

W. EDWARDS DEMING, PH.D.
CONSULTANT IN STATISTICAL STUDIES

Code of Professional Conduct

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I. Introductory Remarks

1. I aim to engage only in work that offers opportunity to create new statistical methods, or to use existing methods (i) to help other scientists and professional men to improve their research; or (ii) to acquire new knowledge through planned research about materials and about man; or (iii) to improve efficiency, uniformity, quality, service, and performance of product; or (iv) to achieve smoother operation and more effective administration and management in industry and in government.

2. I make no solicitation for engagements, but depend on recommendations. Speeches and publication of books, and of papers in professional and scientific journals, which explain new statistical techniques, or which explain to people in other professions various ways in which statistical work may be helpful toward the acquirement of new knowledge, and toward the achievement of more efficient production, smoother operation, and better performance, etc., are the duty of any statistician, and are not in any sense solicitation on my own behalf.

3. An engagement with a client carries with it certain responsibilities. The reason for stating them explicitly is (i) to enable me to render better service; (ii) to forestall disappointment on the part of the client, who if he fails to exercise his responsibilities in the planning of the survey or experiment, may not realize in the end its fullest possibilities, or may discover too late that certain uses that he intended to make of the results are impossible.

II. Obligations of the Client

4. I will expect the client to provide expert knowledge of his own subject-matter or business. My contribution will be statistical. As paragraph 10 explains, I shall offer guidance from the viewpoint of statistical theory and experience, to assist the client in the formulation of his problem, and in understanding statistical operations, and the nature and meaning of statistical results. However, any assistance that I offer does not involve me in decisions that the client is ultimately and rightfully responsible for, specifically:

- (a) The type of statistical information that may be helpful on his problem.
- (b) The methods of test, examination, questionnaire, or interview, by which to elicit the information from any unit selected for investigation.
- (c) The decision on whether a proposed frame is satisfactory. In general, a frame is satisfactory to the client if it contains the people, areas, establishments, materials, parts, or other units that would satisfy his needs if the whole content were included in the study. The frame must also in some studies specify the levels or ranges of concentration.

dosages, pressures, temperatures, speeds, voltages, or other stresses that the client certifies as necessary and sufficient.

- (d) The decision on the classes and areas of tabulation, as these depend on the uses that he intends to make of the data.
- (e) The decision on the approximate level of statistical precision or protection that would be desirable in view of the purpose of the investigation, the skills and time available, and the costs of certain operations. I will offer assistance in this decision, to the extent possible, by explaining to him the procedure, predicted precision, advantages and disadvantages of various statistical plans that appear to be feasible (see paragraph 10b).
- (f) The actual work of preparing the frame for sampling, such as serializing and identifying sampling units at the various stages.
- (g) The selection of the sample according to procedures that I shall prescribe, and preparation for the investigation of the units selected.
- (h) The actual training, testing, interviewing, or other investigation, including of course the supervision of this work.
- (i) The coding and processing, the tabulations and computations, following procedures of estimation that the sampling plans prescribe.

5. The development of the statistical procedures may require experimentation and trial, with successive revisions. The client will carry out my instructions for these explorations, and he will stand the expense therefor.

6. The client will make no change in the statistical procedures without direction from me so long as my responsibility is in force. He will nevertheless inform me at once if he discovers any departure from instructions, as immediate report of a difficulty may permit unbiased adjustment at low cost.

7. The sampling procedures will include, unless omitted by agreement, instructions for statistical controls or probes of the execution of the sampling procedures, and of the consistency of the tests or interviews, the purpose being to detect difficulties and persistent departures from the procedures specified. The probes may include re-investigation of certain units, or of an auxiliary sample of units. They may include verification of computations, and such other tests as seem to me warranted by circumstances. The aim of these probes will be to furnish information on which to evaluate the statistical reliability of the results. The client will carry out these probes according to my instructions, and will furnish to me the results thereof. He will stand the expense therefor.

8. The client will arrange for me to have direct access at any time to the people that carry out the preparation of the sample, the testing or the interviewing, the supervision, and the computation.

