# The Influence of Heart Rate and Age on the Systolic and Diastolic Time Intervals in Children

**By S. Spitaels, M.D., R. Arbigast, M.D., J. C. Fouron, M.D., F.R.C.P.(C.), and A. Davignon, M.D., F.A.C.C.**

## SUMMARY

The systolic time intervals have been measured in 76 normal children, aged 1 month to 15 years, from simultaneous recordings of the electrocardiogram, phonocardiogram and carotid arterial pulse or apexcardiogram (left or right). Four different statistical methods were applied to study the separate influence of heart rate (HR) and age on these intervals. Left ventricular ejection time (LVET) had a highly significant correlation with HR but none with age. Age alone had a slight but significant influence on pre-ejection period (PEP) and isometric contraction time (ICT). Electromechanical systole (Q-II) varied directly with age and inversely with HR. Right and left total mechanical systole (TMS<sub>R</sub>, TMS<sub>L</sub>) and left isometric relaxation time (IMRT<sub>L</sub>) were inversely related to HR, while right electromechanical delay varied only with age. Q to first sound interval (Q-I), interval from onset of contraction to first sound on left (EMDT<sub>L</sub>) and right apexcardiogram (CL<sub>L</sub>, CL<sub>R</sub>) and left electromechanical delay (EMDT<sub>L</sub>) were found to be constant values. PEP/LVET (0.313, SD 0.05) and TMS<sub>L</sub>/LVET (1.546, SD 0.128) were not significantly correlated with HR nor age. Regression equations and mean values are presented to permit rapid estimation of predicted normal values in children. The ratios TMS<sub>R</sub>/LVET and PEP/LVET being unaffected by age or HR, are suggested as practical indices of myocardial function in children.

### Additional Indexing Words:

- Normal standards in infancy
- Phonocardiogram
- Carotidogram
- Systolic time intervals
- Apexcardiogram

**Several Studies** concerning the various phase durations of the cardiac cycle, obtained by phonocardiography and external pulse wave recording in normal adults have been published and regression equations for the prediction of normal values have been presented.1-4 Normal standards for infants and children, however, remain scarce, and contradictory results have been reported on the influence of heart rate and age on the systolic intervals.5-7 Harris et al.7 found in infants and children the same inverse relationship between left ventricular ejection time (LVET) and heart rate (HR) described in normal adults,1,10-14 in this same study, no specific correlation was demonstrated between age and LVET. However, Golde and Burstin9 observed that in children not only heart rate but age had an influence on systolic intervals. Surprisingly, the same specific age influence on LVET, independent of changes in HR, was demonstrated in healthy elderly persons, all over age 60.2

The purpose of this study was to evaluate the separate influence of HR and age on the systolic intervals in children by different statistical methods and to find new formulae for the prediction of normal standards. The same statistical analysis has been applied to find a possible influence of HR and/or age on total mechanical systole and isometric relaxation time, obtained from right and left apexcardiogram. To our knowledge, regression equations for these time intervals in children have never been published.

## Material and Method

The subjects of the present study were 76 children, 42 males and 34 females, aged from 1 month to 15 years. All had normal cardiovascular examination including cardiac auscultation, blood pressure, electrocardiogram and chest roentgenogram. No sedation was used.

The systolic time intervals were obtained from simultaneous recordings of the electrocardiogram, phonocardiogram and one external pulse wave (carotidogram, left or right apexcardiogram) using a three-channel direct writing Philips Cardiopan 3T apparatus (linear frequency response 0.1 to 180 Hz, 30% amplitude reduction beyond 180 Hz). The heart sounds were recorded with a piezo-electric crystal microphone and amplifier using the Maass-Weber filter system. Mechanograms were ob-

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tained with a pulse-sensing pickup of the capacitance type, applied by hand pressure. The time constant of the apparatus is 2.5 sec. The pulse curves were drawn on an oscilloscope and only curves with a completely positive systolic wave were recorded. Synchronization of the galvanometers was regularly checked.

