Longevity and Cardiovascular Mortality among Former College Athletes

By Anthony P. Polenak, Ph.D.

SUMMARY
Among 681 former Harvard College athletes (lettermen), longevity and cardiovascular mortality differed not by type of sport but by extent of participation. Relative to one-letter and two-letter athletes, men with three or more letters died slightly earlier from natural causes, and significantly more often and slightly earlier from cardiovascular diseases and (specifically) coronary heart disease. The three-or-more-letter athletes differed in physique, being significantly more mesomorphic (muscular, bony) than the other two groups. Further analysis suggested that physique did not account for these differences; other possible explanations were discussed.

Additional Indexing Words:
Coronary artery disease Exercise Epidemiology Somatotype

DO CERTAIN kinds of sport in college conduce to shorter lives, while others lengthen the life span? Perhaps the extent of participation-number of years and number of sports—is more crucial? Or is the type of participant, particularly in terms of physique, more important? The data relevant to these questions are limited. Apparently, there is only Rook’s1 study of Cambridge University sportsmen which considered longevity and cardiovascular mortality by type of sport.

In addition to type of sport the present study considers extent of participation, as measured by the number of athletic awards won. Such data may help to explain the slightly reduced longevity of lettermen, relative to their less athletic classmates, reported in several cohort studies.1-5 More broadly, this study relates to the question of whether extensive physical training (such as athletics) has long-term effects on cardiovascular and general health. As Pyörälä et al.6 have observed: “It is not known whether the cardiovascular changes caused by endurance athletics are wholly reversible [or] . . . whether taking part in endurance athletics modifies the course of cardiovascular disease in later life.”

Methods
The present subjects are part of a larger series of 8753 men, 6601 measured anthropometrically,5 and 2152 measured and photographed for somatotype rating,4 while at Harvard College between 1880 and about 1912 by D. A. Sargent and two assistants. Only men born between 1860 and 1889 were included; they were divided into 3 birth decades (1860-69, 1870-79, and 1880-89). All 8753 men had attended Harvard College for at least 2 years. Exclusion of men who were lost (N = 81), or known to be dead but lacking death certificates (N = 269), yielded a study group of 8403 men. Of these 8403 men, 855 were lettermen according to Harvard records7 which listed the number of years an individual won an award in each sport.

Age at death and cause of death were obtained from death certificates. Only the first-listed cause was used here, coded according to the 1957 International Classification of Diseases.8 Height and weight measured in college were available for

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all athletes, and somatotype was available for 177. Somatotype photographs were rated by F. L. Stagg and the late E. A. Hooton, using a modification of Sheldon’s\(^\text{\textsuperscript{a}}\) technic. Of the 855 lettermen, 753 or 88.1% had died as of June 30, 1967. Exclusion of deaths from causes other than natural ones yielded a study group of 783 lettermen, of which 681 were dead of natural causes and 102 were still alive. As previously noted\(^\text{\textsuperscript{4, 5}}\) Harvard athletes and nonathletes did not differ in percentage of deaths from nonnatural causes, i.e. accidents (excluding war) or suicides. We are concerned here only with deaths due to natural causes, and particularly with cardiovascular deaths.

**Results**

**Type of Sport**

In mean age at death from natural causes, differences among the various sports were inconsistent in direction across the 3 birth decades. Combining all 3 birth decades was justified by the similar percentages of lettermen in each sport in each birth decade. Mean ages at death from natural causes were as follows: 65.2 ± 16.1 years for baseball (N = 107); 66.6 ± 15.7 years for football (N = 135); 66.8 ± 16.3 years for crew (N = 133); 66.9 ± 16.7 years for track (N = 186) and 67.2 ± 14.0 years for lettermen in two or more sports (N = 85). Differences among these five groups were small and statistically insignificant. Numbers of lettermen in ice hockey (N = 25), tennis (N = 9), and golf (N = 1) were too small for analysis.

