

# **ORGANIZING THE BIOMEDICAL PAPER**

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“ . . . the preparation of a scientific paper has less to do with literary skill than with *organization*. A scientific paper is not literature.”

***How to Write and Publish a Scientific Paper — Robert A. Day***

# THE TITLE

A good title should

- Accurately, completely, and specifically identify the main topic
- Be unambiguous
- Be concise
- Begin with an important word to attract intended readers
- Include independent and dependent variables and species, if not human
- Be a label suitable for indexing

# THE TITLE

## *(Continued)*

- Avoid
  - Too scholarly or too “cute” titles
  - Subtitles, whenever possible
  - Acronyms
  - Roman numerals
  - Abbreviations
  - Noun clusters
    - Complement Fixation Laboratory Technique for Adult Rhesus Monkey Antigen Isolation
- Don't use jargon
- Keep word order simple



# EFFECTIVE TITLES

- Serum Antibody Responses After Intradermal Vaccination Against Influenza
- A Randomized Comparison of Radial-Artery and Saphenous-Vein Coronary Bypass Grafts
- Improved Survival After Living-Donor Lobar Lung Transplantation
- Long-Term Amiodarone Administration Remodels Expression of Ion Channel Transcripts in the Mouse Heart

# IMRAD

- Introduction
- Methods
- Results
- and
- Discussion

# INTRODUCTION

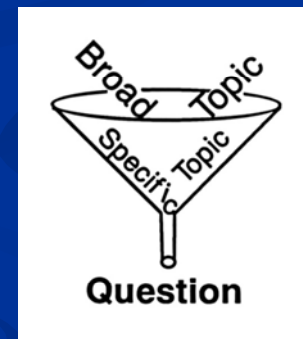
What question (problem) was studied?

The answer is in the Introduction.



# INTRODUCTION

- Catches and keeps the reader's interest
- Uses a “funnel” type of organization
- Include known, unknown, and the question
  - The nature and scope of the problem
  - The gap or general problem
  - Previous findings. Pertinent literature
  - The method of investigation
  - The hypothesis/research question—signal





# THE GAP

“There is considerable variation among the retrospective studies, however, and the results are often difficult to interpret. Prospective trials are clearly needed to confirm the results made in retrospective studies and to assess whether the risk of restenosis can be predicted accurately in specific patients.”

# SIGNALING THE QUESTION

- To determine whether . . . .
- The purpose of this study was . . . .
- Therefore, we tested the hypothesis . . . .
- This report describes experiments designed to determine whether . . . .
- Therefore, our first objective in these studies was to determine whether . . . .
- In this study, we sought to extend our observations and to specifically test . . . .

# THE QUESTION

“For this study, we designed a prospective trial to test whether abnormal coronary vasoconstriction, detected by hyperventilation testing before angioplasty, increases the likelihood of restenosis. A test that could accurately identify patients at high risk for restenosis might influence management.”

# INTRODUCTION

- Keep it brief (1–2 pages)
- Use the present tense for what is currently true
- Use the past tense for previous findings
- Use past tense to state the question
- Avoid using names of other investigators
- Repeat key terms from the title

# MATERIALS AND METHODS

How was the problem studied?

The answer is in the Methods.



# MATERIALS AND METHODS

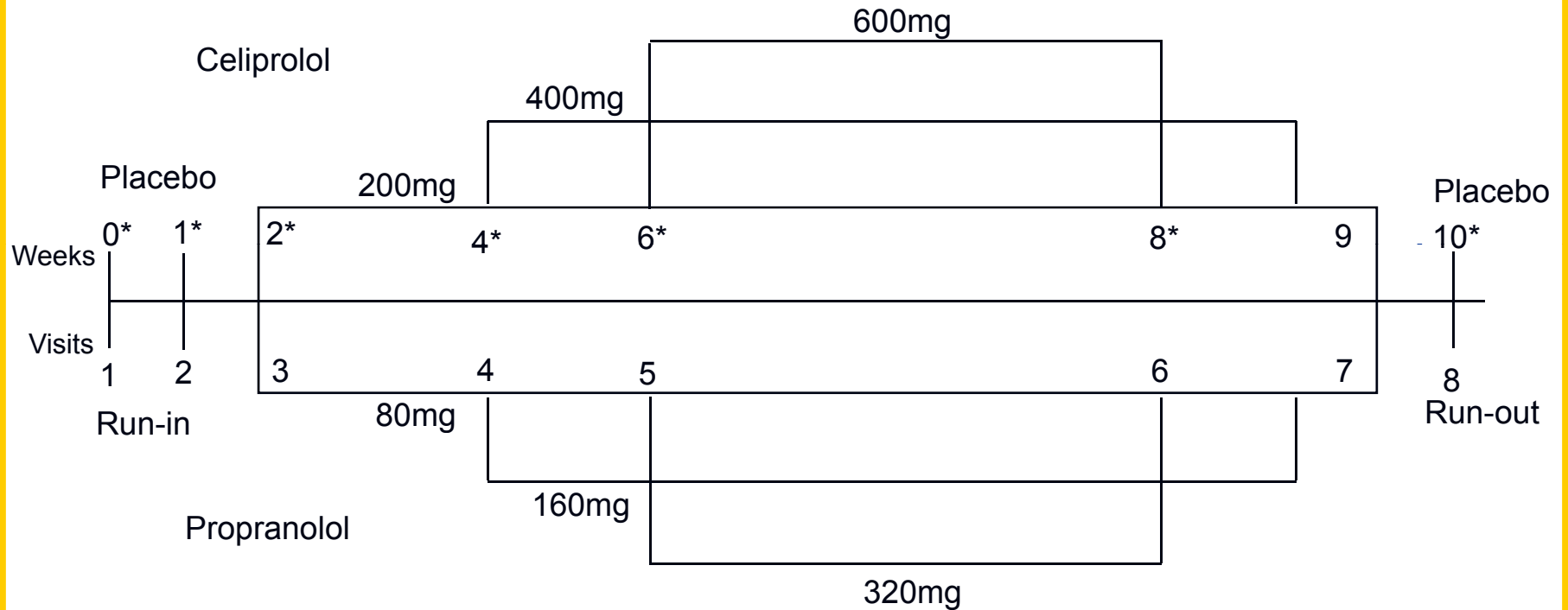
- Describe what was done to answer the research question
- Give full details of the methods
- Include a clear statement of study design and protocol/procedures
- Describe materials/methods or subjects adequately
- Write in a logical order (usually chronological)
- Describe analytical methods

# MATERIALS AND METHODS

*(Continued)*

- Use subheadings
- Do not include results in Methods
- Include appropriate figures and tables
- Write in past tense
- Use active voice whenever possible
- Place details in parentheses
  - Systolic and diastolic pressure both decreased 10% (160/100 to 146/90).