All tracings were recorded at a paper speed of 50 mm/sec allowing measurements to the nearest 10 msec. Spodick et al.18 have shown that the precision of pulse wave measurements is not necessarily improved by higher speed recording, the gain in timing accuracy being counterbalanced by the slurring of the points of deflections, particularly the beginning of the upstroke of the carotidogram and apexcardiogram.

The electrocardiogram was obtained using standard lead placement. The phonocardiographic microphone was placed on the precordium in a position that allows best visualization of the initial high frequency vibrations of the first and second heart sounds. The right carotidogram was obtained over the point of palpable carotid pulsation in the neck, the patient’s head turned slightly to the opposite side. The right precordial tracing was recorded along the left sternal border in the 3rd or 4th intercostal space. For the left apexcardiogram, the child was in the left lateral decubitus position and the captor placed at the point of maximal apical impulse. A precordial electrocardiographic lead was always taken exactly at the place where the apexcardiogram was recorded. In this tracing, the configuration of the QRS complex helped to determine whether the pulse wave originated from the left or the right side of the heart.18 All patients included in this study had typical right ventricular complexes at the left sternal border \( V_2 \) and left ventricular complexes at the apex \( V_3 \).

Older children were asked to hold their breath at the end of expiration and an average measurement of 5 consecutive cycles was calculated. With younger children, however, only the pulse curves with minimal distortion at the end of expiration were selected and an average of at least three cycles was taken into account. A total of 76 carotidograms, 71 left apexcardiograms and 51 right apexcardiograms were recorded. An example of the tracings obtained is shown in figure 1. The following phases of the cardiac cycle were determined (fig. 2):

**Electromechanical systole (Q-II)** — from the beginning of the Q-wave to the first high frequency vibrations of the aortic component of the second sound. Comprises pre-ejection period (PEP) and LVET.

**Left ventricular ejection time** — from the beginning of the upstroke of the carotidogram to the trough of the incisura.

**Pre-ejection period** — from the beginning of the Q-wave to the upstroke of the carotidogram. To take into account pulse transmission delay, this interval was obtained by subtracting LVET from Q-II. It comprises Q-I and isometric contraction time (ICT).

**Q-First sound (Q-I)** — was separated into 2 phases: 1) electromechanical delay (EMD) from the beginning of the Q-wave to the upstroke of the apexcardiogram; and 2) transmission period (C-I) from the upstroke of the apexcardiogram to the first high frequency vibrations of the first sound. C-I was obtained by subtracting EMD from Q-I.

**Isometric contraction time** — from the first high frequency vibrations of the first sound to the upstroke of the carotidogram corrected for pulse transmission delay. This was obtained by subtracting Q-I from PEP.

**Total mechanical systole (TMS)** — from the upstroke of the left \( \text{TMS}_L \) or right \( \text{TMS}_R \) apexcardiogram to the 0-point.

**Isometric relaxation time (IRT)** — from the beginning of the high frequency vibrations of the aortic component of the second sound to the 0-point of the left apexcardiogram \( \text{IRT}_L \); from the beginning of the pulmonic component of the second sound to the 0-point of the right apexcardiogram \( \text{IRT}_R \).

**Figure 1**

Example of the tracing obtained in a one year old girl. **A**: carotidogram; **B**: right precordiogram; **C**: apexcardiogram. Above B and C: precordial electrocardiograms taken at site of recording.

**Figure 2**

Diagram of simultaneous electrocardiogram, phonocardiogram, jugulogram, carotidogram and apexcardiogram, illustrating the time relations between the various sounds and pulsatile events. See text for more detailed explanation of abbreviations.

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All intervals were expressed in msec and the HR, determined from the preceding R-R interval, in beats/min.

Statistical Methods

Three statistical methods were applied in order to evaluate the effects of HR and age on time intervals: 1) multiple regression with age and HR for each interval; 2) partial correlation keeping age or HR constant; 3) correlation between time intervals, corrected for age (or HR), and the other independent variable HR (or age).