Cardiovascular deaths, as a percentage of total deaths from natural causes, were compared among lettermen in different sports (table 1). Crewmen had the lowest percentage, but numbers were small and differences were statistically insignificant. Analysis of physique (table 2) showed that the more endomorphy groups (football, two or more sports, and baseball) tended to die more often and earlier (table 1) from cardiovascular diseases than the mesoectomorphic groups (crew and track). This is not unexpected since physique, specifically high endomorphy (fatness, stockiness), and high mesomorphy (robust muscularity), is a significant risk factor in cardiovascular disease.\(^\text{10, 11}\)

**Extent of Participation**

It is difficult to rate specific sports objectively in terms of strenuousness or level of physical training required for successful performance. One objective method of measuring

### Table 1

<table>
<thead>
<tr>
<th>Sport</th>
<th>N</th>
<th>%†</th>
<th>Mean (yr)</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crew</td>
<td>51</td>
<td>38.3</td>
<td>72.9</td>
<td>11.0</td>
</tr>
<tr>
<td>Track</td>
<td>73</td>
<td>39.2</td>
<td>73.7</td>
<td>11.6</td>
</tr>
<tr>
<td>Football</td>
<td>57</td>
<td>42.2</td>
<td>69.0</td>
<td>12.5</td>
</tr>
<tr>
<td>Baseball</td>
<td>47</td>
<td>43.9</td>
<td>69.1</td>
<td>11.9</td>
</tr>
<tr>
<td>Two or more sports</td>
<td>42</td>
<td>49.4</td>
<td>71.7</td>
<td>10.2</td>
</tr>
</tbody>
</table>

*This table is based on 646 of the 681 athletes dead of natural causes. Numbers for other sports — ice hockey (N = 25), tennis (N = 9), and golf (N = 1) — were too small for analysis.

†Number of deaths attributed to cardiovascular diseases; first listed cause of death, code 400-468."*

†Cardiovascular deaths as a percentage of total deaths from natural causes.

### Table 2

<table>
<thead>
<tr>
<th>Sport*</th>
<th>N</th>
<th>Height (in)</th>
<th>Weight (lb)</th>
<th>Somatotype†</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean (in)</td>
<td>Mean (lb)</td>
<td>Endomorphy</td>
</tr>
<tr>
<td>Crew</td>
<td>133</td>
<td>68.9</td>
<td>152.7</td>
<td>30</td>
</tr>
<tr>
<td>Track</td>
<td>185</td>
<td>69.6</td>
<td>143.7</td>
<td>63</td>
</tr>
<tr>
<td>Football</td>
<td>136</td>
<td>69.5</td>
<td>162.7</td>
<td>23</td>
</tr>
<tr>
<td>Baseball</td>
<td>107</td>
<td>68.4</td>
<td>144.1</td>
<td>9</td>
</tr>
<tr>
<td>Two or more sports</td>
<td>85</td>
<td>69.6</td>
<td>158.4</td>
<td>17</td>
</tr>
</tbody>
</table>

*Numbers of lettermen in ice hockey (N = 25), tennis (N = 9), and golf (N = 1) were too small for analysis.

†Somatotype was available for 142 of the 646 lettermen included in this table.
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extent of participation, however, utilizes the total number of athletic awards (letters) won. This measures both the number of years of competition and the number of sports participated in; it must also reflect, to some extent, the level of physical training achieved.

Mean ages at death from natural causes, by total number of letters won, appear in table 3. In the first birth decade, for which all men had died, longevity decreased as the number of letters increased; this trend was less evident in the next birth decade (1870–79) and absent in the last (1880–89). Since the percentages of men in the three groups (one, two, and three or more letters) were nearly identical in each of the 3 birth decades (table 3), the 3 birth-decade samples were combined. Differences were statistically insignificant. Although percentages still alive (not shown) were nearly identical for the three groups of lettermen, the significance of the general trend, i.e., longevity decreasing as the number of letters increases, may be assessed better when all men have died.

Differences in longevity by number of letters held within each sport, because of small numbers, one-letter athletes were compared with two-or-more-letter athletes; in the case of lettermen in two or more sports, two-letter athletes were compared with three-or-more-letter athletes. The roughly similar frequency of each of these two groups in each of the 3 birth decades justified combining the 3 birth-decade samples. Although differences, i.e., 3.2 years (crew), 2.2 years (baseball), 0.2 years (football), 2.5 years (track), and 1.4 years (two or more sports), were statistically insignificant, the consistency in trend was impressive.

