

TEACHING of STATISTICS in the HEALTH SCIENCES

Scott Evans

From the Section Chair



Greetings! I hope that you are enjoying the fall and the new academic year.

I wish to thank everyone who participated in our very successful TSHS program at JSM in Denver. I extend special thanks to Jodi Lapidus for organizing a great program and Carol Bigelow and Penny Pekow for organizing and leading the interesting coffee roundtables. The sessions were very well attended and the roundtables were sold-out. I further thank Lu Tian and Lingling Li for co-teaching a TSHS-section-sponsored short-course with me (Hot Topics in Clinical Trials) that enrolled approximately 60 students.

Carol Bigelow (2009 TSHS Program Chair) has been hard at work preparing for JSM 2009.

Carol has secured two invited sessions that will be sponsored by the TSHS Section: (1) Best Teaching Practices for Statistics in Translational Research, and (2) Distance Teaching in Practice – Bring Your Laptop and Experience for Yourself. A third

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Newsletter Highlights

- Chair’s Column (to your left!)
- [TSHS Charter review](#) p 2
- [JSM news and notes](#) p 5
- [Best contributed paper](#) p 5
- [JSM Pictures](#) p 7
- [Roundtable – translational researcher:](#) p 8
- [Tips and notes:](#) p 9
- [Publications Officer column](#) p 10
- [TSHS Officers list](#) p 11

session, Teaching Statistics to Nurses – Statistical Literacy for Evidence Based Practice and Research, may be offered as a topic or regular contributed session.

The finances of the TSHS Section are strong and stable. Although the Section sponsored two webinars this year, the Sections’ activities are often limited to annual JSMs and the TSHS Newsletter. Thus there are opportunities for the Section to support initiatives that would benefit TSHS membership. I encourage enthusiastic and energetic TSHS members to develop initiatives such as webinars, workshops, or other activities and submit them to TSHS leadership for consideration of support.

As my tenure as TSHS Chair winds down, I

"I wish to thank the members of the TSHS leadership for their valuable service and for helping to keep the TSHS Section running smoothly."

wish to thank the members of the TSHS leadership for their valuable service and for helping to keep the TSHS Section running smoothly. In particular, I thank Marlene Egger and Cyndy Long (Past Chairs) for their guidance, Jodi Lapidus (Program Chair) for all of her work with the JSM program, Lynn Ackerson (Secretary/Treasurer) for keeping us organized, Janine Janosky (Council of Sections Representative) for representing our section, Ed Gracely (Newsletter Editor) for all of his help with the newsletter and email distribution list, Monica Clark (ASA Staff Liaison) for her dedicated assistance with ASA issues, Carol Bigelow (Program Chair-Elect) for taking us into the future, Bob Oster (Publications Officer) for his publishing duties, help with the review of the charter and general guidance, Gloria Caldito (Past Secretary/Treasurer) and Patrick Tarwater (Past Program Chair) for their help in transition, and Daniel Byrne (Book Review Editor). You made my job very easy and I enjoyed working with you all!

I welcome the incoming TSHS Section leadership and Patrick Arbogast as 2009 Chair. I'm leaving you in great hands! I look forward to seeing you all in future.

CHARTER REVIEW COMMITTEE Bob Oster, Committee Chair Update on Proposed TSHS Charter Changes

It is again time for us to review our charter and propose changes to it that will keep it up to date with current practice and also with any recommendations received from the ASA Council of Sections.

The TSHS charter review committee has reviewed the 2005 version of the TSHS charter and has proposed a few changes to keep it up to date. These proposed changes appear below. The proposed changes, in ~~strikeout~~/addition format, appear with the additions in red. Following each proposed change is the rationale behind that change. The proposed changes are small in terms of the number of words but are important to the section. Each of these has been approved by the entire TSHS executive committee.

The list of proposed changes is provided for your information

"The proposed changes are small in terms of the number of words but are important to the section. ... The list of proposed changes is provided for your information at this time."

at this time. These are the official changes to the charter that all TSHS members will have an opportunity to vote on in the 2009 ASA elections. You will not need to take any action until the official ASA ballots are sent out in March.