9. The client will assume financial obligation for my services and for expenses for travel and for auxiliary requirements such as special tabulations or assistance of another specialist.

III. Obligations of the Statistician

10. In summary, my responsibility covers the statistical aspects of a study. Specifically, I will:

- (a) Assist the client to formulate his problem in statistical terms, in an attempt to enhance the usefulness of the investigation.

- (b) Explain to him the procedure, cost, and use of various possible frames, and of various statistical plans of sampling and of experimentation that seem to be feasible. Prediction of the precision that any plan will deliver is usually dependent on the information that the client furnishes in advance concerning the frame, and hence may differ from the actual precision delivered.
- (c) Explain to him that the results of any survey or experiment may be impaired if a proposed frame and the experimental conditions specified by him fail to include all the material, methods, levels, types, stresses or ranges thereof concerning which he desires information.
- (d) Explain to him that any objective inferences that one may draw by statistical theory from the results of an investigation can only refer to the material in the frame, including the methods, levels, types, stresses, or ranges thereof presented for study: that generalizations to other materials, methods, and conditions are substantive, and will be his responsibility.

11. The final decision on the sampling procedures will be mine, and I will furnish instructions therefor in writing.

12. The sampling procedures will define the sampling units, and will specify how to classify and number them in the frame. The sampling table for the actual selections will follow when the client certifies that the preparation of the frame is complete, including the scheme for serializing the sampling units, or that this work will be independent of the sampling table. I will in some cases, instead of furnishing the sampling table, specify the exact procedure by which to construct it.

13. The sampling procedures will include formulas for the computation of estimates, standard errors, and other statistical measures that may facilitate statistical inferences of the data.

14. I will explain to the client the effects of departures from the procedures specified.

15. The sampling procedures will ordinarily include also statistical controls or probes to detect difficulties and departures (paragraph 7).

16. I will furnish at the client's request statistical procedures for him to use as aids in supervision, to detect blemishes in the work as it proceeds and to attain more uniform performance in the preparation, testing, interviewing, and other processing, than would be achieved otherwise.

17. Assessment of the statistical reliability of the results, in the form of a report or testimony, will be my responsibility.

IV. Some Points concerning the Interpretation of the Results, and about the Statistical Report or Testimony

18. My report on the statistical reliability of the results, and any testimony, will be based on figures and other records that the client furnishes to me at my request for the result of the study. It will state which aspects of the survey my responsibility included and which aspects the procedures delegated to the client. It will estimate the margins of uncertainty that one might reasonably ascribe to the use of sampling and to small accidental variations in processing, including variability in the judgment of investigators and coders. It will include any meaningful

outside comparisons that I made; also interpretation of any formal probe (paragraph 7) for the detection and measurement of persistent errors that might arise from:

- (a) Failure to select sampling units according to the procedure prescribed.
- (b) Failure to reach and to cover sampling units that were designated in the sampling table.
- (c) Inclusion of sampling units not designated for the sample but nevertheless covered and included in the results.
- (d) Other slips and departures from the procedure prescribed.
- (e) Errors and difficulties in eliciting the information desired.
- (f) Wrong information in the documents that form the source of the information.
- (g) Nonresponse.

19. If there was no probe or examination, my statement will say so.

20. The client agrees that if he prints or publishes my report, he will print it in full, and will not omit any part of it without my consent.

21. The client will not mention my participation in a study, verbally or in correspondence or in print, without my approval. I will furnish any description of the sampling procedure or statement of statistical reliability that is to appear in print with my name, and I must see the whole of the accompanying text. The client will pay the cost of my services for this writing.

22. I will not recommend to the client that he take any specific administrative action or policy as a result of the study. My responsibility ends with the statistical interpretation of the results.