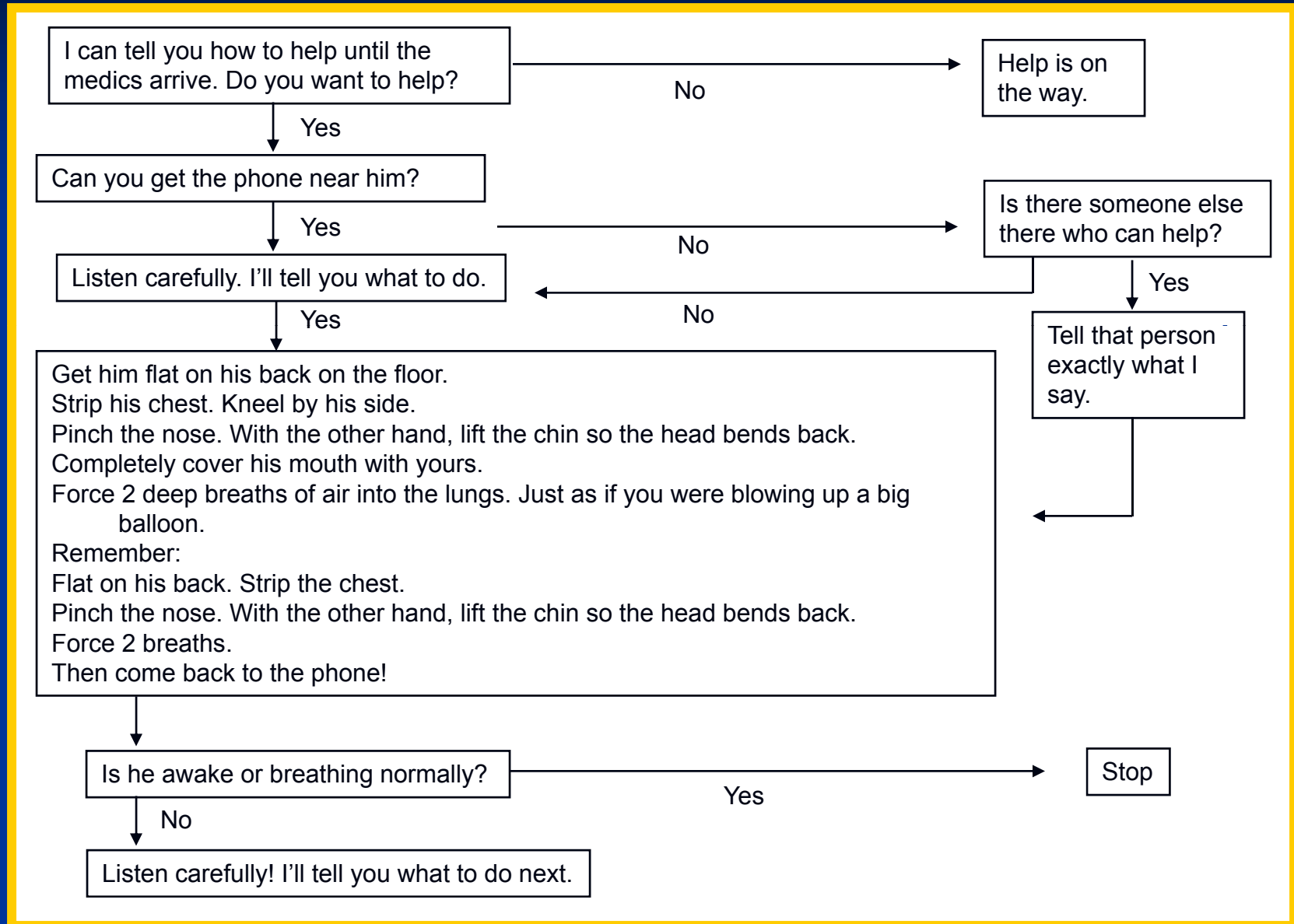
# STUDY DESIGN



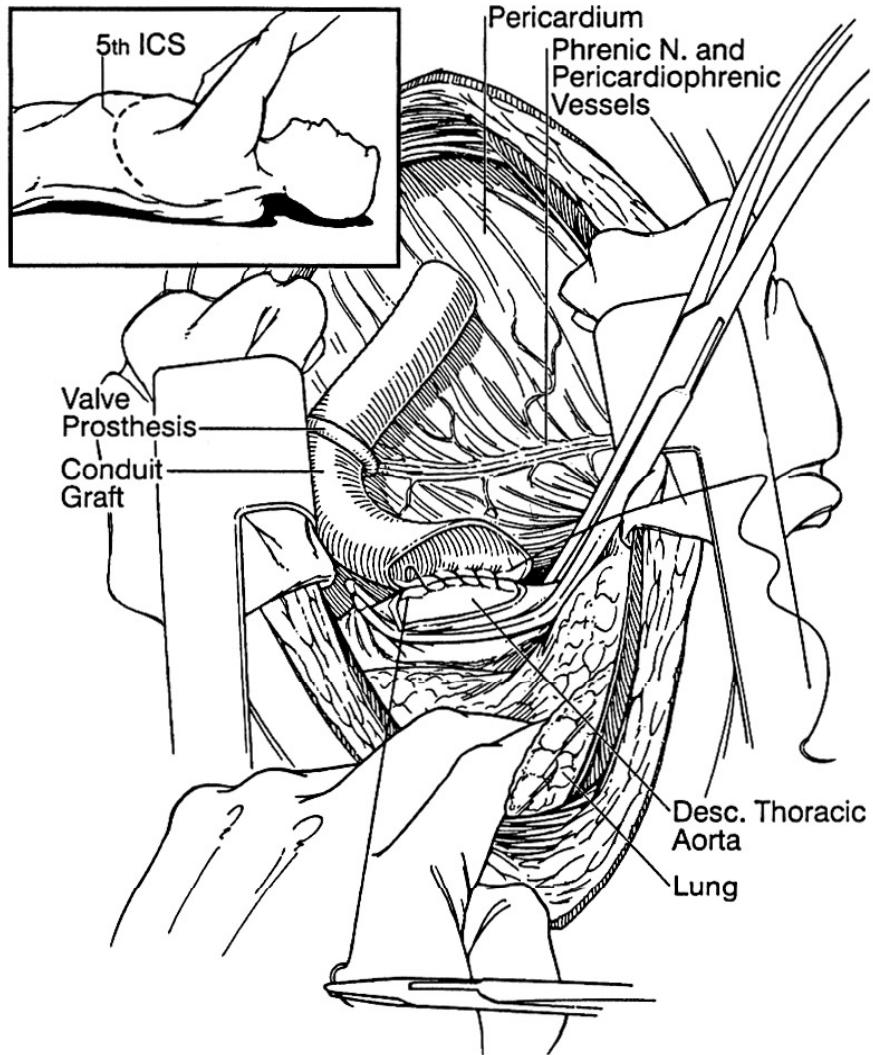
\*Exercise Test



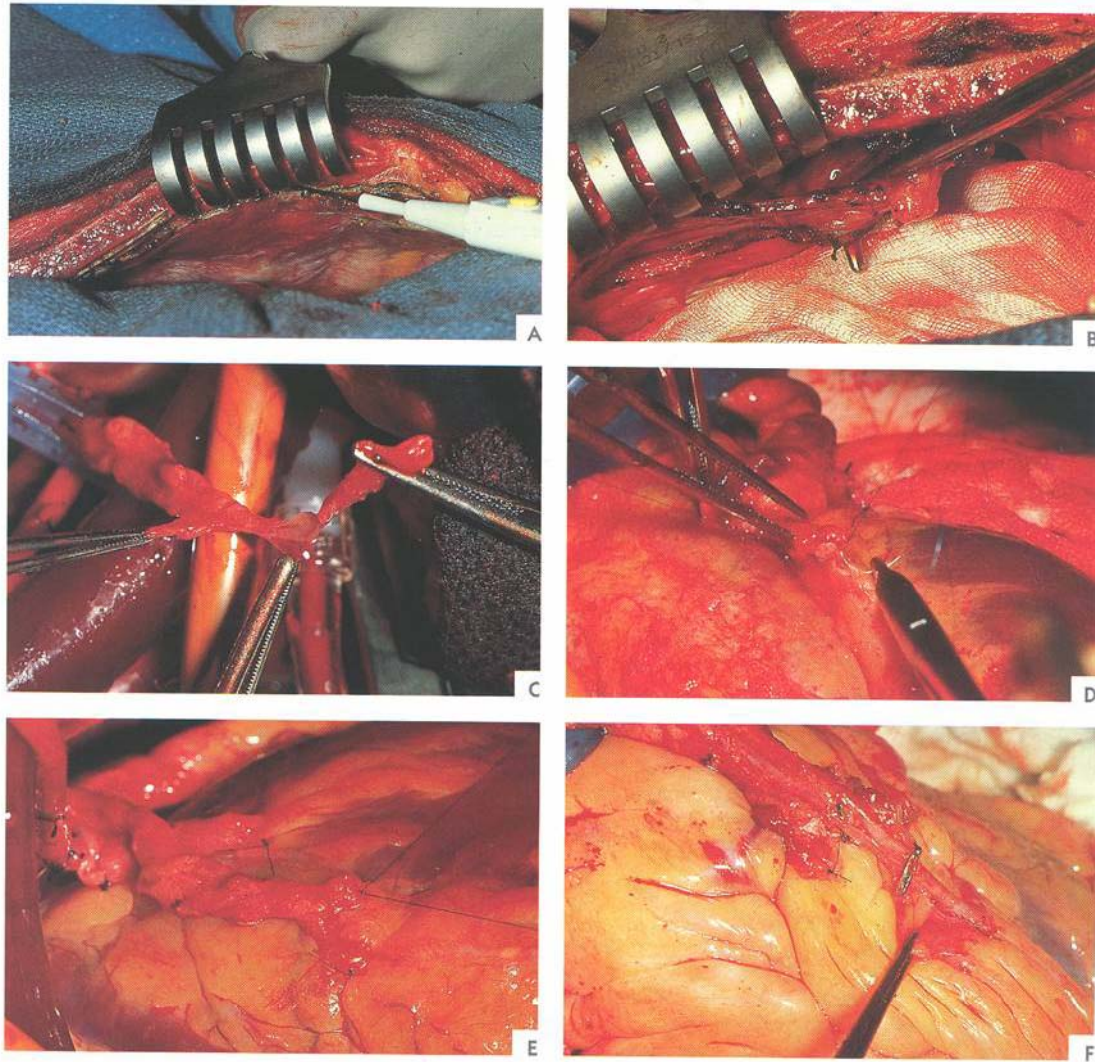
# STUDY PROTOCOL



**A**



*A step-by-step procedure is best shown in an illustration.*



**FIGURE 6.7** • Internal mammary artery used as a bypass graft—harvest (A,B), handling (C), suture anastomosis (D,E), and complete anastomosis (F). (Courtesy of the Texas Heart Institute.)

# MATERIALS AND METHODS

*(Continued)*

- Briefly address questions you can anticipate from the reader, eg, justify/clarify the design of your study:  
"Normally the lower esophageal sphincter relaxes and then contracts during swallowing, producing fluctuations in the pressure profile of the sphincter. . . . Pressure changes recorded during swallowing were therefore excluded, and time was allowed for the pressure profile to settle . . ."

# MATERIALS AND METHODS

*(Continued)*

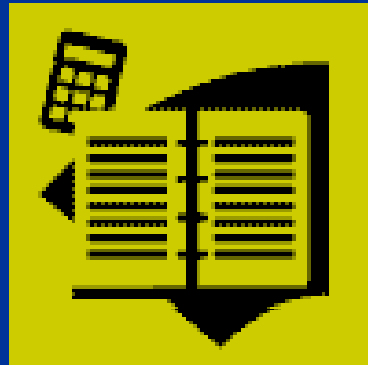
- Treat limitations of this study in a matter-of-fact way:

"These studies were performed as part of a routine clinical assessment, so that no attempt was made to ensure either fasting of the patient or performance of the test at a particular time of day."

