Ethical Guidelines for Statistical Practice

American Statistical Association

Prepared by the Committee on Professional Ethics

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Executive Summary

This document contains two parts: **I. Preamble** and **II. Ethical Guidelines.** The Preamble addresses **A. Purpose of the Guidelines, B. Statistics and Society,** and **C. Shared Values.** The purpose of the document is to encourage ethical and effective statistical work in morally conducive working environments. It is also intended to assist students in learning to perform statistical work responsibly. Statistics plays a vital role in many aspects of science, the economy, governance, and even entertainment. It is important that all statistical practitioners recognize their potential impact on the broader society and the attendant ethical obligations to perform their work responsibly. Furthermore, practitioners are encouraged to exercise "good professional citizenship" in order to improve the public climate for, understanding of, and respect for the use of statistics throughout its range of applications.

The **Ethical Guidelines** address eight general topic areas and specify important ethical considerations under each topic. **A. Professionalism** points out the need for competence, judgment, diligence, self-respect, and worthiness of the respect of other people. **B. Responsibilities to Funders, Clients, and Employers** discusses the practitioner's responsibility for assuring that statistical work is suitable to the needs and resources of those who are paying for it, that funders understand the capabilities and limitations of statistics in addressing their problem, and that the funder's confidential information is protected. **C. Responsibilities in Publications and Testimony** addresses the need to report sufficient information to give readers, including other practitioners, a clear understanding of the intent of the work, how and by whom it was performed, and any limitations on its validity. **D. Responsibilities to Research Subjects** describes requirements for protecting the interests of human and animal subjects of research -- not only during data collection but also in the analysis,

interpretation, and publication of the resulting findings. **E. Responsibilities to Research Team Colleagues** addresses the mutual responsibilities of professionals participating in multidisciplinary research teams. **F. Responsibilities to Other Statisticians or Statistical Practitioners** notes the interdependence of professionals doing similar work, whether in the same or different organizations. Basically, they must contribute to the strength of their professions overall, by sharing non-proprietary data and methods, by participating in peer review, and by respecting differing professional opinions. **G. Responsibilities Regarding Allegations of Misconduct** addresses the sometimes painful process of investigating potential ethical violations and treating those involved with both justice and respect. Finally, **H. Responsibilities of Employers, Including Organizations, Individuals, Attorneys, or Other Clients Employing Statistical Practitioners** encourages employers and clients to recognize the highly interdependent nature of statistical ethics and statistical validity. Employers and clients must not pressure practitioners to produce a particular "result" regardless of its statistical validity. They must avoid the potential social harm that can result from the dissemination of false or misleading statistical work.

I. PREAMBLE

A. Purpose of the Guidelines

The American Statistical Association's Ethical Guidelines for Statistical Practice are intended to help statistical practitioners make and communicate ethical decisions. Clients, employers, researchers, policy makers, journalists, and the public should be urged to expect that statistical practice will be conducted in accordance with these guidelines and to object when it is not. While learning how to apply statistical theory to problems, students should be encouraged to use these guidelines whether or not their target professional specialty will be "statistician." Employers, attorneys, and other clients of statistical practitioners have a responsibility to provide a moral environment that fosters the use of these ethical guidelines.

Application of these or any other ethical guidelines generally requires good judgment and common sense. The guidelines may be partially conflicting in specific cases. The application of these guidelines in any given case can depend on issues of law and shared values, work-group politics, the status and power of the individuals involved, and the extent to which the ethical lapses pose a threat to the public, to one's profession, or to one's organization. The

individuals and institutions responsible for making such ethical decisions can receive valuable assistance by discussion and consultation with others, particularly persons with divergent interests with respect to the ethical issues under consideration.

B. Statistics and Society

The professional performance of statistical analyses is essential to many aspects of society. The use of statistics in medical diagnoses and biomedical research may affect whether individuals live or die, whether their health is protected or jeopardized, and whether medical science advances or gets sidetracked. Life, death, and health, as well as efficiency, may be at stake in statistical analyses of occupational, environmental, or transportation safety. Early detection and control of new or recurrent infectious diseases depend on sound epidemiological statistics. Mental and social health may be at stake in psychological and sociological applications of statistical analysis.

