully comprehending the baseline of PLHIV before the long-term effects of the disease. Besides, these restrictions could have impeded recognizing the substantial effects during the Ross test. Lastly, obtaining the cardiovascular profile for long-term testing of the participants was not collected. With these participants' long-term profiles, our study could have

shown the changes over time on each participant's cardio-motor components.

Future studies should focus on the long-term consequences of the cardio-motor aspects highlighted in this study. We also recommend giving attention to other factors impacting cardio-motor factors such as the lifestyle, comorbidity, body composition, and blood/urine profiles in these participants. One final remark, we encourage people attending PLHIV to invariably assess the cardio-motor components accentuated in this study, however, also considering the female motor and male cardiovascular distinctions unearthed in this work.

REFERENCES

- [1] Centers for Disease Control and Prevention. Estimated HIV incidence and prevalence in the United States, 2010–2016. HIV Surveillance Supplemental Report. 2019;24(No. 1). <http://www.cdc.gov/hiv/library/reports/hiv-surveillance.html>. Published February 2019. Accessed October 14, 2019.
- [2] Woods, S., Moore, D., Weber, E. and Grant, I., Cognitive Neuropsychology of HIV-Associated Neurocognitive Disorders. *Neuropsychology Review*. 2009; 19(2): 152-168.
- [3] Erlandson KM, Allshouse AA, Jankowski CM, et al. (2012) Comparison of Functional Status Instruments in HIV-Infected Adults on Effective Antiretroviral Therapy. *HIV Clinical Trials*. 2012;13(6):324-334.
- [4] Cohen HS, Cox C, Springer G, et al. Prevalence of abnormalities in vestibular function and balance among HIV-seropositive and HIV-seronegative women and men. *PLoS One*. 2012;7(5):e38419.
- [5] Heinze B, Swanepoel D.W., Hofmeyr L.M. Systematic review of vestibular disorders related to human immunodeficiency virus and acquired immunodeficiency syndrome. *The Journal of Laryngology & Otology*. 2011;125(9):881-890.
- [6] Schrack JA, Althoff KN, Jacobson LP, et al. Accelerated Longitudinal Gait Speed Decline in HIV-Infected Older Men. *J Acquir Immune Defic Syndr*. 2015;70(4):370–376.
- [7] Risk by Gender. (2019, November 12). Retrieved August 03, 2020, from <https://www.cdc.gov/hiv/group/gender/index.html>
- [8] Rosario, M. Early signs of standing postural instability in asymptomatic people living with HIV. *HIV & AIDS Review. International Journal of HIV-Related Problems*. 2020;19(3):193-198.
- [9] Berner K, Morris L, Baumeister J, Louw Q. Objective impairments of gait and balance in adults living with HIV-1 infection: a systematic review and meta-analysis of observational studies. *BMC Musculoskeletal Disorders*. 2017;18(1).
- [10] Rosario M.G., Jamison L., & Gines G. The Role of HIV Antiretroviral Medication on Motor-Cognitive and Neurological Alterations in Hispanic People Living with HIV. *J Pub Health Issue Pract*. 2020; 4(1):160.
- [11] Banks LM, Zuurmond M, Ferrand R, & Kuper H.

-
- The relationship between HIV and prevalence of disabilities in sub-Saharan Africa: A systematic review. *Tropical Medicine and International Health*. 2015; 20(4), 411-429.
- [12] Shah KN, Majeed Z, Yoruk YB, Yank H, Hilton TN, McMahon JM, Hall WJ, Walch D, Luque AE, & Ryan RM (2016). Enhancing physical function in HIV-infected older adults: A randomized controlled clinical trial. *Health Psychol*. 2016; 35(6): 563-73.
- [13] Veeravelli S, Najafi B, Marin I, Blumenkron F, Smith S, & Klotz SA (2016). Exergaming in older people living with HIV improves balance, mobility and ameliorates some aspects of frailty. *J Vis Exp*. 2016; (116): 54275.
- [14] Kautzky-Willer, A., Harreiter, J. and Pacini, G., (2016). Sex and Gender Differences in Risk, Pathophysiology and Complications of Type 2 Diabetes Mellitus. *Endocrine Reviews*. 2016; 37(3):278-316.
- [15] Boldt A. What Incline on a Treadmill Is the Same As a Flat Surface? *SportsRec*. <https://www.sportsrec.com/156224-what-incline-on-a-treadmill-is-the-same-as-a-flat-surface.html>. Published October 15, 2019. Accessed April 28, 2020.
- [16] Hidenori, A., Clin, C. Sarcopenia, Frailty, and Osteoporosis. *National Center for Geriatrics and Gerontology*. 2017; 27(9):1279-1285.
- [17] Richert L, Dehai, P, Mercié P, Dauchy FA, Bruyand M, Greib, & Groupe d'Epidémiologie Clinique du SIDA en Aquitaine. High frequency of poor locomotor performance in HIV-infected patients. *AIDS*.) 2011;25(6), 797-805.
- [18] Prevedel L, Morocho C, Bennett MVL, Eugenin EA. HIV-Associated Cardiovascular Disease: Role of Connexin 43. *Am J Pathol*. 2017;187(9):1960-1970.
- [19] Oursler, KK; O'Boyle, HM; Briggs, BC; Sorkin, JD; Jarmukli, N; Katzel, LI; Freiberg, MS; Ryan, AS Association of Diastolic Dysfunction with Reduced Cardiorespiratory Fitness in Adults Living with HIV. *AIDS Patient Care STDS*, 2019; 33(12):493-499.
- [20] Oursler, KK; O'Boyle, HM; Briggs, BC; Sorkin, JD; Jarmukli, N; Katzel, LI; Freiberg, MS; Ryan, AS Association of Diastolic Dysfunction with Reduced Cardiorespiratory Fitness in Adults Living with HIV. *AIDS Patient Care STDS*. 2019; 33(12):493-499.
- [21] Rosario MG and Gonzalez-Sola M. Autonomic nervous system assessment in people with HIV: A cross-sectional study [version 1; peer review: 1 not approved]. *F1000Research* 2018, 7:696.
- [22] Target Heart Rate and Estimated Maximum Heart Rate, Centers for Disease Control website <https://www.cdc.gov/physicalactivity/basics/measuring/heartrate.htm>