# RESULTS

**What were the findings?**

The answer is in the Results.



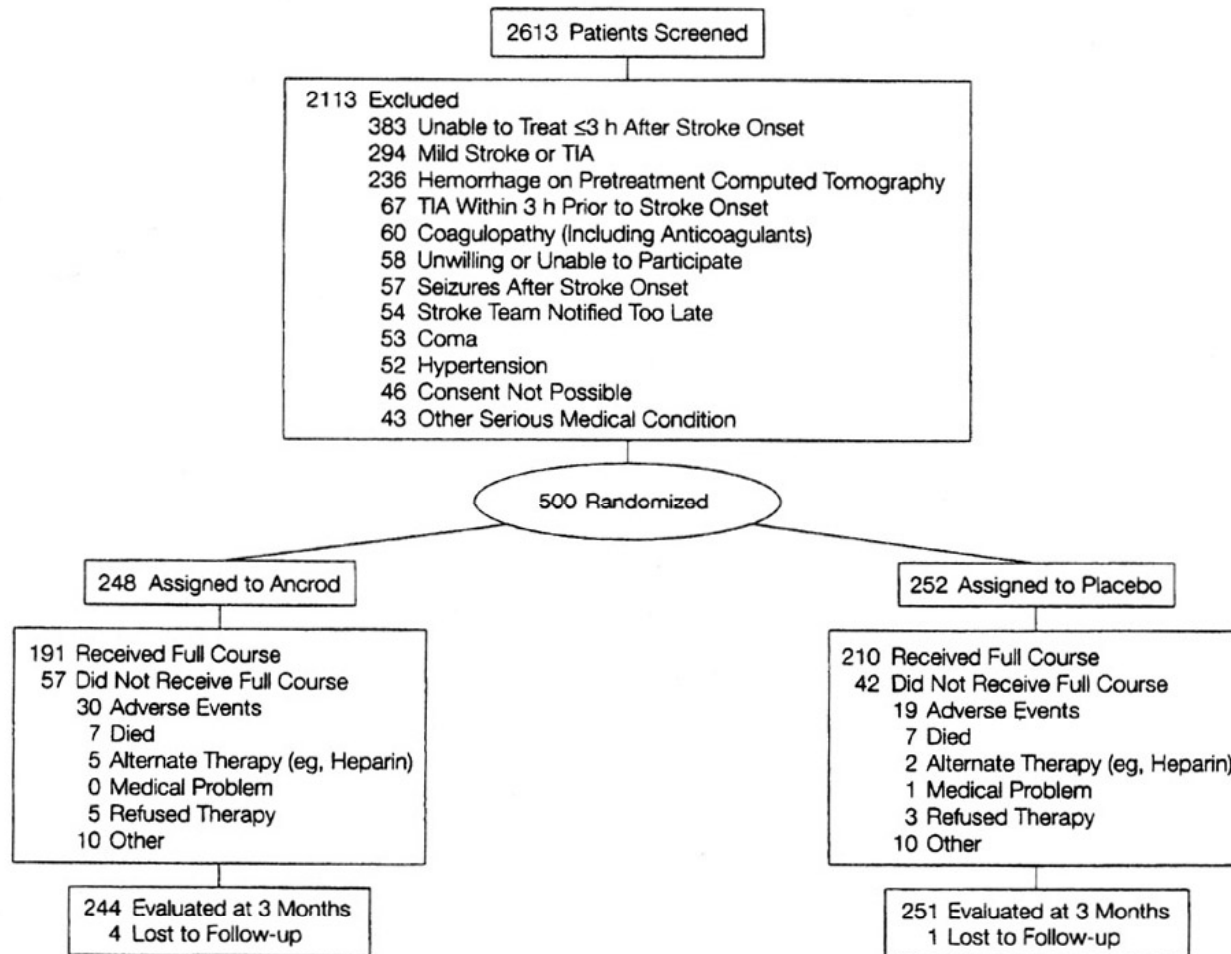
# RESULTS

- Logically answer the research question
- Begin with most important result
- Correlate with the methods
- Use data from this study only (exact  $P$  values, confidence intervals)
- Present the representative data
- Use tables, graphs, photographs, and drawings for data

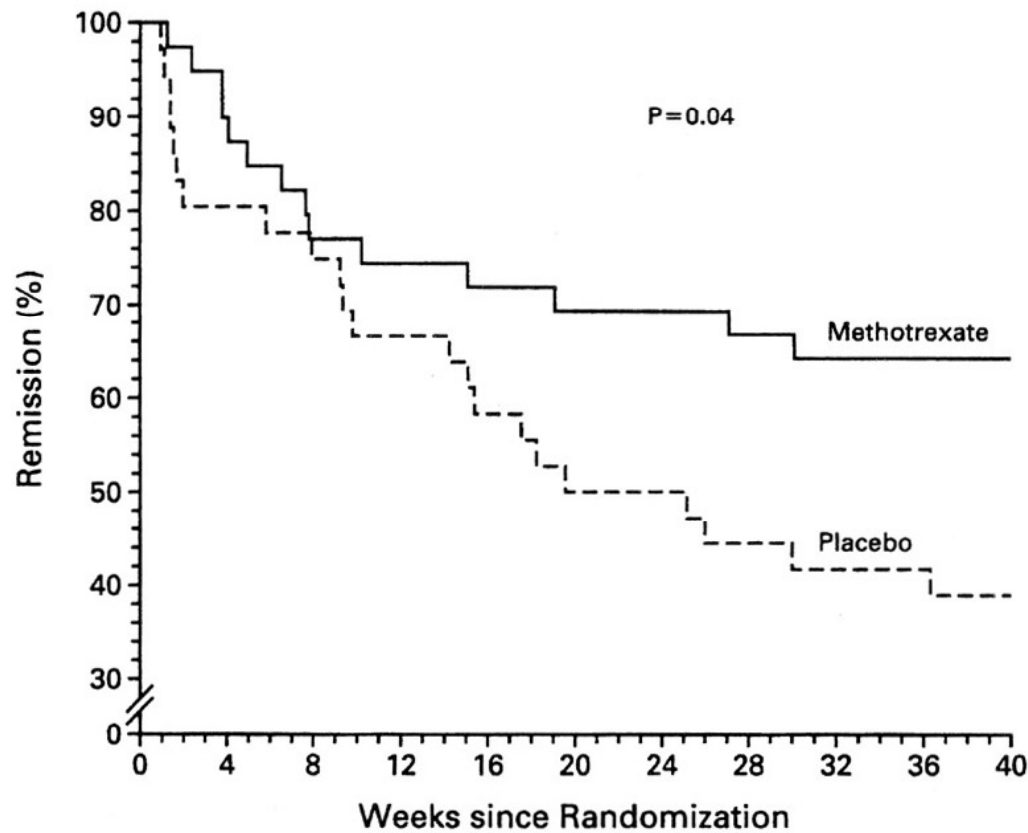
**Table 1.** Characteristics of Subjects Who Could Be Evaluated and Those Who Were Analyzed.

