Ethical Issues for Biostatisticians

Introduction

March 30, 2011

Outline

- **Introductory concepts**
  - What is ethics and why is it important in research?
  - Ethical principles for scientific research
  - Ethical dilemmas
  - Ethical reasoning and decision-making
- **Overview of course**
  - Review of syllabus
  - Description of assignments
  - Student responsibilities
- **Case study discussion**

What is Ethics?

Ethics is:

- A branch of philosophy that encompasses right conduct
- Norms or standards for conduct
  - Distinguish between acceptable and unacceptable behavior
    - Ethical standards are typically broader and more informal than legal rules
    - Actions can be legal but unethical, or illegal and ethical
- Methods, procedures, or perspectives for deciding how to act

Distinguishing rules, norms/standards, and principles:

- **Rules** are the most constraining and rigid, often provide a "bright line" for acceptable conduct
- **Norms** are standards that guide decisions and provide a framework for balancing competing factors
- **Principles** are either used interchangeably with standards or are considered to be a more general and abstract form of guidance for decision-making

Sources: Resnik http://www.niehs.nih.gov/research/resources/bioethics/whatis.cfm
Legal theory lexicon http://lsolum.typepad.com/legal_theory_lexicon/2004/03/legal_theory_le_3.html

Why is Ethics Important in Research?

- Scientific goals and the scientific method are the basis for ethical standards in scientific research
  - Methodological and ethical standards in research are closely connected
- Ethical norms:
  - Promote the aims of research
    - Knowledge, truth, avoidance of error and biases
  - Promote values that are essential to collaborative work
    - Trust, accountability, mutual respect, fairness
  - Help ensure researchers can be held accountable to the public
  - Help build public support for research
  - Promote moral and social values
    - Social responsibility, human rights, animal welfare, compliance w/ the law, health & safety

Source: Resnik http://www.niehs.nih.gov/research/resources/bioethics/whatis.cfm

Overarching Ethical Principles for Scientific Research

- **Honesty**
  - Most important scientific principle (and basis for many rules)
  - Honestly report data, results, methods, procedures, publication status
  - Do not deceive
  - Dishonesty often involves production and reporting of data –
    - Falsification, fabrication, misreprentation (trimming, cooking, fudging)
- **Carefulness**
  - Avoid careless errors and negligence
    - Honest mistakes happen, but serious and repeated errors = negligence
    - Types of errors: experimental, methodological (including of statistics), misuse of theoretical assumptions, human (sloppiness, inattention, indiscretion), self-deception
  - Critically examine your work and that of others
  - Keep good records
- **Competence**
  - Maintain and improve your own professional competence
  - Promote competence in science as a whole

Source: Resnik 1998 and http://www.niehs.nih.gov/research/resources/bioethics/whatis.cfm

Overarching Ethical Principles for Scientific Research

- **Openness**
  - Share data, results, ideas, resources
  - Be open to criticism and new ideas
- **Freedom**
  - Scientists should be free to pursue new ideas and criticize old ones
- **Objectivity**
  - Strive to avoid bias and minimize self-deception
  - Disclose conflicts of interest
- **Integrity**
  - Keep promises and agreements
  - Act with sincerity
  - Strive for consistency of thought and action
- **Confidentiality**
  - Protect confidential information

Source: Resnik 1998 and http://www.niehs.nih.gov/research/resources/bioethics/whatis.cfm

Overarching Ethical Principles for Scientific Research

- **Respect for research subjects**
  - Minimize harms and risks while maximizing benefits
  - Respect human dignity, privacy, autonomy
  - Take special precautions with vulnerable populations
  - Strive to distribute benefits and burdens of research fairly
- **Credit; respect for intellectual property**
  - Give credit where credit is due, not where it is not due
    - Don't plagarize
    - Responsibility comes with taking credit
    - Guest, ghost, and honorary authorships are not OK
    - Give proper acknowledgement
  - Honor patents, copyrights, etc.
  - Don't use unpublished materials without permission
- **Use resources efficiently**
  - Don't conduct unnecessary or poorly designed experiments
  - Show proper respect for animals in research