Effective functioning of the economy depends on the availability of reliable, timely, and properly interpreted economic data. The profitability of individual firms depends in part on their quality control and their market research, both of which should rely on statistical methods. Agricultural productivity benefits greatly from statistically sound applications to research and output reporting. Governmental policy decisions regarding public health, criminal justice, social equity, education, the environment, the siting of critical facilities, and other matters depend in part on sound statistics.

Scientific and engineering research in all disciplines requires the careful design and analysis of experiments and observations. To the extent that uncertainty and measurement error are involved -- as they are in most research -- research design, data quality management, analysis, and interpretation are all crucially dependent on statistical concepts and methods. Even in theory, much of science and engineering involves natural variability. Variability, whether great or small, must be carefully examined both for random error and for possible researcher bias or wishful thinking.

Statistical tools and methods, like many other technologies, can be employed either for social good or for evil. The professionalism encouraged by these guidelines is predicated on their use in socially responsible pursuits by morally responsible societies, governments, and employers. Where the end purpose of a statistical application is

itself morally reprehensible, statistical professionalism ceases to have ethical worth**.**

C. Shared Values

Because society depends on sound statistical practice, all practitioners of statistics, whatever their training and occupation, have social obligations to perform their work in a professional, competent, and ethical manner. This document is directed to those whose primary occupation is statistics. Still, the principles expressed here should also guide the statistical work of professionals in all other disciplines that use statistical methods. All statistical practitioners are obliged to conduct their professional activities with responsible attention to:

1. The social value of their work and the consequences of how well or poorly it is performed. This includes respect for the life, liberty, dignity, and property of other people.
2. The avoidance of any tendency to slant statistical work toward predetermined outcomes. (It is acceptable to advocate a position; it is not acceptable to misapply statistical methods in doing so.)
3. Statistics as a science. (As in any science, understanding evolves. Statisticians have a body of established knowledge but also many unresolved issues that deserve frank discussion.)
4. The maintenance and upgrading of competence in their work.
5. Adherence to all applicable laws and regulations, as well as applicable international covenants, while also seeking to change any of those that are ethically inappropriate.
6. Preservation of data archives in a manner consistent with responsible protection of the safety and confidentiality of any human beings and organizations involved.

In addition to ethical obligations, good professional citizenship encourages:

7. Collegiality and civility with fellow professionals.
8. Support for improved public understanding of and respect for statistics.
9. Support for sound statistical practice, especially when it is unfairly criticized.
10. Exposure of dishonest or incompetent uses of statistics.
11. Service to one's profession as a statistical editor, reviewer, or association official and service as an active participant in (formal or informal) ethical review panels.

II. ETHICAL GUIDELINES

A. Professionalism

1. Strive for practical relevance in statistical analyses. Typically, each study should be based on a competent understanding of the subject matter issues, statistical protocols that are clearly defined for the stage (exploratory, intermediate, or final) of analysis before looking at those data that will be decisive for that stage, and technical criteria to justify both the practical relevance of the study and the amount of data to be used.
2. Guard against the possibility that a predisposition by investigators or data providers might predetermine the analytic result. Employ data selection or sampling methods and analytic approaches that are designed to assure valid analyses in either frequentist or Bayesian approaches.
3. Remain current in dynamically evolving statistical methodology; yesterday's preferred methods may be barely acceptable today and totally obsolete tomorrow.