| Characteristic                                | Group That Could Be Evaluated (N=4404) | Analyzed Subgroup (N=2507) |
|---|--|----------------------------|
| Age   |  |                            |
| Mean — yr                                     | 68.6                                   | 69.5                       |
| 50–59 yr — no. (%)                            | 570 (12.9)                             | 210 (8.4)                  |
| 60–69 yr — no. (%)                            | 1971 (44.8)                            | 1150 (45.9)                |
| 70–79 yr — no. (%)                            | 1678 (38.1)                            | 1025 (40.9)                |
| ≥80 yr — no. (%)                              | 185 (4.2)                              | 122 (4.9)                  |
| Male sex — no. (%)                            | 1963(44.6)                             | 1115 (44.5)                |
| Race or ethnic group — no. (%)                |  |                            |
| White   | 3846 (87.3)                            | 2180 (87.0)                |
| Black   | 369 (8.4)                              | 217 (8.7)                  |
| Other   | 189 (4.3)                              | 110 (4.4)                  |
| Family history of colorectal cancer — no. (%) | 615 (14.0)                             | 348 (13.9)                 |



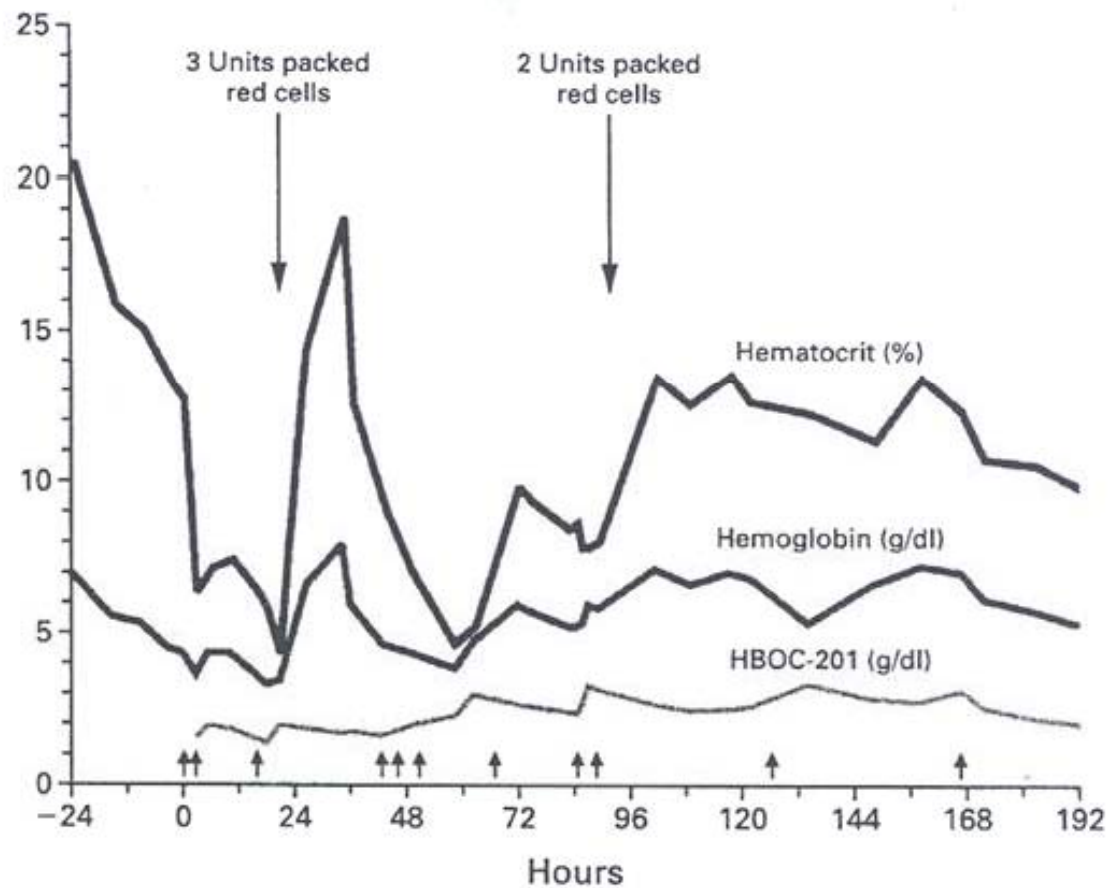


*Trial profile (Sherman et al, 2000, p. 2398) that shows patient assignment to the different arms of the study.*