Source: Resnik 1998 and http://www.niehs.nih.gov/research/resources/bioethics/whatis.cfm

Overarching Ethical Principles for Scientific Research

- **Respect for colleagues and students**
  - Treat colleagues and students fairly and with respect
  - Science is built on cooperation and trust; this breaks down when there is no respect
- **Responsible mentoring**
  - Help educate, mentor, advise students
  - Promote student welfare; allow students to make their own decisions
- **Responsible publication**
  - Publish to advance research and scholarship, not just to advance your own career
  - Avoid wasteful and duplicative publication
- **Legality**
  - Know and obey relevant laws and institutional policies
- **Social responsibility**
  - Strive to promote social good, and prevent or mitigate social harms
  - Scientists have an obligation to conduct socially valuable research, participate in public debates, help make science policy, debunk junk science

Source: Resnik 1998 and http://www.niehs.nih.gov/research/resources/bioethics/whatis.cfm

Basic Moral Principles of Medical Ethics (Norms)

- **Respect for autonomy**
  - People have the right to make informed and rational decisions for themselves
- **Justice**
  - Fairness – risks and benefits of research should be equally distributed across all groups
- **Beneficence**
  - Making efforts to secure the well-being of persons
- **Non-maleficence**
  - Do not intentionally harm patients, through errors of omission or commission

- Notes:
  - Respect for autonomy, beneficence, and justice are the foundation of the Belmont Report that governs human subjects research
  - Non-maleficence is not in the Belmont Report but is part of the Hippocratic oath

Ethical Misconduct (Rules)

- Only some ethical lapses are considered misconduct
- Nine major offenses:
  1. Fabrication of data
  2. Plagiarism
  3. Abuse of confidentiality
  4. Falsification
  5. Dishonesty in publication
  6. Deliberate violation of regulations
  7. Property violations
  8. Failure to report major offenses
  9. Retaliation

University of Michigan Policy Statement on the Integrity of Science:
http://www.rackham.umich.edu/policies/gsh/add/

Some General Guidelines

- Accept personal responsibility
- Avoid conflict of interest
- Reject bribery in all its forms
- Maintain your technical competence
- Seek, accept and offer honest criticism
- Treat people fairly (regardless of who they are)
- Avoid injuring others
- Assist others in behaving ethically

Based on IEEE code of ethics

Limitations and Ambiguities of Ethical Standards

- Ethical standards
  - May conflict
  - Do not cover all situations
- Application of ethical standards often depends on implicit or explicit assignment of weights to each standard
- There may not be broad consensus about what should be done in specific situations
- Because of their informality and ambiguity, ethical standards may lead to **ethical dilemmas**

Sources: Cournand 1977; Resnik NIEHS

Ethical Dilemmas

- An **ethical dilemma** is the need to make a choice between different actions where each is supported by some standard of conduct
  - Could be the lesser of two evils, or the greater of two goods
  - Can involve:
    - Two different ethical standards where the ethical principles conflict
    - Good arguments on both sides of the issue
    - Conflict between ethics and the law

Ethical Analysis to Address Ethical Dilemmas

Ethical analysis provides a means to clarify a dilemma, identify the values involved, and determine a course of action. A useful approach is to think in terms of the following steps:

Recognition	*What are the issues being raised? What is the underlying ethical concern? How does this issue impact me?*
Reasoning	*What values are at stake? Are there competing points of view? What are the potential benefits and harms of different actions? Are there any rules or guidelines that can help?*
Responsibility	*What are my responsibilities? Do others have responsibilities also?*
Action	*What should I do – and why?*

Source: Biomedical Research Integrity Program and Kelly Fryer-Edwards, UW Department of Bioethics and Humanities