A PDF file of what the charter will look like if the changes are approved can be found on the TSHS website at this URL:

http://www.bio.ri.ccf.org/ASA_TSHS/html/charter.htm.

A PDF file of the current charter also appears there.

I want to thank Patrick Arbogast, our 2009 Chair, and Cyndy Long, our 2006 Chair, for serving with me on the charter review committee. I also want to thank Scott Evans, our current Chair, for asking me to serve as chair of this committee.

PROPOSED CHANGES TO THE TSHS CHARTER
(To Be Voted On in the 2009 ASA Elections)

1. **Article IV, Officers, 2nd paragraph, 4th sentence.** Recommended change:

The Chair shall coordinate the work of the officers and committees of the Section and shall prepare ~~an annual report, for publication in a news bulletin, on the activities of the Section~~ **reports on the activities of the Section for publication in the Newsletter of the Section on Teaching Statistics in the Health Sciences and include any annual reports prepared for the Association in the Section Newsletter as well.**

Rationale:

The phrase “and shall prepare an annual report, for publication in a news bulletin, on the activities of the Section” needs to be revised since the phrase is vague and also since it does not accurately describe our current practice. The Chair currently sends the annual report to ASA when requested, and then has it posted on our website.

2.) **Article IV, Officers, 4th paragraph.** Recommended change:

The Secretary/Treasurer **shall be appointed by the Chair, after consultation with the Executive Committee**, ~~elected by vote of the membership, shall serve as a voting member of the Executive Committee.~~ The Secretary/Treasurer shall be responsible for the minutes of all meetings of the Section and the Executive Committee. The Secretary/Treasurer shall also assist the Chair-Elect in preparing the annual budget and shall monitor the Section's dues collections and expenditures and prepare an annual report on the financial condition of the Section. **The Secretary/Treasurer serves as a voting member of the Executive Committee.**

Rationale:

The ASA Council of Sections (COS) recently reviewed the TSHS Charter and recommended that the Section change the Secretary/Treasurer from an elected position to an appointed position. One of the reasons for this recommendation is that the ASA requires sections to elect only their Chairs and COS Representatives. Individual sections decide whether or not the other offices are elected or appointed. The ASA COS also stated that they are advising, but not requiring, other sections to appoint officers other than the Chair and COS Representative. Since TSHS currently appoints its Publications Officer and Program Chair, it makes sense from an administrative point of view that the Secretary/Treasurer also be appointed. Another reason for making this change is that TSHS seldom has more than one member who is truly interested in running for Secretary/Treasurer.

3) **Article VII, Terms of Office, last sentence.** Recommended change:

The Chair, Chair-Elect, Program Chair, and Program Chair-Elect shall each serve a one-year term. The Chair-Elect shall automatically succeed the Chair and the Program Chair-Elect shall automatically succeed the Program Chair at the annual change of officers, which shall occur on January 1. The Secretary-Treasurer and the Publications Officer shall each serve a two-year term. The term of office for the Representative(s) to the Council of Sections shall be as specified in the Charter of the Council of Sections. **The Chair and the Representative(s) to the Council of Sections**

~~shall not be eligible for immediate re-election to their respective positions. No officer except the Secretary-Treasurer shall be eligible for immediate re-election to the same position.~~

Rationale:

This sentence is inconsistent with the current and proposed language for Article IV.

4) **Article XI, Amendments, section 2 (ratification), 1st sentence.** Recommended change:

Ratification. All proposed amendments shall be submitted to the members of the Section for mail, **e-mail, or webpage** vote at the time of the next annual election of officers. If approved by a majority of members voting, the amendment shall take effect immediately, or at such other time as specified in the amendment. A copy of the amendment shall be filed with the Secretary of the Association.

Rationale:

TSHS members currently have the option of voting for candidates and on proposed changes to the charter in the ASA elections by mail or on a webpage that ASA has designed for voting. However, the TSHS charter specifically states that approval of changes to the charter shall take place by mail vote. This language is clearly outdated and therefore needs to be updated.