4. Assure that adequate statistical and subject-matter expertise are both applied to any planned study. If this criterion is not met initially, it is important to add the missing expertise before completing the study design.
5. Use only statistical methodologies suitable to the data and to obtaining valid results. For example, address the multiple potentially confounding factors in observational studies, and use due caution in drawing causal inferences
6. Do not join a research project unless you can expect to achieve valid results and unless you are confident that your name will not be associated with the project or resulting publications without your explicit consent.
7. The fact that a procedure is automated does not ensure its correctness or appropriateness; it is also necessary to understand the theory, the data, and the methods used in each statistical study. This goal is served best when a competent statistical practitioner is included early in the research design, preferably in the planning stage.
8. Recognize that any frequentist statistical test has a random chance of indicating significance when it is not really present. Running multiple tests on the same data set at the same stage of an analysis increases the chance of obtaining at least one invalid result. Selecting the one "significant" result from a multiplicity of parallel tests poses a grave risk of an incorrect conclusion. Failure to disclose the full extent of tests and their results in such a case would be highly misleading.
9. Respect and acknowledge the contributions and the intellectual property of others.
10. Disclose conflicts of interest, financial and otherwise, and resolve them. This may sometimes require divestiture of the conflicting personal interest or recusal or withdrawal from the professional activity. Examples where conflict of interest may be problematic include grant reviews, other peer reviews, and tensions between scholarship and personal or family financial interests.
11. Provide only such expert testimony as you would be content to have peer reviewed.

B. Responsibilities to Funders, Clients, and Employers

1. Where appropriate, present a client or employer with choices among valid alternative statistical approaches that may vary in scope, cost, or precision.
2. Clearly state your statistical qualifications and experience relevant to your work.
3. Clarify the respective roles of different participants in studies to be undertaken.
4. Explain any expected adverse consequences of failure to follow through on an agreed-upon sampling or analytic plan.
5. Apply statistical sampling and analysis procedures scientifically, without predetermining the outcome.
6. Make new statistical knowledge widely available, in order to provide benefits to society at large beyond your own scope of applications. Statistical methods may be broadly applicable to many classes of problem or application. (Statistical innovators may well be entitled to monetary or other rewards for their writings, software, or research results.)
7. Guard privileged information of the employer, client, or funder.
8. Fulfill all commitments.
9. Accept full responsibility for your professional performance.

C. Responsibilities in Publications and Testimony

1. Maintain personal responsibility for all work bearing your name; avoid undertaking work or coauthoring publications for which you would not want to acknowledge responsibility. Conversely, accept (or insist upon) appropriate authorship or acknowledgment for professional statistical contributions to research and the resulting publications or testimony.
2. Report statistical and substantive assumptions made in the study.
3. In publications or testimony, identify who is responsible for the statistical work if it would not otherwise be apparent.
4. Make clear the basis for authorship order, if determined on grounds other than intellectual contribution. Preferably, authorship order in statistical publications should be by degree of intellectual contribution to the study and to the material to be published, to the extent that such ordering can feasibly be determined. When some other rule of authorship order is used in a statistical publication, the rule used should be disclosed in a footnote or endnote. (Where authorship order by contribution is assumed by those making decisions about hiring, promotion, or tenure, for example, failure to disclose an alternative rule may improperly damage or advance careers.)
5. Account for all data considered in a study and explain the sample(s) actually used.

6. Report the sources and assessed adequacy of the data.
7. Report the data cleaning and screening procedures used, including any imputation.
8. Clearly and fully report the steps taken to guard validity. Address the suitability of the analytic methods and their inherent assumptions relative to the circumstances of the specific study. Identify the computer routines used to implement the analytic methods.
9. Where appropriate, address potential confounding variables not included in the study.
10. In publications or testimony, identify the ultimate financial sponsor of the study, the stated purpose, and the intended use of the study results.
11. When reporting analyses of volunteer data or other data not representative of a defined population, include appropriate disclaimers.
12. Report the limits of statistical inference of the study and possible sources of error. For example, disclose any significant failure to follow through fully on an agreed sampling or analytic plan and explain any resulting adverse consequences.
13. Share data used in published studies to aid peer review and replication, but exercise due caution to protect proprietary and confidential data, including all data which might inappropriately reveal respondent identities.
14. As appropriate, promptly and publicly correct any errors discovered after publication.
15. Write with consideration of the intended audience. (For the general public, convey the scope, relevance, and conclusions of a study without technical distractions. For the professional literature, strive to answer the questions likely to occur to your peers.)