Steps in Moral and Ethical Reasoning and Decision-making

Steps:

1. Define the problem. What are the conflicts and clashing ideals?
2. Gather all relevant information (factual, technical, moral)
3. Delineate or construct different options
4. Relate each option to the values or principles at stake
5. Evaluate each option in light of different values or principles, and the facts. Seek advice and input in this evaluative process
6. Arrive at a carefully reasoned judgment after weighing all the relevant moral factors and reasons in light of the facts (this is the HARD step)

- This is casuistry: case-based moral reasoning

Source: Ratner, UW bioengineering; Resnik, NIEHS

Challenges of Application

Overview of Course

- 20 hours in class
- Combination of guest speakers, discussion, and case studies
  - Details in the second half of the quarter still being finalized
- Combination of statistics, science, and public health concerns
- Goals:
  - Short-term: Learn rules and conventions guiding research practice; understand ethical considerations in research
  - Long-term: Develop ethical sensitivity, critical thinking skills, and habits to prepare you to effectively resolve situations that commonly confront statisticians
- Syllabus review and introductions

Learning Objectives Stated Differently

- Stimulate the moral imagination
- Recognize ethical issues
- Develop ethical analysis skills
- Elicit a sense of moral obligation and responsibility
- Learn to cope with moral ambiguity

Case Study Discussion

As a professional statistician, you are called by a colleague to examine and "bless" a biomedical experimental report. You are urged to do it quickly because the report has already been submitted and accepted for publication in a prestigious journal in the author's field. One of the reviewers, however, had suggested that a quick review by a statistician might be in order. To your horror, the report appears to be utter statistical nonsense. The data were not sampled according to any plan, but rather were drawn from various similar experiments done for different purposes. There is no reason to assume the observations were random or independent within or among data sets. There was no definition of how many data points had been originally available or how those used had been selected. The scatter plots within the paper were plainly skewed, but the computer statistical tests which had been run would have presumed a normal distribution. You explain gently that the statistical work is not an asset to the paper and could prove embarrassing to the author and the institution if published. You suggest that he eliminate the statistical portions and describe his work based on the qualitative reasoning which he obviously used. Initially very angry, he calms down and says, "I'll leave the contents alone, but I will add you as a coauthor. How's that?"

Extra slides

- Van Belle's four basic questions
- Science and its goals; the scientific method
- More background on ethics
- Overview of Cournand's code of the scientist
- Full case study

Four Basic Questions – van Belle Rule of Thumb # 1.1

- Any statistical treatment must address the following questions:
  1. What is the question?
  2. Can it be measured?
  3. Where, when, and how will you get the data?
  4. What do you think the data are telling you?
- "Essentially mimics the scientific method with particular emphasis on data collection and analysis"

What is the question? Van Belle 1.1(i)

The statistician does **not** ask

"Does X do Y?"

but instead

"How much" *or* "To what extent" *or* "Under what conditions" X does Y.

Answers must come in the way that is most fair in conveying the *uncertainty* of the claim. Ethics comes in right from the outset, as your judgment about what is "fair" here is an ethical judgment: a judgment about how you are treating the people to whom you happen to be speaking and also the others for whom this possible new knowledge might or might not be beneficial.

What is the question? Van Belle 1.1(i)

... The time is past, if ever there was such a time, when you can just discover knowledge and turn it loose in the world and assume that you have done good.

Wendell Berry, *Life is a Miracle*, p. 145

Stakeholders include taxpayers, government bureaucrats, politicians, fundamentalists, academic colleagues, industries and their owners, parents, people with other theories than yours, and, centrally, the living human beings who consciously or unconsciously contribute the actual numbers that make up most of our data sets.