The null hypotheses tested throughout this study were that the various coefficients (correlation or regression) were equal to zero; the "t" and "F" criteria were applied in testing the hypotheses at the commonly accepted significance level of 5%. Computations were made with the help of an IBM-360 Model 67 computer using standard statistical programs.

Results

The frequency distribution of age, HR and body surface area of the 76 children is shown in figure 3. Mean values for age, HR and body surface area were respectively: 89 months (SD 46.1), 90 beats/min (SD 18.7) and 0.87 m² (SD 0.29).

In the regression equations relating systolic intervals with age and HR, the regression coefficients were not significantly different in males and females. Body surface area was always less closely related to the

![Figure 3](http://circ.ahajournals.org/)

**Figure 3**

Frequency distribution for age, heart rate, and body surface area in 76 normal children studied.

### Table 1

**Different Types of Correlation Between LVET and Age, and LVET and Heart Rate**

<table>
<thead>
<tr>
<th>DEPENDANT VARIABLE</th>
<th>TYPE OF CORRELATION</th>
<th>INDEPENDENT VARIABLE</th>
<th>REGRESSION EQUATION</th>
<th>S.E. OF THE ESTIMATE</th>
<th>P</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>LVET (msec)</td>
<td>SIMPLE LINEAR</td>
<td>AGE (M) (months)</td>
<td>LVET = 225.24 + 0.351 M (0.059)</td>
<td>23.84</td>
<td>0.565</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>SIMPLE RECIPROCAL</td>
<td></td>
<td>LVET = 278.58 - 1005.59/M (27.19)</td>
<td>25.68</td>
<td>-0.458</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>SIMPLE EXPONENTIAL</td>
<td></td>
<td>LVET = 142.54 + 26.32 log M (4.54)</td>
<td>23.95</td>
<td>0.559</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>MULTIPLE POLYNOMIAL 2d degree</td>
<td></td>
<td>LVET = 273.78 + 0.656 M - 0.0016*M² (0.0278)</td>
<td>23.80</td>
<td>—</td>
<td>0.575</td>
</tr>
<tr>
<td></td>
<td>MULTIPLE POLYNOMIAL 3d degree</td>
<td></td>
<td>LVET = 223.21 - 0.322<em>M + 0.007</em>M² - 0.00003*M³ (0.0769)</td>
<td>23.90</td>
<td>—</td>
<td>0.578</td>
</tr>
<tr>
<td></td>
<td>SIMPLE LINEAR</td>
<td>HEART RATE (R) (beats/min)</td>
<td>LVET = 372.69 - 1.281 R (0.096)</td>
<td>15.61</td>
<td>-0.341</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SIMPLE RECIPROCAL</td>
<td></td>
<td>LVET = 154.15 - 878.95/R (723.57)</td>
<td>16.68</td>
<td>0.816</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>SIMPLE EXPONENTIAL</td>
<td></td>
<td>LVET = 752.06 - 110.67 log R (8.47)</td>
<td>15.88</td>
<td>-0.835</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>MULTIPLE POLYNOMIAL 2d degree</td>
<td></td>
<td>LVET = 389.15 - 1.669 R + 0.002*M² (0.750) (0.004)</td>
<td>15.69</td>
<td>—</td>
<td>0.842</td>
</tr>
<tr>
<td></td>
<td>MULTIPLE POLYNOMIAL 3d degree</td>
<td></td>
<td>LVET = 361.40 - 0.668<em>M - 0.009</em>M² + 0.00004*M³ (4.534) (0.051)</td>
<td>15.79</td>
<td>—</td>
<td>0.842</td>
</tr>
<tr>
<td></td>
<td>MULTIPLE</td>
<td>AGE and HEART RATE</td>
<td>LVET = 375.42 - 0.011*M - 1.310 R (0.064) (0.133)</td>
<td>15.71</td>
<td>—</td>
<td>0.841</td>
</tr>
<tr>
<td></td>
<td>PARTIAL</td>
<td>AGE (Heart rate kept constant)</td>
<td>—</td>
<td>0.024*</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PARTIAL</td>
<td>HEART RATE (age kept constant)</td>
<td>—</td>
<td>-0.755</td>
<td>—</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: S.E. of the estimate = standard error of the estimate; r and R = correlation coefficients for simple and multiple correlations respectively; M = age in months; the symbol R in the regression equations refers to heart rate in beats per minute.