JSM Notes and reports[Back to list](#)

Best Contributed Paper Award: Congratulations to Scott Emerson, U Washington!

His paper was: The Scientist Game: Power and Subterfuge in the Statistical Design of Studies



Abstract: Proper characterization of the hypotheses addressed by a randomized clinical trial or other biomedical study is crucial for evaluation of the study's scientific merit and for ensuring the ethical treatment of study subjects. The most standard approaches presented in introductory statistics texts often do not adequately address the true scientific issues. Drawing on the game of Eleusis as described by Martin Gardner in *Scientific American* 30 years ago, I developed an exercise ("The Scientist Game") to illustrate some common foibles of scientists and statisticians when they first approach the statistical design of an experiment. This example is used to illustrate the importance of clearly defining relevant and important hypotheses, mapping out a scientific strategy that extends beyond a single experiment, and properly powering the study or studies to discriminate between hypotheses.

Further comments for the TSHS Newsletter:

When the Statistical Crimes Against Humanity Trials are held at some point in the (hopefully near) future, I believe the top three charges against teachers of introductory applied statistics courses and authors of introductory texts will be

1. Ever making mention of an assumption of data having a normal distribution—or any other specific distribution, for that matter (instead, we should in the most typical case talk about whether our sample size is sufficiently large to justify an approximate normal distribution for our estimates of effect),
2. Any emphasis on the P value as the primary result of a statistical analysis (instead, we should focus on the precision of our estimates as measured on the scientific scale of a frequentist confidence interval or Bayesian credible interval), and
3. Promotion of experimental design based on 80% power (instead, we should discuss the design of experiments to discriminate between hypotheses).

The common thread in the definition of these crimes is my belief that an introductory applied statistics course should be titled "The Use of Statistics to Answer Scientific Questions". That is, for the students in a non-majors applied statistics class, Statistics is merely a tool to be used in Science (in the broadest sense of the word), and Science is about proving things to people. I find, however, that introductory statistics texts completely lose sight of the need to emphasize the scientific method, which is ultimately based on an adversarial view of proof: Scientific studies should be directed toward discriminating between competing (sets of) hypotheses. Hence, goals of experiments should not be stated as a desire to "prove that" a certain hypothesis is true (it might not be), but instead to "decide which" of two hypotheses might be true.

In teaching experimental design, then, we must first discuss the ways in which the applied scientist should define the most plausible competing hypotheses and then design an experiment that would tend to result in different outcomes under those competing hypotheses. In order to address the nondeterministic nature of the outcomes, we must describe a framework for defining what we mean by statistically discriminating between hypotheses.

Drawing on the game of Eleusis (invented by Robert Abbott and described by Martin Gardner in *Scientific American* in October, 1977), I developed an exercise ("The Scientist Game") to illustrate some common foibles of scientists and statisticians when they first approach the statistical design of an experiment. The "game" aspect was originally used by me to teach elementary school students (grades 2 through 5) about the scientific method. But I later started presenting the game to my colleagues at the Arizona Cancer Center, audiences in statistical seminars, and students in my statistics classes. In a revelation that perhaps says more about me than the true recreational appeal of the game, I have also presented it to fellow attendees at a wine and cheese party and fellow passengers on commercial airlines.

In this game, the Scientist is charged with discovering the rule that dictates patterns of objects appearing over time in a greatly simplified universe. Starting with observational data, the Scientists are to first identify the "low hanging fruit", and then devise an experimental strategy to test the scientific hypotheses that they have formulated from their observation. In this exercise, I have found that the vast majority of participants, no matter the level of prior scientific experience, make choices that would correspond to very poor experiments. In my presentation I then demonstrate what I would regard a more appropriate scientific approach and make brief comments on the role of multiple comparisons (data dredging or data mining), binary searches, and incorporation of Bayesian priors into the optimal design strategy. Lastly I draw a parallel to the choice of statistical power when designing a study in the real world: My claim is that the only thing that should differ is the use of confidence intervals or credible intervals to "discriminate" between hypotheses.