D. Responsibilities to Research Subjects (including census or survey respondents and persons and organizations supplying data from administrative records, as well as subjects of physically or psychologically invasive research)

1. Know about and adhere to appropriate rules for the protection of human subjects, including particularly vulnerable or other special populations who may be subject to special risks or who may not be fully able to protect their own interests. Assure adequate planning to support the practical value of the research, the validity of expected results, the ability to provide the protection promised, and consideration of all other ethical issues involved. Some pertinent guidance is provided in key references 3 - 7 at the end of this document for U.S. law, the U.N. Statistical Commission, and the International Statistical Institute. Laws of other countries and their subdivisions and ethical principles of other professional organizations may provide other guidance.
2. Avoid the use of excessive or inadequate numbers of research subjects by making informed recommendations for study size. These recommendations may be based on prospective power analysis, the planned precision of the study endpoint(s), or other methods to assure appropriate scope to either frequentist or Bayesian approaches. Study scope should also take into consideration the feasibility of obtaining research subjects and the value of the data elements to be collected.
3. Avoid excessive risk to research subjects and excessive imposition on their time and privacy.
4. Protect the privacy and confidentiality of research subjects and data concerning them, whether obtained directly from the subjects, from other persons, or from administrative records. Anticipate secondary and indirect uses of the data when obtaining approvals from research subjects; obtain approvals appropriate for peer review and for independent replication of analyses.
5. Be aware of legal limitations on privacy and confidentiality assurances. Do not, for example, imply protection of privacy and confidentiality from legal processes of discovery unless explicitly authorized to do so.
6. Before participating in a study involving human beings or organizations, analyzing data from such a study, or accepting resulting manuscripts for review, consider whether appropriate research subject approvals were obtained. (This safeguard will lower your risk of learning only after the fact that you have collaborated on an unethical study.) Consider also what assurances of privacy and confidentiality were given and abide by those assurances.
7. Avoid or minimize the use of deception. Where it is necessary and provides significant knowledge, as in some psychological, sociological, and other research, assure prior independent ethical review of the protocol and continued monitoring of the research.
8. Where full disclosure of study parameters to subjects or to other investigators is not advisable, as in some randomized clinical trials, generally inform them of the nature of the information

withheld and the reason for withholding it. As with deception, assure independent ethical review of the protocol and continued monitoring of the research.
9. Know about and adhere to appropriate animal welfare guidelines in research involving animals. Assure that a competent understanding of the subject matter is combined with credible statistical validity.

E. Responsibilities to Research Team Colleagues

1. Inform colleagues from other disciplines about relevant aspects of statistical ethics.
2. Promote effective and efficient use of statistics by the research team.
3. Respect the ethical obligations of members of other disciplines as well as your own.
4. Assure professional-quality reporting of the statistical design and analysis.
5. Avoid compromising statistical validity for expediency, but use reasonable approximations as appropriate.

F. Responsibilities to Other Statisticians or Statistical Practitioners

1. Promote sharing of (nonproprietary) data and methods. As appropriate, make suitably documented data available for replicate analyses, metadata studies, and other suitable research by qualified investigators.
2. Be willing to help strengthen the work of others through appropriate peer review. When doing so, complete the review promptly and well.
3. Assess methods, not individuals.
4. Respect differences of opinion.
5. Instill in students a positive appreciation for the practical value of the concepts and methods they are learning.
6. Use professional qualifications and the contributions of the individual as an important basis for decisions regarding statistical practitioners' hiring, firing, promotion, work assignments, publications and presentations, candidacy for offices and awards, funding or approval of research, and other professional matters. Avoid as best you can harassment of or discrimination against statistical practitioners (or anyone else) on professionally irrelevant bases such as *race, color, ethnicity, sex, sexual orientation, national origin, age, religion, nationality, or disability.*