( ) Numbers in parentheses are the standard errors of the estimates of the coefficients.

*Regression coefficient or correlation coefficient which are not significantly different from zero (significant meaning P < 0.05).
systolic intervals than age and HR, or both taken simultaneously.

In order to define the best fitting curves relating systolic intervals to age or HR, five types of regression lines were calculated. The best fitting curves were the linear for LVET. In the polynomial equations, the second and third degree terms were not significantly different from zero (table 1). The same results were obtained for PEP and Q-II (table 2). Q-II, LVET and PEP were found to prolong significantly with increasing age and decreasing HR as illustrated in figures 4 and 5. But the negative correlation between HR and age is also very significant ($r = -0.68, P < 0.001$). It is therefore difficult in children to speculate on the effect of HR or age alone on the systolic time intervals because of the relationship between these two variables. To separate independent effects of HR or age on the various time intervals of the cardiac cycle, the following methods were used:

1 — Multiple regression analysis. In the multiple regression equation, the regression coefficient relating LVET to age (0.011) was not significantly different from zero, while the regression coefficient relating LVET to HR (1.310) was highly significant (table 1). In con-
contrast, the regression coefficient relating PEP to age (0.136) was significantly different from zero, while the one relating PEP to HR (0.118) was not (table 2). Both regression coefficients relating Q-II to HR (1.428) and Q-II to age (0.123) were significantly different from zero (table 2).

2 — Partial regression analysis with HR or age kept constant (tables 1 and 2). Only the partial correlation with HR, age kept constant, was significant for LVET (r = -0.755). In contrast, only the partial correlation with age, HR kept constant, was significant for PEP (r = 0.423). Both partial correlations were significantly different from zero for Q-II: with age, HR kept constant (r = 0.235) and with HR, age kept constant (r = 0.749).

3 — The correlation between LVET, corrected for HR, and age (fig. 6) was not significant (r = 0.002).

Multiple and partial regression analysis was also used for all the other intervals (table 3). A significant influence of HR, with age kept constant, was found for TMSL, TMSR and IRTL. HR kept constant, a significant influence of age alone was found on ICT and EMDR. No significant correlation could be found for Q-I, C1L, C1R and EMDL.

The ratio TMSL/LVET was not significantly correlated either with HR (r = 0.164), or with age (r = 0.054). The ratio PEP/LVET also was not significantly correlated with HR (r = 0.069) or with age (r = 0.209) as illustrated in figure 7.

Taking into account only the significant correlations, final regression equations and mean values are presented in table 4.

**Discussion**

The data obtained in this study show that most of the variability in the duration of LVET in normal children can be explained by the HR differences, LVET increasing with maturity mainly because of a slower HR. In table 5, several published regression equations relating HR and LVET in normal subjects of various ages are grouped. The regression coefficient, which represents the slope of the regression line, is highest in elderly persons beyond 60 years of age and changes gradually to be lowest in premature neonates.

Our regression coefficient (1.29) does not differ from that of Harris, Takahashi and Moritz, Golde and Burstin and Weissler for children and is nearly identical to that found in adults by others. A statistically significant influence of age alone, independent of changes in HR, as found in elderly people, could not be demonstrated in our group of children. This is in contrast to what Golde and Burstin have published in their work, the regression equation for LVET in children takes into account not only...
HR but also age. They conclude that the alterations in LVET occurring with maturation in children are qualitatively similar to those seen in old age. The similarity between children and adults demonstrated in our study is also supported by the publication of Graham et al.\(^\text{18}\) who found by left heart volume estimation that the ejection fraction (EF), which has a significant negative correlation with LVET,\(^\text{19}\) is identical in adults and children older than two years of age.

