Outline

• General comments on the role of statisticians
• Responsibilities and advice for graduate students
• Responsibilities and advice for teaching
• Responsibilities and advice for methodological research
• Responsibilities and advice for working with collaborators/clients
• Issues: authorship, objectivity, etc.
The discipline of Statistics:

- Statistics is concerned with collection and interpretation of information (data)
- In some sense, Statistics is unique, as we would not exist but for the need to do this in other disciplines
- For knowledge in all disciplines to advance uncompromised, collection and interpretation must be done in an honest and principled fashion
General Comments

Restated: Statistics is concerned with **honest** and **principled** collection and interpretation of information (data)

- The contribution of statistics is to make sure that evidence on which public and private decisions are based and on which the next steps in advance of science are formulated is **credible**
Collection and interpretation of data:

- In general, investigators are focused on pursuit of the truth.
- Excited investigators have hypotheses to verify, ideas to defend, and hope that data may be collected that have an interpretation that supports their objectives.
- However, hypotheses and ideas can be incorrect, or may be correct but evidence in their favor can be weak or inappropriate.
General comments

The role of statisticians:

- Ensure that data are collected in a fair and unbiased way so as not to favor certain viewpoints
- Ensure that questions to be addressed can in fact be addressed with available information
- Ensure that interpretations are made independently of desired results or predispositions
- To some extent, statisticians are the “morality police” for science!
In particular:

• The FDA bases regulation and approval of drugs, biologics, and devices on formal statistical evidence

• Many substantive journals require that claims be supported by formal statistical evidence

• Environmental regulations are based on formal statistical approaches and evidence

• Teams conducting clinical trials are almost always required to include at least one statistician
At the same time:

- Statistics has a "PR" problem
- *How to Lie With Statistics* (Huff, 1954)
- "There are three kinds of lies: lies, damned lies, and statistics" (Benjamin Disraeli)
- Despite our role, the public is *suspicious* of statistics
Result: Statisticians have a special obligation to practice our profession independently and with principle, honesty, integrity, and fairness.

- More generally, we have a responsibility to act this way in everything we do, statistical or otherwise.
Advice for Graduate Students Get in the habit early in your career!

- Play by the rules in your coursework, always – if the instructor directs you not to collaborate, consult certain materials, etc., DON’T DO IT!!!

- Not adhering to the rules now will make it more difficult for you to do so later, when it matters even more...

- ...and you will have not developed the skill of learning independently that is critical to being a good statistician (in research or applications)
Advice for Graduate Students

Coursework: Don’t cheat yourself

- Treat your coursework as an opportunity to learn and hone technical/applied skills, demonstrate your ability to learn and master your discipline, cultivate an ability to work independently as preparation for your later work habits, NOT as a just a prerequisite for an “A”

- Accept the idea that graduate school is NOT about grades!
Coursework: Don’t cheat yourself

• Graduate school is one time in your professional life where you have the luxury to learn

• Take demanding (not “easy A”) courses that will expand your knowledge of Statistics and challenge your abilities

• Take courses beyond the minimum requirement for your degree
Advice for Graduate Students

Dissertation research: Don’t cheat yourself

- A dissertation is an exercise in learning to work and think independently, critical to your ability to contribute and carry out your responsibilities later

- This is NOT homework! Do not expect your advisor to “assign” the next task
Advice for Graduate Students

Dissertation research: Don’t cheat yourself

• Don’t just get results, interpret them! Do the results make sense? Could there be a mistake in your program?

• Identify the next step yourself: investigate new approaches on your own, try new simulation scenarios, etc.
Advice for Teaching

Not just academia: Industry, government short courses, presentations

• Teaching Statistics or communicating statistical ideas carries a responsibility for **completeness**; **honesty** about what can and cannot be done, assumptions, etc.; staying **up-to-date**
Advice for Teaching

Responsibility: To students and the profession

- Developing and maintaining a **good** course is **hard work** and time-consuming, but cutting corners will only shortchange the profession by telling an incomplete or outdated story to students.