As the number of letters increased mean height and weight also increased (table 4). Two differences were significant; athletes with three or more letters were heavier ($P < 0.01$) and taller ($P < 0.05$) than those with one letter. The weight difference was due largely to muscle or bone rather than fat (table 4). That is, three-or-more-letter athletes were significantly more mesomorphic ($P < 0.05$) than either of the other two groups, but did not differ in endomorphy or ectomorphy (linearity, here based on height divided by cube root of weight). One-letter and twoletter athletes did not differ in somatotype.

Could physique (mesomorphy) account for the differences in longevity among the three groups of lettermen (table 3)? Among 2450 Harvard men from the same era as the present subjects, longevity was only slightly, but negatively, associated with mesomorphy. In the present study numbers are too small for the proper analysis, i.e. longevity within each athletic group by specific somatotype categories. A cruder approach limits the analysis to lettermen with a low or moderate mesomorphy rating of 4 or lower on the 7-point scale. A total of 118 of 145 athletes dead of natural causes (for whom somatotype ratings were available) had a mesomorphy rating of 4 or less. Combining all 3 birth decades the difference in mean age at death from natural causes, between 68 men with one letter and 50 men with two or more letters

Table 3

<table>
<thead>
<tr>
<th>Letters (no.)</th>
<th>Birth decade 1860–69</th>
<th>Mean (yr)</th>
<th>Birth decade 1870–79</th>
<th>Mean (yr)</th>
<th>Birth decade 1880–89</th>
<th>Mean (yr)</th>
<th>Total</th>
<th>Mean (yr)</th>
<th>sd (yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>Mean (yr)</td>
<td>N</td>
<td>%</td>
<td>Mean (yr)</td>
<td>N</td>
<td>%</td>
<td>Mean (yr)</td>
</tr>
<tr>
<td>1</td>
<td>92</td>
<td>47.7</td>
<td>68.3</td>
<td>125</td>
<td>48.3</td>
<td>69.6</td>
<td>109</td>
<td>47.6</td>
<td>63.3</td>
</tr>
<tr>
<td>2</td>
<td>44</td>
<td>22.8</td>
<td>68.0</td>
<td>66</td>
<td>25.5</td>
<td>65.4</td>
<td>50</td>
<td>21.8</td>
<td>66.3</td>
</tr>
<tr>
<td>3 or more</td>
<td>57</td>
<td>29.5</td>
<td>62.1</td>
<td>68</td>
<td>26.3</td>
<td>69.2</td>
<td>70</td>
<td>30.6</td>
<td>64.6</td>
</tr>
<tr>
<td>Total</td>
<td>193</td>
<td>100.0</td>
<td>66.4</td>
<td>259</td>
<td>100.0</td>
<td>68.4</td>
<td>229</td>
<td>100.0</td>
<td>64.3</td>
</tr>
</tbody>
</table>

*Percentages still alive, as of June 30, 1967, were: 0.0% for 1860–69; 12 of 271 or 4.4% for 1870–79; and 90 of 319 or 28.2% for 1880–89. This table includes lettermen in ice hockey, tennis, and golf (total N = 35); these men were excluded from the previous tables.

Circulation, Volume XLVI, October 1972
Table 4

Height, Weight, and Somatotype by Number of Letters; All Birth Decades Combined*

<table>
<thead>
<tr>
<th>Letters (no.)</th>
<th>Height (in)</th>
<th>Weight (lbs)</th>
<th>Somatotype†</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>1</td>
<td>326</td>
<td>69.2</td>
<td>2.5</td>
</tr>
<tr>
<td>2</td>
<td>160</td>
<td>69.7</td>
<td>2.6</td>
</tr>
<tr>
<td>3 or more</td>
<td>195</td>
<td>69.8</td>
<td>2.4</td>
</tr>
</tbody>
</table>

*For significance of differences, see text.
†Somatotype ratings were available for 145 (21.3%) of the 681 lettermen dead of natural causes.