G. Responsibilities Regarding Allegations of Misconduct

1. Avoid condoning or appearing to condone careless, incompetent, or unethical practices in statistical studies conducted in your working environment or elsewhere.
2. Deplore all types of professional misconduct, not just plagiarism and data fabrication or falsification. Misconduct more broadly includes all professional dishonesty, by commission or omission, and, within the realm of professional activities and expression, all harmful disrespect for people, unauthorized use of their intellectual and physical property, and unjustified detraction from their reputations.
3. Recognize that differences of opinion and honest error do not constitute misconduct; they warrant discussion but not accusation. Questionable scientific practices may or may not constitute misconduct, depending on their nature and the definition of misconduct used.
4. If involved in a misconduct investigation, know and follow prescribed procedures. Maintain confidentiality during an investigation, but disclose the results honestly after the investigation has been completed.
5. Following a misconduct investigation, support the appropriate efforts of the accused, the witnesses, and those reporting the possible scientific error or misconduct to resume their careers in as normal a manner as possible.
6. Do not condone retaliation against or damage to the employability of those who responsibly call attention to possible scientific error or misconduct.

H. Responsibilities of Employers, Including Organizations, Individuals, Attorneys, or Other Clients Employing Statistical Practitioners

1. Recognize that the results of valid statistical studies cannot be guaranteed to conform to the expectations or desires of those commissioning the study or the statistical practitioner(s). Any measures taken to assure a particular outcome will lessen the validity of the analysis.
2. Valid findings result from competent work in a moral environment. Pressure on a statistical practitioner to deviate from these guidelines is likely to damage both the validity of study results and the professional credibility of the practitioner.
3. Make new statistical knowledge widely available in order to benefit society at large. (Those who have funded the development of new statistical innovations are entitled to monetary and other rewards for their resulting products, software, or research results.)
4. Support sound statistical analysis and expose incompetent or corrupt statistical practice. In cases of conflict, statistical practitioners and those employing them are encouraged to resolve issues of ethical practice privately. If private resolution is not possible, recognize that statistical practitioners have an ethical obligation to expose incompetent or corrupt practice before it can cause avoidable harm to research subjects or society at large.
5. Recognize that within organizations and within professions using statistical methods generally, statistical practitioners with greater prestige, power, or status have a responsibility to protect the professional freedom and responsibility of more subordinate statistical practitioners to comply with these guidelines.
6. Do not include statistical practitioners in authorship or acknowledge their contributions to projects or publications without their explicit permission.

Key References:

1. American Statistical Association. Discussions of the statistics profession and information about the organization are available on the Association's home Web site: **http://www.amstat.org**

2. These ethical guidelines, case studies in statistical ethics, and other related resources and links can be found at the Ethics and Statistics Web site: **http://www.tcnj.edu/~ethcstat**

3. U.S. Federal regulations regarding human subjects protection are contained in Title 45 of the Code of Federal Regulations, Chapter 46 (45 CFR 46), accessible at: **http://www.access.gpo.gov/cgi-bin/cfrassemble.cgi?title=199845**, using the search term "46."

4. *The Belmont Report: Ethical Principles and Guidelines for the Protection of Human Subjects of Research* is available through the Office for the Protection from Research Risks at: **http://grants.nih.gov/grants/oprr/humansubjects/guidance/belmont.htm**

5. Title 13, U.S. Code, Chapter 5 - Censuses, Subchapter II - Population, housing, and unemployment, Sec. 141 restricts uses of U.S. population census information. Similar restrictions may apply in other countries.

6. The International Statistical Institute's 1985 *Declaration on Professional Ethics* is available at: **http://www.cbs.nl/isi/ethics.htm**

7. The United Nations Statistical Commission's 1994 *Fundamental Principles of Official Statistics* is available at: **http://unstats.un.org/unsd/goodprac/bpabout.asp**

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