What is the question? Van Belle 1.1(i)

- Is it ethical to investigate racial differences in intelligence? Some people answer, very seriously, "No."
- Is it ethical to study brain function in people who are mentally retarded, or to study the health of people in prison? Again, the rules make it quite difficult to proceed with these projects.
- Is it ethical to study the effect of lead house paint on children without treating the cases of lead poisoning or high blood lead you come across? No, not today, if ever it was.
- Should you take special care before publishing the argument that measles vaccines cause autism?
- You cannot escape your responsibility for demonstrating that answering the research question on which you are working (whether or not you are the person originating the question) is cost-effective as a social act.

Can it be measured? Van Belle 1.1(ii)

photographs, medical images, height and weight

readings from machines, like spectrographs or EEG's

answers to verbal questions (preferences, for instance)

extracts from medical records

vital statistics, death rates

brain function, cognitive function

social facts, like income, education, occupation

exposures and other environmental facts/factors

... and many more.

Where, when, and how will you get the data? Van Belle 1.1(iii)

You have particular obligations toward the people whose bodies or lives generated your data.

- Three of these obligations will be discussed in detail next week: informed consent, beneficence, justice.
- Subjects are giving you a gift; accept it in this spirit.

To do this honorably is more difficult than you might think. "Beneficent" for whom, for instance? The current system of science-as-profession makes conflicts of interest almost impossible to circumvent. Those conflicts will likewise be the topic of a session of this course.

What do you think the data are telling you? Van Belle 1.1(iv)

Here is where ethics comes to grips with the specific skills we are teaching you as (bio)statisticians.

As a species, we humans evolved to make decisions under uncertainty. Science is not like that. – decisions that scientists make quickly are usually bad decisions.

The rules of statistical practice are intended to protect everybody – the statistician, the patient, your colleagues and the public – against the predictable pathologies of misunderstanding or misrepresenting patterns in data that come when wishful fallible humans jump to conclusions. These rules come under the heading of ethics just like the human subjects concerns of the paragraph before.

What do you think the data are telling you? Van Belle 1.1(iv)

A data analysis is not complete until you have surveyed *and reported* the most common ways in which your seemingly reasonable numerical inference might be mistaken: heterogeneity, historical change, sampling bias, confounding, confusion, systematic measurement error, statistical insignificance (in practice, the least important of these).

Before the analysis you may have a preferred way that you hope a finding should turn out. The whole point of competent statistics is to protect the truth of findings, whatever they might be, from that perfectly natural human tendency to find what one is expecting to find.

A good statistician, like a good lawyer, is capable of arguing either side of an existential ("Does ...") scientific question with nearly equal apparent rhetorical force. It is unethical, not merely incompetent, to pursue only the explanation that agrees with one's mentor, sponsor, or earlier publications.

Essentially mimics the scientific method with an emphasis on data collection and analysis Van Belle 1.1 summary note

There are many different scientific methods. What they share are such notions as

consilience, the convergence of evidence from multiple sources

likelihood ratios according to which one hypothesis is supported by the data over a wide range of others

independence from **artifacts** or accidents of design

reproducibility and **generalizability**

But none of the preceding refer to numbers!

As statisticians we specialize in quantitative evidence, and as biostatisticians we further specialize in systems that can be poked and prodded, or that leave traces in records of poking and prodding in the past. Our skills are the skills of **rhetoric**, of persuasion based on patterns in numbers.

There is a terrific power here, especially when graphics is part of the persuasive machinery. The strengths are obvious when the underlying assumptions are true. But the statistician knows better than anybody else "how to lie with statistics," as they say. In teaching you how to detect errors in others' arguments we are also teaching you how to intentionally bias presentations of your own.

But none of the preceding refer to numbers!

But, except in this course, we do not spend enough time teaching you how to balance the two mutually contradictory human tendencies of wanting to believe and wanting to be truthful. The ethics of (bio)statistics comes from the moral dilemma of the tension between learning the truth when reality is ambiguous and telling the truth under exactly the same circumstances.

But none of the preceding refer to numbers!