More information about my Scientist Game presentation can be found on my webpages at www.emersonstatistics.com/ScientistGame. Included are an audio recording of my presentation of the game during the second quarter of an introductory applied statistics class taken by graduate students in public health, as well as an interactive version that can be "played" by web site visitors.

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Pictures from JSM, 2008

[Back to list](#)



Convention Center, with blue bear. It's huge!



Mountains from the train west of Denver. Of course, Denver itself is high plains, not actually in the mountains. But close!



TSHS members paying rapt attention at the mixer, while Ed talks about the newsletter... ☺

TSHS officers and Leadership.



[Back to list](#)

The Coffee Buzz: A New Statistics Student – The Translational Researcher

Carol Bigelow, TSHS Program chair Elect

If you've never done it, consider participating in a coffee roundtable at your next JSM meeting. Bring an appetite (you won't be sorry) and pen and paper. If our 2008 coffee is any indication, your java will come with useful ideas, resources, and bits of wisdom. At our roundtable in Denver were: **Bruce Center** (University of Minnesota), **Patricia English** (Pfizer, Inc), **Doc Muhlbaier** (Duke University), **Taylor Pressler** (Ohio State University), **Eleanor Pullenavegum** (McMaster University), **Chris Schmid** (Tufts University), **Rochelle Tractenberg** (Georgetown University), and **Zhiyung You** (University of Alabama). We swapped insights and experiences focusing on three aspects of teaching statistics to the translational researcher: who is the translational researcher, what are his or her statistical literacy needs and, what should be our priorities in their statistical training?

Most of us agreed that the translational researcher in class is likely to have an advanced degree, be quantitatively savvy, and have already completed some statistics course work, with the latter most likely taught from an experimental perspective. He or she is less likely to be expert in aspects of statistical thinking that pertain to the design, analysis, and interpretation of *observational* studies of human subjects. Interestingly, we discovered that this student can be reasonably expected to enroll in at most a limited number of courses in biostatistics, perhaps even just one or two.

"We were unanimous in our opinion that the statistical literacy of the translational researcher needs modernization, with a greater emphasis on "real world" intuition pertaining to causal inference and a lesser emphasis on number crunching..."



*Who is the translational researcher?
What are his or her statistical literacy needs?
What should be our priorities in their statistical training?*

We were unanimous in our opinion that the statistical literacy of the translational researcher needs modernization, with a greater emphasis on "real world" intuition pertaining to causal inference and a lesser emphasis on number crunching (e.g. - the all too familiar "detonator plot"). Areas of statistical literacy noted as needing more attention include sampling and bias, prospective versus retrospective probability frameworks, confounding versus effect modification, and apparent statistical significance versus study power.

Top priority, we decided, is to make the most of, *and expand upon*, our limited opportunities for teaching. Examples and illustrations should be linked, where possible, to the student's day to day work (e.g. – manuscript preparation, grant proposal development). The consulting relationship should be exploited to teaching advantage. Wouldn't it be nice, we thought, if routine consulting included the distribution of key teaching materials such as modular and self-guided tutorials on key statistics concepts that are especially relevant to translational research. Wouldn't it be nice, we thought, if there existed a repository of resources that is specific to teaching in the consulting environment.

Hoping you'll join us at JSM in 2009. .

[Back to list](#)

Tips and Notes

Ed Gracely

I attended several interesting sessions at JSM relevant to statistics education. Here are some comments and ideas you may find useful as well.

Clickers: These are handheld devices that enable the holder to electronically answer questions posed by the instructor. Typically, every student has one in class. Then the instructor can see what the class knows (or doesn't) and present the distribution of answers. One session at JSM was devoted to their use and pitfalls. (I neglected to record all the names – can't tell from the program. Sorry).

I've had students answer questions as a class by raising their hand ("How many vote for 'A'?"), but the clickers allow some degree of anonymity and ensures that everyone responds.

