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Graphs

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Two rules of good graphs are presented and explicated.

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I am at a loss for words. I did not expect that looking through recent issues of *CHEST* would cause both relief and disappointment. Relief, because the topic this month is still relevant. The need for advice about graphs is as strong now as at any time in at least 2 decades. Disappointment, for the same reason: newly published medical literature still has far too many graphs that are unnecessary, distracting, difficult to decipher, and sometimes even deceptive.

At the risk of oversimplification, I suggest that there are two rules of good graphs. First, a good graph shows data that deserve to be graphed. It displays or reveals relations or patterns that would be hard to grasp if the data were shown in running text or in a table. Second, a good graph succinctly emphasizes the data, not the graph itself. Just as good writing has no needless words,¹ good graphs have no distracting lines or other needless marks of any kind.

To see how these two rules work, let us inspect a graph published in a medical journal that shall remain nameless, although I will say that its impact factor is 5 to 10 times higher than that of *CHEST*. That fact is not trivial. Some of the worst graphs can be found in the most prestigious journals. I redrew the graph as faithfully as I could, although I changed the labels to avoid violating copyright. (Why a publisher might want to protect its copyright to junk is a

question I leave to others.) The offending graph is shown in Figure 1. It reminds me of a bit of wisdom I learned from my mother: *Es genügt nicht, keine Gedanken zu haben. Man muß auch unfähig sein, sie auszudrücken.* (It is not sufficient to have no ideas. You must also be incapable of expressing them.) Not only do the data shown in Figure 1 have no right to be shown in a graph, they are shown in a graph that is badly drawn.

What is the first thing you notice about Figure 1? Perhaps it is the fact that this graph shows only four values (four data). Good graphs showing only four values are not unheard of, but they are uncommon, and this one is not among them. What relationship or pattern is revealed in Figure 1 that could not be described at least as well in words or shown at least as clearly in a two-by-two contingency table? None.

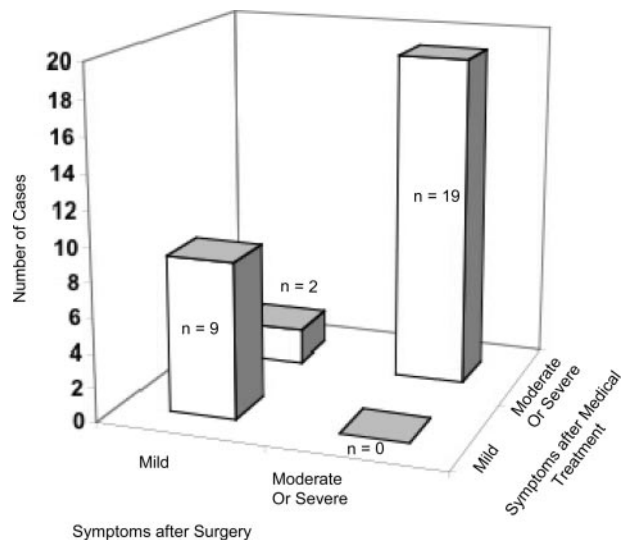


FIGURE 1. A really terrible graph of four values that should not be shown in a graph at all.

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The first rule of good graphs has been violated. These data should not have appeared in a graph at all.

But wait: there is more. Not only does showing those data as a graph add nothing to the reader's understanding, it also gives the readers who want to comprehend the author's point a task that is unnecessarily difficult. It does so by distracting us and thus violating the second rule of good graphs. The heights of the columns tell us something about the values they are intended to represent, so we need not ask why the columns are as tall as they are. So far, so good. Now, what purpose is served by making the columns so wide and so deep? None. None, that is, unless the author intends to distract, or to appear important, or to waste paper. But would making the columns narrower and shallower turn this sow's ear into a silk purse? No. We (at least some of us) would still be distracted by the phony third dimension. It is completely unnecessary. Even the use of two dimensions to show one value can be reasonably questioned; the phony third dimension is overkill.

I wish that you, as a contributor to *CHEST*, could sit back and say in all sincerity "I don't make graphs like that!" But many of you do. Graphs of data that could be shown just as well or better in running text or in tables, and graphs that distract the reader's attention rather than directing it appropriately are easy to find, even in *CHEST*. Fortunately, they are also easy not to make. As someone who lives in a glass house but still throws stones, I recommend the book by Mary Briscoe² (still in print after 10 years), and the section on graphs in the second edition of

How to Report Statistics in Medicine by Thomas Lang and Michelle Secic (which should be available by October 2006).³ If you want to learn more about graphs, I recommend the works of Edward Tufte,⁴⁻⁶ William Cleveland,^{7,8} and Howard Wainer.⁹

Even without a second opinion, you can make progress on your own. Be honest about why you think your data should be shown in a graph and, if you still choose to make one, ask yourself whether your graph draws attention merely to itself, or to important relations and patterns in the data.

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