In this course, we will talk about many specific cases where numbers have settled arguments or not. Some will be success stories, but the majority will be descriptions of predictable failures. Part of being an ethical statistician is to know these stories. And to know your own selves, and to understand the power you hold in your hand to persuade your colleagues of what is not true, or to misinform them of the level of confidence with which they should believe patterns – that you yourself have computed – to actually be true. Especially when they are rewarded (financially or otherwise) for some of these pattern claims, you are responsible for keeping a lot of other stakeholders honest. This is an awesome task – gatekeepers of the most important claims about causes and effects in the biological sciences, especially the human biological and medical sciences. Over the next ten weeks we will try to teach you some strategies that will help you do this job as well as you can.

Science and Its Goals

- Goals of science:
  - Give accurate description of nature
  - Develop explanatory theories and hypotheses
  - Make reliable predictions
  - Eliminate errors and biases
  - Teach the next generation and inform the public
- Scientific method: process for justifying scientific beliefs
- "Science is a profession in which individuals cooperate together in order to advance human knowledge, eliminate ignorance, and solve practical problems" (Resnik 1998 p 41)

Scientific Method

1. Pose a research problem
2. Develop a working hypothesis
3. Make predictions based on the hypothesis and background knowledge
4. Design an experiment to test the hypothesis
5. Perform the experiment to test the hypothesis
6. Analyze the data
7. Interpret the data
8. Confirm or disconfirm the hypothesis
9. Disseminate results

Ethics and Morals

- Roots:
  - Moralitas, mores (Latin) → morals
  - Ethos (Greek) → ethics
- Morality: multiple uses
  - Authoritative code of conduct about right and wrong (descriptive morality)
  - Ideal code of conduct (universal, normative morality)
  - Synonymous with ethics – systematic philosophic study of the moral domain
- Ethics: multiple uses
  - The rules or standards governing the conduct of a person or the conduct of the members of a profession
  - System of moral principles
  - Branch of philosophy that deals with morality and is concerned with distinguishing between right and wrong human actions

➔ Ethics refers to both morality and ethical theory

Note: We speak of medical or statistical ethics, not morals

Historical Perspectives

- "Virtue is its own reward." *Cicero, c.a. 100 B.C.*
- The unexamined life is not worth living. -- *Socrates* (~460 BC)
- Socrates' position (2500 yrs ago): Ethics consists of knowing what we ought to do, and such knowledge can be taught
- From the Tao Te Ching (written between the 7 and 4 centuries BCE) on how to live ethically:

  In dwelling, live close to the earth
  In thinking, be open to new ideas
  In relationships, be kind
  In speech, tell the truth and keep your word
  In leading people, demonstrate integrity
  In daily matters, be competent
  In taking action, consider the appropriate timing

What Is Ethics?

- Branch of philosophy that encompasses right conduct and good life
- Broader than assessing right and wrong
- Includes personally reflecting on ideas and beliefs associated with behaviors and actions.
- In considering ethics, we start with the idea that there are certain things, irrespective of culture, country, gender, color or profession, that are *right* or *wrong*.
  - This is a controversial idea among professional ethicists, but a useful perspective initially
  - Use this understanding to define and adhere to moral standards of behavior

Ethical Approaches

- Normative
  - Standards of right and wrong
- Non-normative:
  - Descriptive
    - Investigation of behaviors and beliefs
  - Metaethics
    - Concerned with the meaning or nature of ethical judgments and principles
    - Analysis of language and concepts such as a right, an obligation, a responsibility

From: Wikipedia and *Principles of Biomedical Ethics, 4th Edition, Beauchamp & Childress, Oxford University Press, 1994*

Why Study Ethics?