- Promoting Statistics to non-majors (and majors!) through clear, thoughtful teaching benefits the **entire discipline**.
Advice for Teaching

Responsibility: To students and the profession

- Teaching is not a popularity contest! An easy, entertaining course and light workload may please students in the short term, but fails them in the longer term

Your goal: Communicate statistical thinking and principles in the best way you know how
“Publish or perish” In academia, pressure to publish is considerable in any discipline

- The eternal struggle: Quantity vs. quality
- The “minimum publishable unit”
- Temptation to send out work that is incomplete or promote methods that are not well-studied
Responsibility: The objective of research is to advance knowledge. Ask yourself

- Does this work represent a “$\epsilon$” advance?
- Have I portrayed the advantages and disadvantages fairly and accurately?
- Have I done my best to communicate my work clearly and effectively, rather than expecting editors/referees to do it for me?
Advice for Collaboration

The practice of statistics: As a statistician, you will work with investigators/clients on “real problems”

- As a consultant to a client who has already collected data and wants help with an analysis
- As a collaborator who participates in conception, design, analysis, and reporting of results (publication)

The most challenging aspect of being a statistician!
Advice for Collaboration

First principle: Be principled!

- Statistics is about impartial, fair, unbiased interpretation
- Statistics recognizes and is up-front about the limitations of methods and assumptions
- A statistician should always strive to present only what is reasonable to infer, to make limitations transparent, and not be pressured by “special interests”
Advice for Collaboration

Example 1: The mission – *Statistical Significance*!

- Investigators obviously hope to show their hypotheses, theories, conjectures are *true* and would like statistical analyses that support this!

- It’s all about the *p-value*!

- Some client/collaborators view statistical methods a “bag of tricks”

- “What if we analyzed this as a two-way analysis of variance instead?”
Advice for Collaboration

Statistician’s obligation:

• Use the most relevant model and method with reasonable assumptions, regardless of outcome

• Stand your ground
Example 2: The sample size conundrum

- A collaborator wants to conduct a study to test a hypothesis but has limited resources

- You: “What’s an important (subject-matter) difference?”

- Them: “Whatever I can detect with at most 50 patients/rats/plots”
Advice for Collaboration

Statistician’s obligation:

• It may be a waste, or downright unethical, to conduct a study that is too small (underpowered) or poorly designed.

• Help the client to understand what s/he can reasonably hope to achieve within his/her constraints and to focus on the scientific relevance given the limitations.
Advice for Collaboration

Example 3: The color of money

- If the FDA approves this drug, we’ll all be rich!
- The word from upper management: Statisticians, your job is to deliver $p < 0.05$
Advice for Collaboration

Statistician’s obligation:

- This can be tough!
- Strength of character, integrity, self-confidence (comes from knowing your discipline very well)
- Strive within your organization to educate
Example 4: The VIC (Very Important Client)

- Unfortunately, some clients/collaborators do not think highly of Statistics or statisticians (and view them as “staff” who run software packages...)

- Unfortunately, some clients/collaborators think they know as much or more than you do

- “Run this analysis and bring me the results”

Statistician’s obligation: See previous slide!
Advice for Collaboration

Example 5: The obsessive-compulsive (you!)

- Sloppiness or haphazard work is unacceptable
- “The mystery of the treatment codes”

Statistician’s obligation: Be precise and careful with every design, analysis, report, no matter how small
Issues

Authorship: For collaborative work

- If you have made a contribution to a paper, you should be listed as an author
- In some substantive disciplines, there is a protocol for authorship
- In others, you may have to fight for recognition
Issues

Reporting results: For collaborative work

- Collaborators (and their journals) often insist on minimal statistical content-description

- **Insist** at the minimum that the paper state clearly: statistical model (reference), assumptions, limitations, extent of generalizability
Know what you don’t know:

• You can’t be a statistician in a vacuum; when working with subject-matter investigators, make an effort to learn the basics of the area...

• ...while recognizing you are not an expert

• Listen to your collaborators, ask questions

• Don’t be afraid to be “dumb!”
Issues

Peer review:

• When acting as a referee, resist the temptation to be competitive

• Your goal should be to evaluate whether the contribution is substantial enough to be communicated – be honest, fair
Some References


American Statistical Association (1999) Ethical guidelines for statistical practice (at the ASA web site; see the class web page)