V. Fees

23. The annual fee for regular consultation on a continuing basis will be agreed upon in advance, subject to change by agreement. The client may of course spread payments throughout the year at his convenience. Otherwise, he will receive a bill at the end of every year. With respect to an engagement for a single study, I will send a bill at completion, or possibly at the end of a year if completion appears to be far in the future. I do not itemize time nor regular office expenses for service: my fee will be based on my subjective judgment of the relative effort expended on behalf of the engagement. Irregular expenses such as for travel, or for tabulations done outside my office, are extra, and I may from time to time send a bill to bring them up to date.

24. I do not estimate in advance what my fee might be for participation in a single study. My fees are not competitive. I do not tailor my participation to fit a price. Another point is that the client too often has no idea about the efficiency and economy that statistical theory and techniques can contribute to his study, hence has no basis on which to compare cost against returns. Moreover, neither of us may foresee the complications and duration of a proposed study.

25. In conformity with this last paragraph and with paragraph 2, I will draw up plans for a study and for statistical participation therein only as a professional engagement. I do not make competitive proposals.

26. There will be a fee for an exploratory consultation.

27. I may, at my discretion, engage counsel of another specialist. Such an arrangement requires no clearance from the client except by specific restriction in the interest of confidentiality. Necessity for protracted assistance may call for separate financial arrangements between my

client and the specialist. The choice of the specialist will ordinarily be mine.

28. I will make appropriate arrangements at my expense for competent statistical guidance during any prolonged absence that I may elect to take for vacation, meeting, lectures, or disability. If the client elects to engage some other statistician during my absence, he may do so, but at his own expense and subject to my review and satisfaction.

VI. There are not Proprietary Rights in Statistical Procedures

29. I may accept engagements from competitive firms. My aim is not to concentrate on the welfare of any particular client, but to raise the level of service of my profession (see paragraphs 1 and 2).

30. I will prescribe in every engagement whatever methods known to me seem to be most efficient and feasible under the circumstances. Thus, I may prescribe for firms that are competitive methods that are similar or even identical word for word in part or in entirety. Put another way, no client has proprietary right in any procedures or techniques that I prescribe.

31. I will, to the best of my ability, at his request, lend technical assistance to another statistician. In rendering this assistance, I may provide copies of procedures that I have used, along with whatever modification seems advisable. I will not, in doing this, use confidential data. Protracted assistance may of course incur necessity of a business arrangement.

VII. Other Matters

32. I may publish or describe in a professional or scientific meeting the theory and application of any statistical procedure that I use. However, I do not publish actual data or substantive results or other information about the client's business by name without his permission. An article on a study may be a joint one with the client or with other participants and colleagues.

33. I may undertake to review and report on another statistician's plans, or on a completed survey or experiment, if in my judgment this review might lead to improved statistical practice. I shall not render an opinion, however, except under arrangements that allow sufficient time for me to study the procedures, results, and conclusions that I am asked to review.

34. I will undertake an engagement for a single consultation only if in my judgment there is good promise, on the basis of the proposed agenda, of results that seem to warrant the effort and expense.

35. Each of us, client and I, has a unilateral right to break off the engagement at any time, with or without explanation. I should feel obligated to break off an engagement if the performance of the investigators or the processing does not in my judgment meet standards that are acceptable for my participation.

36. I will write my own testimony in a legal case. I will not accept offer of legal counsel to prepare my testimony, though I shall be grateful to him or to anyone else for criticism and assistance for clarification of my own writing.

37. I will not agree to use of my name as advisor to a study, nor as a member of an advisory committee, unless this service carries with it explicit responsibilities for certain prescribed phases of the study, in conformance with the rest of this code. Any service agreed to places

on me the obligation to resign at any time when in my judgment it appears that the study will not meet my requirements. I will issue an objection or a minority report at the conclusion of a study, if I am still an advisor thereto but find that I can not concur with the stated limitations of published conclusions of importance. My acceptance as advisor to a study obligates the management thereof to abide by the rules of this code and to bear the expense of publication or dissemination of any differences that in my judgment require circulation or publication.

The attention of readers is drawn to a paper by the author entitled "Principles of Professional Statistical Practice" in *Ann. Math. Statist.* (1965) **36**, 1883-1900.