Prof. David L. Schriger: Guidelines for Presenting Tables and Figures in Scientific Manuscripts

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Editor's note

In March 2021, AME Publishing Company translated the book "Guidelines for Reporting Health Research: A User's Manual" into Chinese and completed the work in June 2021. While the Chinese edition is now beginning official publication, the AME editorial office launches alongside its publication interviews with the book editors and authors, hoping to highlight some updates on the status and trends of the reporting guidelines in the Chinese edition.

We take the pleasure to interview Dr. David L. Schriger to share his insights based on the book. Dr. David L. Schriger is a chapter author of the book and his chapter title is "Guidelines for Presenting Tables and Figures in Scientific Manuscripts".

AME: *How important do you think tables and figures (graphs) are in an article?*

Prof. David L. Schriger: Some types of observations are very simple and others quite complex but the whole idea of science is that you are sharing your observations with others, so they can learn from them and be critical of them. Tables and figures are really important especially in an environment where people aren't sharing their data. We can talk about how wonderful it would be if we leverage the internet—if every publication came with its data so that people could really do the deepest dive possible if it was warranted—but that's not happening. Therefore, the next best thing is to have detailed tables and figures that allow the reader to get as close to the data as possible even though they don't have the actual data to analyze. One aspect of tables and figures is allowing people to take a deep dive, the other is the tables and figures can often be the best way to let someone take a superficial dive. Short of the abstract, short of a title or a headline, a good figure may be the fastest way to understand what's going on in the paper. In fact, journals using visual abstracts often include figures because people realize that rather than reading a prose abstract, a graphical abstract is the fastest way for people to understand the study.

AME: *How well are graphs currently reported in the biomedical literature? Has the status of poor reporting changed? What are the worst aspects?*

Prof. David L. Schriger: CONSORT is very good about telling people what methods to report but much weaker in talking about what results to report and there's almost nothing in CONSORT that speaks to the content of tables and figures. One area of the CONSORT could be improved is to be more specific about how to present data. For example, CONSORT is quite specific about how to describe methods of randomization, but there isn't an equivalent statement about how to present baseline characteristics or outcomes. CONSORT provides no guidance regarding how to report continuous outcomes, categorical outcomes, etc. Right now, CONSORT doesn't say very much about tables and figures or about the presentation of results. In general, it's very vague about that and it's much more about methods. That's not inappropriate especially for the first couple of iterations of CONSORT. As a start, you have to get what was done straight before you can talk about what you found. I think future iterations could be much more specific about the presentation of results.

The reality is that the quality of tables and figures in the medical literature is really highly variable, and it varies from paper to paper and journal to journal. Some journals may have dedicated editors for tables and figures and have

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the resources to redraw every figure for publication in the journal. For those journals there is a uniform style and all graphics meet the same quality standards. Obviously, there are also journals that are just essentially reproducing whatever is submitted to them without additional editing to make them better. It's commonplace to see things like bar charts that have almost no information. Four bars are four data points, which could be written in a single sentence in much less space with equal clarity. On the contrary, there are also some beautiful graphics that really tell stories in a very detailed way. In a published *BMJ* study that I worked on, we estimated that the typical randomized controlled trial presents only 3% of the available data so that's not exactly a glowing endorsement of the status of tables and figures. It is unfortunate that, in a randomized trial, patients have volunteered to participate by putting themselves at risk of getting a treatment that wasn't so good or risk of not getting a treatment that turned out to be good. There's certainly a contribution to society by agreeing to be in a trial so one could argue that we have a moral obligation to make the most of the information that comes out of that participation, and that would mean making all the data available so everyone can learn whatever is to be learned. If we're only presenting 3% of the data, we're failing those patients as well as the greater society. My bottom line would be that we have a way to go in terms of improving the quality of tables and figures.