(70.1 ± 15.4 years vs 67.2 ± 17.5 years), was statistically insignificant, but the same trend was evident as in table 3. Mean somatotype ratings were nearly identical for the one-letter and two-or-more-letter athletes: 3.60 (endomorphy), 3.49 (mesomorphy), 4.51 (ectomorphy) for the former (N = 68), and 3.58, 3.56, and 4.46, respectively, for the latter (N = 50).

In all but 1 birth decade (1860–69) athletes with three or more letters had the highest percentage of cardiovascular deaths (table 5). Combining all 3 birth decades (table 5), this percentage was significantly higher (P < 0.05) for athletes with three or more letters than for either of the other two groups. In mean age at death from cardiovascular diseases (table 5), the three-or-more-letter athletes died earliest in all but the last birth decade (1880–89). Although differences were statistically insignificant, 102 lettermen are still alive; conceivably, differences may become greater when all men have died.

Mortality from coronary heart disease (CHD) was analyzed separately (table 6). Again, the three-or-more-letter athletes died most often and earliest. In percentage of deaths attributed to CHD, one difference was statistically significant (two letters vs three or more; P < 0.05) and another approached significance (one letter vs three or more; 0.10 > P > 0.05). Differences in mean age at death from CHD were statistically insignificant for these small samples.

Since mesomorphy is the predominant somatotype component among young men with myocardial infarction,11 physique might account for the relatively greater cardiovascular mortality among athletes with three or more letters. Again, we limit our analysis to the 118 men with a low or moderate mesomorphy rating. For cardiovascular mortality the figures were: 36 of 94 or 38.3% for men with one or two letters (mean age at death, 76.1 years); and 13 of 24 or 54.2% for men with three or more letters (mean age at death, 71.5 years). Differences were statistically insignificant, but the same trend is evident.

Table 5

Cardiovascular Deaths by Numbers of Letters*

<table>
<thead>
<tr>
<th>Letters (no.)</th>
<th>Birth decade</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1860–69</td>
<td>1870–79</td>
<td>1880–89</td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>Mean (yr)</td>
<td>N</td>
<td>%</td>
<td>Mean (yr)</td>
<td>N</td>
<td>%</td>
<td>Mean (yr)</td>
<td>N</td>
<td>%</td>
<td>Mean (yr)</td>
</tr>
<tr>
<td>1</td>
<td>40</td>
<td>43.5</td>
<td>74.6</td>
<td>47</td>
<td>37.6</td>
<td>73.6</td>
<td>44</td>
<td>40.0</td>
<td>66.1</td>
<td>131</td>
<td>40.2</td>
<td>71.4</td>
</tr>
<tr>
<td>2</td>
<td>14</td>
<td>31.8</td>
<td>75.6</td>
<td>24</td>
<td>36.4</td>
<td>73.2</td>
<td>23</td>
<td>46.0</td>
<td>68.3</td>
<td>61</td>
<td>38.1</td>
<td>71.9</td>
</tr>
<tr>
<td>3 or more</td>
<td>18</td>
<td>31.6</td>
<td>70.7</td>
<td>42</td>
<td>61.8</td>
<td>71.1</td>
<td>37</td>
<td>52.9</td>
<td>68.0</td>
<td>97</td>
<td>49.7</td>
<td>69.9</td>
</tr>
<tr>
<td>Total</td>
<td>72</td>
<td>37.5</td>
<td>73.8</td>
<td>113</td>
<td>43.6</td>
<td>72.6</td>
<td>104</td>
<td>45.2</td>
<td>67.3</td>
<td>289</td>
<td>42.4</td>
<td>71.0</td>
</tr>
</tbody>
</table>

*For significance of differences, see text.
†Number of deaths attributed to cardiovascular diseases; first listed cause of death code 400–468.
‡Cardiovascular deaths as a percentage of total deaths from natural causes.

