recovery after pacing will invalidate assessment of antianginal drugs." This conclusion must obviously be extended to all cardioactive drugs that undergo similar protocols.

**Graham Jackson, M.D.**
Department of Cardiology
King’s College Hospital
London, SE5 9RS, England

**References**

**Statistics and Biomedical Literature**

To the Editor:

The current interest in the correct use of statistics1 prompts me to ask Dr. Glantz to comment on the appropriate tests for comparing the left ventricular ejection fractions of two groups of patients. Ejection fraction is the difference between two continuous and correlated variables divided by the larger of the two, so the use of unpaired t tests seems to me to be inappropriate.

**P. J. Bourdillon, M.R.C.P.,**
Royal Postgraduate Medical School
Hammersmith Hospital
London W12, England

**Reference**

The author replies:

To the Editor:

If the ejection fractions are normally distributed, it would be appropriate to use a t test. If the distribution of ejection fractions does not appear normal, one should use a nonparametric test. The important point is that each ejection fraction represents an independent observation. The fact that the numbers used to compute each ejection fraction are correlated is not relevant.

**Stanton A. Glantz, Ph.D.**
Cardiovascular Research Institute
University of California, San Francisco
San Francisco, California

To the Editor:

We were greatly encouraged by the recent appearance of the paper on biostatistics in the medical literature by Glantz.1 As he points out, the inadequacies of medical literature in that area have been repeatedly documented and the consequences of erroneous data interpretation may be wide ranging. The publication of well-written and understandable articles like his in well-established journals like Circulation is another step toward correcting the problems he describes.

We would, however, like to comment on a potentially misleading statement that Dr. Glantz makes regarding the use of the t test. He states, as his first of three rules of thumb on the t test that, "the t test should be used to test the hypothesis that two group means are not different." Such a statement is not technically incorrect, but its meaning to a physician and to a statistician are different. The t test is used to test a hypothesis of no difference between two group means (often called the null hypothesis), with the purpose of the test being to reject the null hypothesis, i.e., to show that the group means are significantly different. A physician may interpret Dr. Glantz’s statement as implying that a t test can be used to show that two group means are not different, i.e., that they are the same. There is, in fact, no statistical method to prove that condition. To quote Colton,2 " ‘not statistically significant’ does not prove the null hypothesis true. The most that can be said with results that are not statistically significant is that the data fail to provide sufficient evidence to doubt the validity of the null hypothesis. The null hypothesis might actually not be valid, but the sample was just too small to reach this conclusion at the predetermined significance level. Hence, ‘not significant’ is like ‘not proved’ or ‘inconclusive.’ It indicates that one has to live with the null hypothesis value until other evidence is obtained.’

While this may seem a minor distinction, from our experience in working with investigators unsophisticated in statistics, this is a major point of confusion. Consequently, an article on biostatistics, written to clarify the field for clinical and biomedical researchers, should be as clear as possible on this issue.

**J. David Curb, M.D.**
Judith A. Kautz, Ph.D.
The University of Texas School of Public Health and Baylor College of Medicine Houston, Texas

**References**

**Table 1. Number of Articles Using the Standard Deviation, Standard Error of the Mean, Both Measures or an Unspecified Measure in Circulation and Circulation Research**

<table>
<thead>
<tr>
<th>Journal</th>
<th>Volume: Year</th>
<th>SD</th>
<th>SEM</th>
<th>Both</th>
<th>Unspecified</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circulation</td>
<td>56:1977</td>
<td>28</td>
<td>38</td>
<td>0</td>
<td>15</td>
<td>81</td>
</tr>
<tr>
<td></td>
<td>60:1979</td>
<td>53</td>
<td>51</td>
<td>5</td>
<td>9</td>
<td>118</td>
</tr>
<tr>
<td>Circulation</td>
<td>40:1977</td>
<td>8</td>
<td>59</td>
<td>4</td>
<td>2</td>
<td>73</td>
</tr>
<tr>
<td>Research</td>
<td>45:1979</td>
<td>11</td>
<td>64</td>
<td>2</td>
<td>4</td>
<td>81</td>
</tr>
</tbody>
</table>

that reported at least one measure of variability, there was ambiguity in 41 (12%). There is little, if any, change from 1977 to 1979 in spite of an editorial7 in Circulation Research and Instructions to Authors of Circulation suggesting use of the SD, not the SEM. We hope that a similar survey done in the future will show an increase in the use of the SD and a decrease in ambiguity.

**Gary B. Weiss, M.D., Ph.D.**
Harvey Bunce, III, Ph.D.
University of Texas Medical Branch
Galveston, Texas
Statistics and biomedical literature.

Circulation. 1980;62:915-916
doi: 10.1161/01.CIR.62.4.915
Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 1980 American Heart Association, Inc. All rights reserved.
Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://circ.ahajournals.org/content/62/4/915.citation

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in Circulation can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Circulation is online at:
http://circ.ahajournals.org//subscriptions/