AME: *Do you have any prioritized content for this guideline?*

Prof. David L. Schriger: The first thing is to graph the data not the statistics; the second thing is that graphics can be multivariate and you can show multiple variables simultaneously. There's always some other variable of interest so you might as well take advantage of that. If you're talking about a paper in pediatrics and you're talking about all ages from infancy up to teenagers, you probably want to separate that data for infants, toddlers and kids that are almost like adults, so don't just report that the mean age was five years old. Show us how many kids were less than one year old, how many were 1 to 4, how many were 4 to 13, how many were 13 to 18. A histogram is a perfect way to do this. Second, a good graphic should tell a story. I think a lot of investigators just make a graph without really thinking "what is the purpose of this graph and what story do we want to tell". Because it's science though and not fiction, the story has to reveal as much data as possible. Scientific graphs should not be cartoons or simple infographics. You

need to show the data that justifies the conclusion.

AME: *Do you plan to update and expand this guideline as more research types and chart types come out?*

Prof. David L. Schriger: Unfortunately, Douglas G. Altman has passed away. I don't know what David Moher's plan is in terms of redoing this book and I've written chapters for other books that are coming out about how to present tables and figures in scientific papers and there's at least one more book coming out from *JAMA*, in the next year or two designed to help young authors prepare scientific manuscripts.

To my knowledge no one has written a series of template tables and figures that could be used as a template for writing a certain type of medical science paper. CONSORT offers various types of templates for the flow diagram of randomized trials but that's about it. I haven't seen a whole lot of granular suggestion about how to present results and I don't know anybody who specifically plans to do that. I haven't done that because while I believe that there are certain principles you want to teach and you want to apply, each paper is unique. We don't serve science well by just saying or using this template because what you want is to let the author think about their specific situation and apply the principles to make the best graphic for that situation as opposed to just pulling something off the shelf and filling in the blanks and submitting it without a lot of thought. I think in this area, there isn't a whole lot of substitute for thinking and what we really want to do is give people the tools to allow them to think about things creatively and make the best graphics. Beyond that I'm not so sure we can be any more specific. It's really teaching the principles that is the most important thing and then it falls on the journals to work with authors to improve things. Different journals make different degrees of effort to do that.

AME: *What suggestions or recommendations do you have for Chinese users?*

Prof. David L. Schriger: If you have the opportunity to show a detailed presentation of your data, take advantage of that because if you present all the data or as much of the data as possible, then no one is going to wonder "well what about this" because you have shown it to them. If you present something which is much more simplistic, then people are left to wonder "what about this and what about that". I think that trying to make the data analyses, and the data presentations as comprehensive as possible is a very desirable thing. If you have nothing to hide, don't hide, you should show everything—

Figure 1 Photo of Prof. David L. Schriger.

like when you're looking to buy a car and if they don't let you look under the hood you wonder what kind of shape is the engine in, but if the hood is up and you can see everything then you're more comfortable. I know what I'm looking at and what I'm getting. I think that concept is really important. Sometimes the graph can be so busy that the message doesn't come through and the real art is to make a graphic that shows both the detail and the larger message. In an ideal graphic you can see all the details of all the individual trees in the forest but at the same time you learn about the forest in general, which means that standing far away you can get the headline, the big message and then getting up close all kinds of little details. Two different users could both say this is a great graph but for two different reasons. One because they can look back and see the big picture and the other because they can look way in and see all the details. It speaks equally well to different audiences and those are the kind of graphs that people should be trying to make.

Expert introduction

Dr. Schriger (*Figure 1*) is currently Professor Emeritus and Vice Chair of the Emergency Department at the University of California, Los Angeles (UCLA). He has conducted research in a number of areas of medical care. Current interests include methods for making the medical literature more transparent and less biased, and understanding how patients and physicians approach low probability—high risk conditions such as "r/o pulmonary embolism", and how behavior can be modified to produce more cost-effective strategies for dealing with such problems. He has written or co-written over 100 peer-reviewed publications.

Dr. Schriger has served as a methodologist to clinical guideline development panels for AHCPR (now AHRQ), NHLBI, AAOS and ACOEM. He serves on the panel which develops and revises the reporting guideline CONSORT. He is a Deputy Editor for *Annals of Emergency Medicine* and an Associate Editor at *JAMA* where he edits the tables and figures for all research papers.

Footnote

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