PEP remains relatively constant throughout the range of HR studied in our group of children and this is in agreement with others.\(^\text{7, 9, 20}\) This was also true for ICT in adults as already published.\(^\text{5, 21}\) The inverse relationship between HR and PEP found by Weisssler\(^\text{5}\) may be due, according to Talley,\(^\text{20}\) to adrenergic influence that affects both HR and myocardial contractile state. Indeed, at identical levels of left ventricular diastolic pressure, aortic diastolic pressure and internal indices of contractility, various heart rates had no significant effect on PEP\(^\text{20}\) and, when HR was increased with pacing, the PEP of the left ventricle tended to remain constant.\(^\text{4}\) Independent of changes in HR, we were able to demonstrate a slight but statistically significant influence of age alone on PEP. This progressive elongation of PEP could possibly reflect alterations in afterload, secondary to a rising arterial diastolic pressure with aging. Indeed, in normal individuals an increase in mean and diastolic aortic pressure has been reported to increase PEP.\(^\text{5, 22}\) and experiments in dogs indicate that for any given state of intrinsic contractility, PEP is slightly but significantly lengthened by elevation of the aortic diastolic pressure.\(^\text{20}\) There was no correlation between other components of PEP (EMD, CI, Q-I) and HR or age, suggesting that the changes in PEP observed with maturity occur entirely during left ventricular isovolumic contraction. The mean Q-I interval of 48 msec ±7.7 falls between the normal range of 30 to 70 msec mentioned in adults.\(^\text{23, 26}\) The mean EMDI value of 20 msec ±3.4 was also found in adults\(^\text{16, 26}\) while the mean EMDI value of 28 msec ±7.5 was already published in children.\(^\text{27}\) Noteworthy is the influence of age on EMDI and not on EMDI. This may be due to the physiological and anatomical transformations known to occur in the pulmonary circulation in early infancy. The mean CI, interval of 29 msec ±3.8 falls between the range found in adults\(^\text{28}\).
and the CI_R interval of 22 msec ±9.3 also corresponds to the value of 20 to 30 msec proposed by Craig and Schmidt.27

TMS comprises the isovolumic contraction, the ejection and the isovolumic relaxation time and is inversely correlated with HR. Influence of age is statistically not significant. The same negative correlation was found between IRT and HR for the left apex-cardiogram but not for the right. More studies will be necessary to clarify the different factors influencing the IRT of both ventricles. The average IRT_R value of 56 msec ±14.1 corresponds well with the mean value of 53 msec found in another series of children.27 Kesteloot and Joossens28 mentioned exactly the same

Table 4

<table>
<thead>
<tr>
<th>TIME INTERVALS (msec)</th>
<th>MEAN VALUES (±SD)</th>
<th>REGRESSION EQUATIONS</th>
<th>STANDARD ERROR OF THE ESTIMATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q-II</td>
<td>454 -1.428R +0.125M</td>
<td>17.5</td>
<td></td>
</tr>
<tr>
<td>PEP</td>
<td>65 +0.169M</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>LVET</td>
<td>373 -1.291R</td>
<td>15.6</td>
<td></td>
</tr>
<tr>
<td>ICT</td>
<td>22 +0.105M</td>
<td>9.7</td>
<td></td>
</tr>
<tr>
<td>C-I_L</td>
<td>29 ± 7.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q-I</td>
<td>48 ± 7.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMD_L</td>
<td>20 ± 3.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TMS_L</td>
<td>546 -1.668R</td>
<td>31.4</td>
<td></td>
</tr>
<tr>
<td>IRT_L</td>
<td>128 -0.423R</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>EMD_R</td>
<td>22 +0.058M</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>TMS_R</td>
<td>534 -1.590R</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>IRT_R</td>
<td>56 ± 14.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CI_R</td>
<td>22 ± 9.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEP/LVET</td>
<td>0.313 ± 0.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TMS_L/LVET</td>
<td>1.546 ± 0.128</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
value of 56 msec for the isovolumic relaxation time measured on the jugular venous pulse tracing.