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Table 6
Coronary Heart Disease (CHD) by Number of Letters; All Birth Decades Combined*

<table>
<thead>
<tr>
<th>Letters (no.)</th>
<th>N†</th>
<th>%‡</th>
<th>Mean (yr)</th>
<th>SD (yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>72</td>
<td>22.0</td>
<td>72.6</td>
<td>10.2</td>
</tr>
<tr>
<td>2</td>
<td>32</td>
<td>20.0</td>
<td>70.4</td>
<td>13.1</td>
</tr>
<tr>
<td>3 or more</td>
<td>57</td>
<td>29.2</td>
<td>70.1</td>
<td>10.1</td>
</tr>
<tr>
<td>Total</td>
<td>161</td>
<td>23.6</td>
<td>71.3</td>
<td>11.4</td>
</tr>
</tbody>
</table>

*For significance of differences, see text.
†Number of deaths attributed to CHD; first listed cause of death, code 420.1.*
‡Percentage of total deaths (natural causes) attributed to CHD.

Discussion

Although numbers are small there are no significant differences in longevity among prominent college athletes subdivided by type of sport. This finding agrees with Rook’s¹ on Cambridge University sportsmen from roughly the same era as the present subjects. Rook’s oarsmen had significantly fewer cardiovascular deaths relative to several other groups, while in the present series crewmen also had the lowest percentage of such deaths but differences were not statistically significant. Our somatotype data suggest that this finding may be explained by physique.

The present data show differences in longevity and cardiovascular mortality by extent of participation in college athletics, a novel finding. Relative to one- or two-letter athletes, men with three or more letters died slightly earlier from natural causes, and significantly more often and slightly earlier from cardiovascular diseases (and coronary heart disease). We should note, however, that death-certificate data are reportedly inaccurate in measuring mortality from specific conditions, such as myocardial infarction.¹³ In addition, table 5 shows that percentages of deaths attributed to cardiovascular diseases in this cohort increased from 37.5 to 43.6 to 45.2 across the 3 birth decades. This secular trend must be due, at least in part, to changes in diagnostic practices and in preparation of death certificates. Since the diagnostic criteria for cardiovascular disease have changed markedly over time—especially since the delineation of coronary heart disease in 1912—dates of birth, diagnosis, and death should be taken into account. Although it is doubtful that these changes in diagnosis affected one athletic group more than another, this problem has been only partly overcome by analyzing cardiovascular deaths by number of awards within each birth decade. This procedure presumably minimized time trends in diagnosis, as well as in longevity. The number of subjects was too small for a similar analysis of CHD mortality among the three groups of lettermen.

Our data also suggested that physique did not account for the differences in longevity and cardiovascular mortality by extent of participation. Without comparable data from other studies we can only speculate. Other explanations might involve: (1) long-term effects of college athletics, related either to extensive physical training itself, or to the stress of athletic competition; and (2) factors of selection other than physique. We have no data on the life style of athletes after college, for example, exercise habits, relative weight gain, personality, or smoking habits. Speculating further, athletes with three or more letters might be more likely to continue exercise in later life relative to athletes with only one or two letters. If this were true, the effects would most likely oppose the trends observed in this study; two small studies found that former prominent athletes who continued exercise in later life had fewer myocardial infarcts¹⁴ and less symptomatic CHD⁶ than less active former athletes.

Another possible explanation involves personality factors. Such attributes as aggressiveness, competitiveness, hard-driving effort, striving for achievement, and commitment to one’s occupation, are part of the behavior pattern (type A) significantly associated with smoking¹⁵ and increased risk of CHD.¹⁶ Not unexpectedly, high school¹⁷ and college¹⁸,¹⁹ athletes score higher than their less athletic classmates on scales of dominance, aggressiveness, competitiveness, and leadership. The most successful college athletes, such as those
with three or more athletic awards, may be more highly selected for such personality traits. Is the kind of participant or the participation itself more important in determining these personality differences? The former seems more likely\textsuperscript{20} but there are few longitudinal data on the psychological effects of athletic competition.

Acknowledgment

The author thanks Dr. Albert Damon of the Department of Anthropology, Harvard University, for access to death-certificate data, F.L. Stagg for somatotype ratings and compilation of birth dates, Bonnibel Sack for obtaining data from death certificates, and the Department of Anthropology, Harvard University, for computer funds.

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