- It is the right thing to do
- It is a crucial part of modern statistics and science
- It may save lives
- It may keep you out of trouble
- Statisticians as "keepers of the scientific method"

Cournand's Code of the Scientist

- **Intellectual integrity and objectivity** – unremitting honesty in scientific investigation; minimize subjectivity in science; depends on sensitive discernment and a strict conscience. Affects choices of which problems to investigate, how to present data and interpret results
- **Tolerance** – recognize creative potential; don't discard new ideas out of hand or waste time on obvious nonsense
- **Doubt of certitude** – question authoritative assertions; readiness to question accepted certainties
- **Recognition of error** – cruder forms are easily avoided but more subtle forms are difficult to discern; recognition, acknowledgment, and admission of error favor progress
- **Unselfish engagement** – primary purpose of scientific engagement is not personal gain or promotion of an ideology
- **Communal spirit** – respect participation in the larger scientific enterprise

Source: Cournand 1977

Limitations and Ambiguities of the Code

- Principles may reinforce or be in competition with each other, depending upon the situation
- Norms do not cover all situations
- Application of the norms is not always unequivocal; applications often depend on implicit or explicit assignment of weights to each norm
- Code encourages conduct which, in some situations, facilitates reconciliation of opposed positions (because of its informality and ambiguity)

Source: Cournand 1977

Threats and Stresses to the Code

- **Nonobservance of the norms of the code** – intolerance, abuse of authority, non-recognition of priority, selective dissemination, biasing influences of pecuniary gains and desires for publicity and personal recognition, unforeseen temptations, fraudulent conduct
- **Denial of the principle of objectivity** –
  - Blatant: willful distortion of observation and interpretation by desires and fears
  - Subtle: lack of fine discernment and discretion in the interpretation of data (by e.g. favoring prior beliefs over observation)
- **Overspecialization** – infringes on the norm of universalism by breaking up the scientific community
  - Note the potential for statisticians to provide balance
- **The growing concern of society about science** strains the primacy of disinterested pursuit of knowledge
  - Society has more at stake because scientific advances have been incorporated into many spheres of life
  - Science has an increased capacity to affect the order of nature and man (e.g. nuclear physics, genetics)

Source: Cournand 1977

Doing Good

- "Happiness is the exercise of vital powers, along lines of excellence, in a life affording them scope" *Aristotle (or Edith Hamilton 1930)*

General Ethical Concerns for Scientists and Statisticians

Additional concerns

- Sloppy records
- Omission of data
- Improper use of statistics
- Ideas and intellectual property -- use of "overheard" ideas
- Professional responsibility
- Do the ends justify the means?
- The professional-client (or patient) relationship
- Pet hypotheses
- Gender or race bias
- Treating others with respect
- Conflict of interest
- Rationing scarce treatments to patients

from Buddy Ratner, UW Bioengineering

ASA Ethics Case Study #1

"After the Fact" Co-author?

As a professional statistician, you are called by a colleague to examine and "bless" a biomedical experimental report. You are urged to do it quickly because the report has already been submitted and accepted for publication in a prestigious journal in the author's field. One of the reviewers, however, had suggested that a quick review by a statistician might be in order. To your horror, the report appears to be utter statistical nonsense. The data were not sampled according to any plan, but rather were drawn from various similar experiments done for different purposes. There is no reason to assume the observations were random or independent within or among data sets. There was no definition of how many data points had been originally available or how those used had been selected. The scatter plots within the paper were plainly skewed, but the computer statistical tests which had been run would have presumed a normal distribution. You explain gently that the statistical work is not an asset to the paper and could prove embarrassing to the author and the institution if published. You suggest that he eliminate the statistical portions and describe his work based on the qualitative reasoning which he obviously used. Initially very angry, he calms down and says, "I'll leave the contents alone, but I will add you as a coauthor. How's that?"

How do you reply? How is your reply conditioned by the relative power positions you may hold? If you are unable to reach an accommodation with the author, under what conditions, if any, would you write to the journal editor to preclude publication? Under what conditions, if any, would you decline to comment on the paper yourself, but refer the author to another colleague whose statistical expertise you consider to be so minimal that he or she might approve the paper as written?