Some faculty utilize clickers to take attendance or enforce prompt arrival (with a graded quiz at the start of the class!).

One presenter described glitches and equipment problems that undercut the perceived value of the devices in class. His advice was that anyone planning to use clickers should be sure to have a backup plan and be familiar enough with the technology as to be able to deal comfortably with the inevitable problems. Faculty who weren't prepared in that way got worse ratings for the clicker technique than others who were more prepared.

One speaker in the same session described an interesting way to involve the class. She offers a fairly hard question, which half get right, then asks them to talk to each other

about the answer. Upon asking it again, commonly 100% get it right, and they appreciate the opportunity to hear the explanation from each other! The question she gave as an example of this technique provided a non-significant 95% confidence interval and asked if it would be significant using $\alpha = 0.01$. The class typically divides 50-50 between "no" and "can't be determined".

Studies of the clicker approach report that developing better questions gives superior results to developing more questions.

It is, of course, possible to duplicate the clicker effect if every student has a lap top. They can log into a site where answers are recorded in a similar way. Some instructors in my institution have done this.

Bias: Fritz Scheuren gave an interesting talk on some historical matters. One example I liked (and may use) involved fighter planes in World War II. The air force kept a record of bullet-hole locations on the planes that came back damaged. They hired Wald (yes, "that" Wald!) to summarize those locations, intending to reinforce the most often-hit spots more effectively. Wald did the summary, but recommended exactly the *opposite* in terms of reinforcement. He said to reinforce the spots with few or no bullet holes. Before reading on -- do you see why? Wald reasoned that the points with no bullet holes represented planes that didn't come back. Those were the spots that needed extra armor.

I like the example -- it forces students to think about how a sampling bias could affect the observed results.

[Back to list](#)*FROM THE PUBLICATIONS OFFICER*

Robert A. Oster, Ph.D., University of Alabama at Birmingham



I enjoyed seeing a number of you at the 2008 JSM in Denver. The TSHS-sponsored sessions and posters were again excellent. The JSM are always a good venue in which to meet and greet section members.

Regarding section publications, I am pleased to say that TSHS had an article published in the July issue of *Amstat News*. In this article, we recognized our 2007 award winners, listed the awards that we would be offering this year, and described the TSHS program at this year's JSM. The latter included a description of our short course, our invited, topic-contributed, and contributed sessions, and our roundtables with coffee. I want to thank Jodi Lapidus and Scott Evans for their contributions to this article.

TSHS members will be writing additional articles for *Amstat News*. Ed Gracely has written an article about his responsibilities for and experiences with his position as section newsletter editor. I have been asked to write a similar article about my position as publications officer. Members of the section executive committee may be asked to contribute to various TSHS articles for *Amstat News* as well.

Thus far this year, TSHS members have contributed articles to the TSHS newsletter and manuscripts to the JSM proceedings and peer-reviewed journals. The executive committee has also tried to update and improve the section website (http://www.bio.ri.ccf.org/ASA_TSHS/html/charter.htm).

Please consider writing an article or book review for our section newsletter. Articles that describe any topic on teaching or consulting in the health sciences, or any combination of the two, will be welcomed by our newsletter editor, Ed Gracely. Reviews of books that you have been using in teaching and/or consulting will be welcomed by our book review editor, Dan Byrne. Suggestions for updating and improving the TSHS website are welcomed by the executive committee.

That is all for this column. I will have another column for you in the spring 2009 issue of this newsletter!

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[Back to list](#)

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FROM THE EDITOR

Nice to see a lot of you at JSM. Maybe even more next year when the meeting is in Washington, close to where large numbers of us live and work.

Ed

American Statistical Association

<http://www.amstat.org/>

Section on Teaching Statistics in the Health Sciences

Section web page: http://www.bio.ri.ccf.org/ASA_TSHS/html/index.html

Links to all newsletters: http://www.bio.ri.ccf.org/ASA_TSHS/html/newsletter.htm