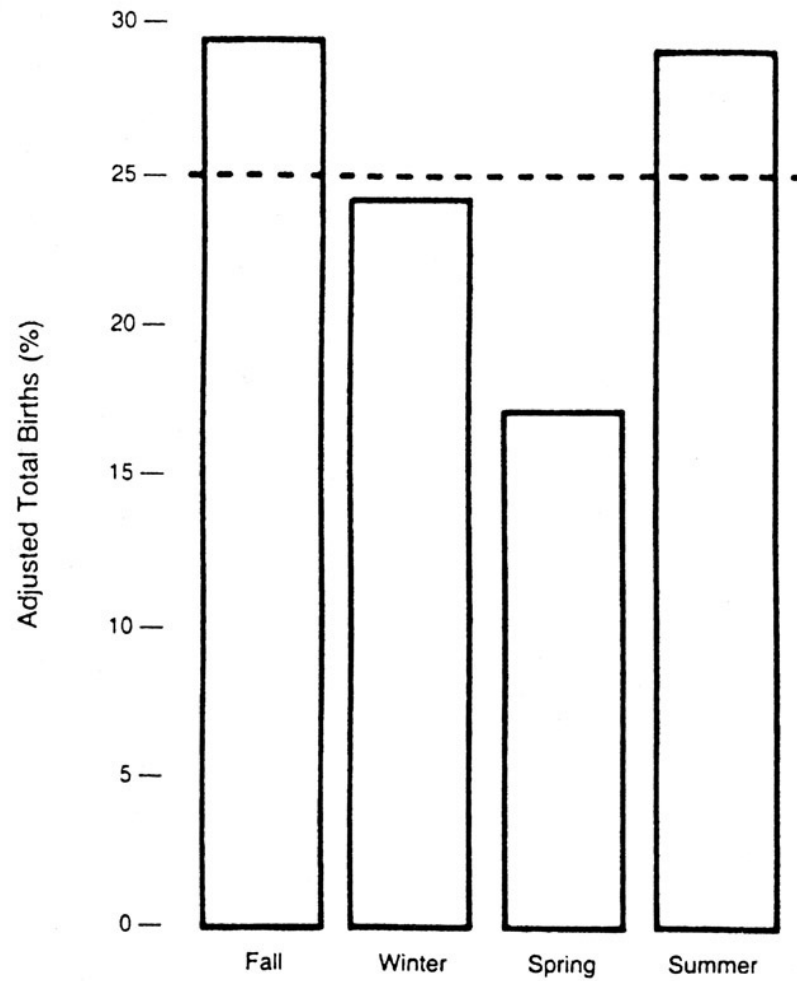


| No. AT RISK  |    |    |    |    |    |    |    |    |    |    |    |
|--------------|----|----|----|----|----|----|----|----|----|----|----|
| Methotrexate | 40 | 36 | 30 | 29 | 28 | 27 | 27 | 26 | 25 | 24 | 19 |
| Placebo      | 36 | 29 | 28 | 24 | 21 | 18 | 18 | 16 | 15 | 15 | 12 |

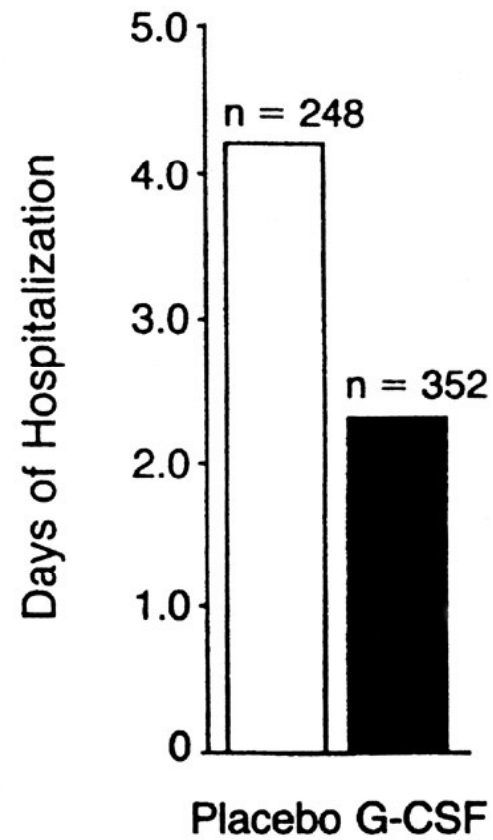
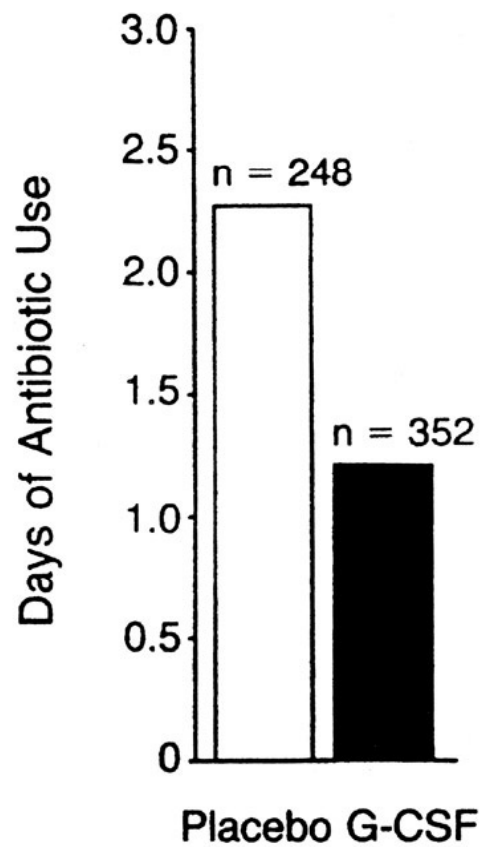
*Kaplan-Meier estimates of the time to relapse in patients given methotrexate and placebo (Feagan et al, 2000, p. 1630), shown in a line drawing.*



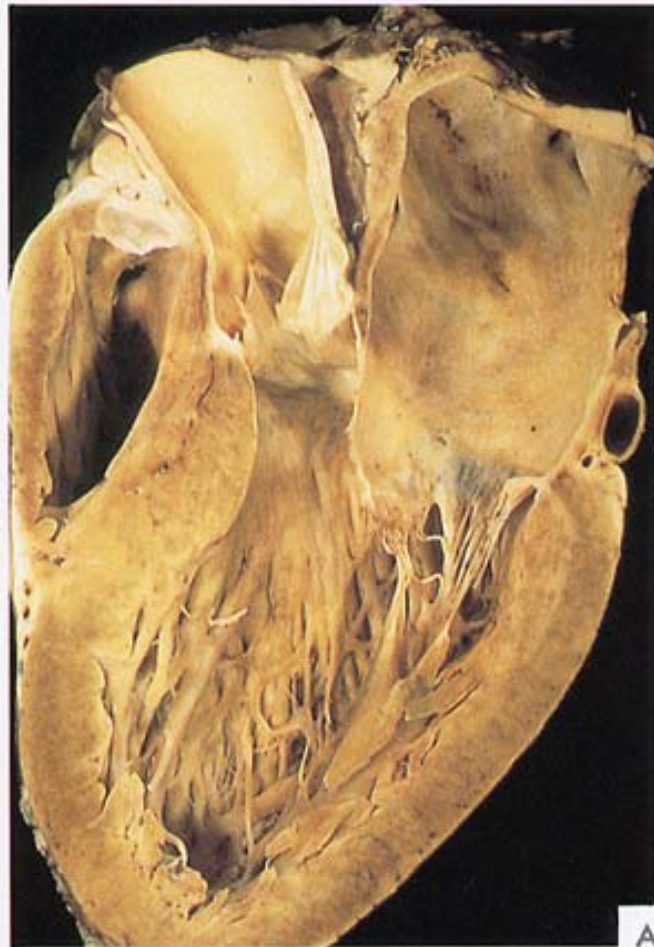
*Figure 3. Hematocrit, hemoglobin, and calculated HBOC-201 levels, presented graphically (Mullon et al, 2000, p. 1641). These data would be impossible to present in the text.*