TMS₁ and LVET being both inversely related to HR, the ratio TMS₁/LVET was found to be a nearly constant one in normal children, as found in adults,¹ with a mean value of 1.546 (SD 0.128) compared to 1.51 (SD 0.06) in adults. The uncorrected PEP/LVET ratio also does not significantly vary with either age or with HR in our study. The mean PEP/LVET for the 76 normal children studied is 0.313 (SD 0.05) compared to 0.345 (SD 0.036) found in adults.²⁹

Certain practical applications can be derived from our study. The fact that both ratios, TMS₁/LVET and PEP/LVET, give a constant value in normal children, unrelated to age or HR, may permit a clear separation of normal children from those with heart disease, as already described in adults.¹⁵ Also of great practical value is that LVET correlated only with HR, so that LVET expressed in % of the normal, as already published by Meiners,¹² Hartman¹⁰ and Willems,¹ can immediately be derived from a diagram after registration of the carotidogram. The regression equations or mean values proposed in this study, allow the estimation of cardiac function by a simple, indirect method, using age and/or HR as dependent variables. By comparing the observed with the predicted value, one can determine whether or not a patient falls within 95% limits of normality.

**Table 5**

<table>
<thead>
<tr>
<th>Author</th>
<th>Regression Equation</th>
<th>N</th>
<th>Sex</th>
<th>Age</th>
<th>Mean HR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harris (1964)</td>
<td>Y = 376 - 1.3 HR</td>
<td>49</td>
<td>M+F</td>
<td>older child 1 w. - 16 y.</td>
<td>96</td>
</tr>
<tr>
<td></td>
<td>Y = 317 - 1.0 HR</td>
<td>50</td>
<td></td>
<td>mat. neonate 1 d. - 1 w.</td>
<td>139</td>
</tr>
<tr>
<td></td>
<td>Y = 275 - 0.6 HR</td>
<td>47</td>
<td></td>
<td>premature &lt; 2.5 kg</td>
<td>158</td>
</tr>
<tr>
<td>Spodick (1968)</td>
<td>Y = 376 - 1.22 HR</td>
<td>50</td>
<td>M</td>
<td>21 + 35 y.</td>
<td>-</td>
</tr>
<tr>
<td>Willems (1967)</td>
<td>Y = 377 - 1.16 HR</td>
<td>289</td>
<td>M+F</td>
<td></td>
<td>76</td>
</tr>
<tr>
<td></td>
<td>Y = 390 - 1.36 HR</td>
<td>219</td>
<td>M</td>
<td>mean: 34 y.</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td>Y = 392 - 1.25 HR</td>
<td>70</td>
<td>F</td>
<td>mean: 23 y.</td>
<td>87</td>
</tr>
<tr>
<td>Leighton (1971)</td>
<td>Y = 373 - 1.3 HR</td>
<td>27</td>
<td>M+F</td>
<td>12 + 42 y.</td>
<td>-</td>
</tr>
<tr>
<td>Diamant (1970)</td>
<td>Y = 380 - 1.3 HR</td>
<td>35</td>
<td>M+F</td>
<td>28 + 81 y.</td>
<td>-</td>
</tr>
<tr>
<td>Weissler (1968)</td>
<td>Y = 413 - 1.7 HR</td>
<td>121</td>
<td>M</td>
<td>19 + 65 y.</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Y = 418 - 1.6 HR</td>
<td>90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Willems (1970)</td>
<td>Y = 416 - 1.56 HR</td>
<td>512</td>
<td>M+F</td>
<td></td>
<td>74.7</td>
</tr>
<tr>
<td></td>
<td>Y = 434 - 1.93 HR</td>
<td>205</td>
<td>M</td>
<td>mean: 71.8 y.</td>
<td>69.4</td>
</tr>
<tr>
<td></td>
<td>Y = 422 - 1.58 HR</td>
<td>307</td>
<td>F</td>
<td>mean: 69.8 y.</td>
<td>78.3</td>
</tr>
</tbody>
</table>

Abbreviations: N = numbers of individuals; kg = kilogram; M = male; F = female.

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