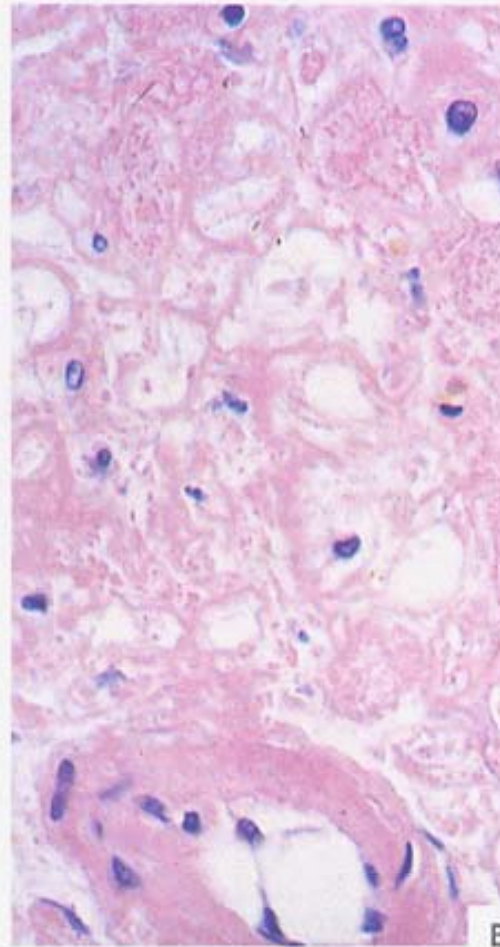
*Adjusted births by season, as a percentage of adjusted total births in all seasons (Levine et al, 1990, p. 15), shown by a bar graph.*



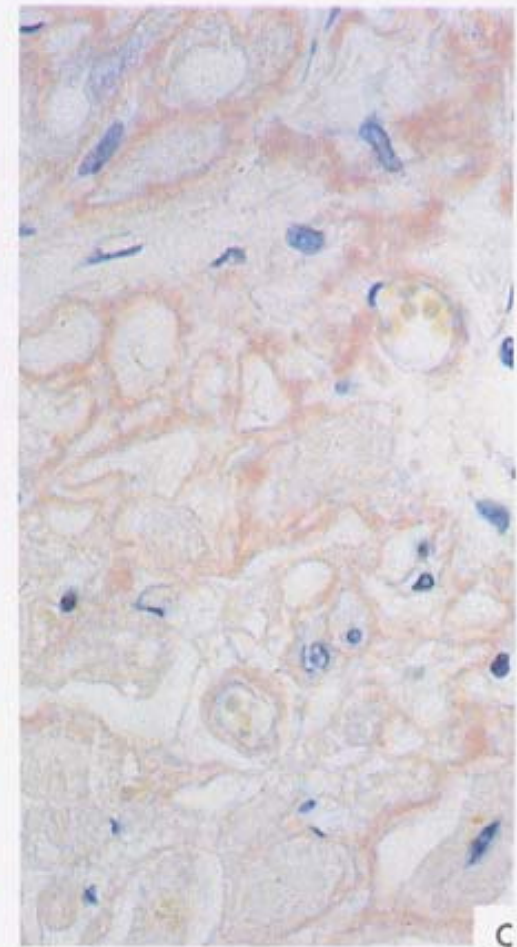
*Secondary clinical end points in the study groups (Crawford et al, 1991), shown by comparative bar graphs.*



A



B



C

**FIGURE 2.73** • Long axis section through a heart with amyloid disease demonstrates the sandy appearance of the left atrial endocardium (A). Histologic section shows myocardial cell degeneration and extensive extracellular deposition of amorphous material enclosing

the cells (B). The amyloid stains positive with a Congo red stain (C). (Reproduced with permission. Hurst JW, Anderson RH, Becker AE, et al: *Atlas of the Heart* New York, NY: Gower Medical Publishing; 1988:5.18.)

# RESULTS

*(Continued)*

- Supplement rather than repeat data in visuals and tables
  - Data agrees within the section and with data given in other sections and visuals
- Avoid overwhelming the reader with data
  - The mean resting blood pressure was 10% higher in the 30 tennis players than in the 20 control subjects ( $94 \pm 3$  v.  $85 \pm 5$  mmHg,  $P < .05$ )
- Should be simply stated (past tense)

QUANTIFICATION OF BENEFITS, COVERAGE OF ADVERSE EFFECTS AND COSTS, AND DISCLOSURE OF TIES  
WITH INDUSTRY IN MEDIA STORIES, ACCORDING TO DRUG.\*

| CHARACTERISTIC OF STORY            | TOTAL             |        | ALENDRONATE       |        | PRAVASTATIN       |        | ASPIRIN           |        |
|------------------------------------|-------------------|--------|-------------------|--------|-------------------|--------|-------------------|--------|
|                                    | % (no./total no.) | 95% CI | % (no./total no.) | 95% CI | % (no./total no.) | 95% CI | % (no./total no.) | 95% CI |
| Did not quantify benefits          | 40 (83/207)       | 33-47  | 57 (40/70)        | 45-69  | 13 (9/70)         | 6-23   | 51 (34/67)        | 38-63  |
| Quantified benefits                |                   |        |                   |        |                   |        |                   |        |
| Only relative benefits             | 83 (103/124)      | 75-89  | 87 (26/30)        | 69-96  | 80 (49/61)        | 68-89  | 85 (28/33)        | 68-95  |
| Only absolute benefits             | 2 (3/124)         | 1-7    | 0 (0/30)          | 0-12†  | 0 (0/61)          | 0-6†   | 9 (3/33)          | 2-24   |
| Relative and absolute benefits     | 15 (18/124)       | 9-22   | 13 (4/30)         | 4-31   | 20 (12/61)        | 4-32   | 6 (2/33)          | 1-20   |
| Adverse effects and costs          |                   |        |                   |        |                   |        |                   |        |
| Adverse effects mentioned          | 47 (98/207)       | 40-54  | 53 (37/70)        | 41-65  | 31 (22/70)        | 21-44  | 58 (39/67)        | 46-70  |
| Costs mentioned                    | 30 (63/207)       | 24-37  | 21 (15/70)        | 12-33  | 30 (21/70)        | 20-42  | 40 (27/67)        | 28-53  |
| Ties with industry                 |                   |        |                   |        |                   |        |                   |        |
| Cited expert or study              | 82 (170/207)      | 76-87  | 83 (58/70)        | 72-91  | 87 (61/70)        | 77-94  | 76 (51/67)        | 64-86  |
| Cited expert or study<br>with tie‡ | 50 (85/170)       | 42-58  | 71 (41/58)        | 57-82  | 70 (43/61)        | 57-82  | 2 (1/51)          | 0-10   |
| Disclosed tie§                     | 39 (33/85)        | 28-50  | 32 (13/41)        | 18-48  | 47 (20/43)        | 27-66  | 0 (0/1)           |        |

\*CI denotes confidence interval.

†The one-sided 97.5 percent confidence interval is given because the percentage is zero.

‡The story quoted at least one expert or study-group member with a tie, as determined by a search of the published scientific literature.

§The tie was also disclosed in the media story.



# DISCUSSION

What do these findings mean?

The answer is in the Discussion.



# DISCUSSION

- Present the principles, relationships, and generalizations shown by the Results
- Discuss—*not recapitulate*—the Results
- Include a beginning, middle, and end
- Write in present tense, active voice—except for results, which are described in past tense
- Discuss this study only

# DISCUSSION

Beginning:

- Answer the research question
- Begin with a signal
- Give your conclusions, based on your results
- Give your strongest result first



# DISCUSSION

Answer the question from the Introduction

- End of Introduction:

" . . . to test whether abnormal coronary vasoconstriction, detected by hyperventilation testing before angioplasty, increases the likelihood of restenosis."

- Beginning of the Discussion:

"The presence of abnormal coronary vasoconstriction, detected on hyperventilation testing before angioplasty, was associated with an increased likelihood of restenosis in patients with unstable angina and single-vessel coronary disease."

# DISCUSSION

Middle:

- Interpret your results
- Compare your work with others' work
- Present ambiguous results and discrepancies with others objectively
- Explain unexpected findings
- Describe limitations
- Use subheadings, when helpful

# DISCUSSION

- **Introduce Points With Your Findings**

Example:

The high incidence (26%) of postpartum maternal hemorrhage recorded in this review was not unexpected; Heys found a 24% increase in his large series in Manchester.

# DISCUSSION

*(Continued)*

- **Compare With Earlier Work**

Own work first:

Our result that increased core temperature ( $T_c$ ) failed to directly stimulate expiratory volume on exercise ( $V_e$ ) agrees with other work in which raising<sup>12</sup> or lowering<sup>29</sup>  $T_c$  passively failed to change exercise  $V_e$ .

# DISCUSSION

*(Continued)*

- **Compare With Earlier Work**

Other's work first:

Other work showed that passive raising<sup>12</sup> or lowering<sup>29</sup> of core temperature failed to change expiratory volume on exercise; our result agrees with those findings.



# DISCUSSION

End:

- Write a strong conclusion
- Begin with a signal
- Mention applications, implications, and speculation, if appropriate
- Suggest future work, if necessary
- Use present tense except when making comparisons to previous studies or results



# ACKNOWLEDGMENTS

Include

- Intellectual assistance
- Technical help
- Special equipment or materials
- Outside financial assistance (including grants, contracts, or fellowships)

# REFERENCES

- Include only significant, published works
- Use the correct format. Consult a current copy of the journal
- Check original sources
- In text, cite references at names of authors and after ideas, eg, “Jones and Smith<sup>8</sup> have shown that people with a low ABI have an increased risk of morbidity<sup>9</sup> and mortality.<sup>10</sup>”

# REFERENCES

*(Continued)*

- Cite grouped references in chronological order
- Number references in tables and figures according to where they are cited in the text
- Name 2 authors; use et al for more than 2
- Obtain permission for citing unpublished data

# PLAGIARISM AND COPYRIGHT INFRINGEMENT

- Learn about US laws (plagiarism, copyright infringement, fair use), which differ from laws and practices in other countries.
  - Take the CME-accredited course on “Ethics, Plagiarism, and the Internet” on THI’s website: <http://texasheart.org/cme>
- Avoid direct plagiarism, mosaic plagiarism, unacceptable paraphrasing, and insufficient acknowledgment.
  - Do not use the exact wording from another paper in your paper — even when you cite the source
  - Use quotation marks when you borrow blocks of text

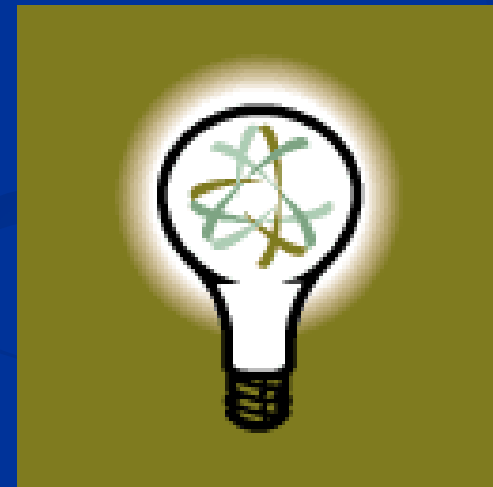
# TIPS

- Include one thought per sentence, one idea per paragraph
- Use active voice whenever possible
- Keep words simple
- Be as succinct as possible
- Use transitions and key words
- Outline
- Consult a statistician
- Remember the question



But in science the credit goes to the man who convinces the world, not to the man to whom the idea first occurs.

— Sir Francis Darwin



**Thank You!**

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