Journal of Sound and Vibration (1997) **206**(5), 685–695

GUIDELINES FOR REPORTING CORE INFORMATION FROM COMMUNITY NOISE REACTION SURVEYS

COMMUNITY RESPONSE TO NOISE TEAM OF ICBEN

(The International Commission on the Biological Effects of Noise)

J. M. FIELDS (Principal and Corresponding Author)

10407 Royal Road, Silver Spring, Maryland, USA

R. G. DE JONG (Chairman)

TNO Prevention and Health, Section Environment, P.O. Box 2215, 2301 CE Leiden, The Netherlands

A. L. BROWN

School of Environmental Planning, Griffith University, Nathan, Brisbane 4111, Australia

I. H. FLINDELL

Institute of Sound and Vibration Research, University of Southampton, Southampton SO17 1BJ, England

T. GJESTLAND

SINTEF Telecom and Informatics, N-7034 Trondheim, Norway

R. F. S. JOB

Department of Psychology, University of Sydney, NSW 2006 Australia

S. KURRA

Istanbul Technical University, Faculty of Architecture, Division of Environment, Taksim 80191, Istanbul, Turkey

P. LERCHER

Institute of Social Medicine, University of Innsbruck, Austria

A. SCHUEMER-KOHRS

Elberfelderstrasse 32, D-58095 Hagen, Germany

M. VALLET

INRETS-LEN, Case 24, 69675 Bron Cedex, France

AND

T. YANO

Kumamoto University, Kurokami 2-39-1, Kumamoto 860, Japan

(*Received* 2 *June* 1997)

Difficulties in comparing the results from studies have interfered with accumulating knowledge about communities' responses to noise. Gaps in the information presented in publications have been especially serious problems for combined social and acoustical surveys of residents' responses to environmental noise. In an attempt to alleviate this

0022–460X/97/400685 + 11 $25.00/0/sv971144

problem an ICBEN team, Community Response to Noise, recommends the guidelines in this article for reporting on combined social/acoustical surveys of residents' reactions to noise. A table lists guidelines for information on 18 topics for publications of three levels of detail. The guidelines were developed in three years of correspondence with acoustical and social science experts from 12 countries. These guidlines are supported by the 11 members of the ICBEN noise team and the 26 experts listed in the article.

1. INTRODUCTION

This article concerns studies of residents' reactions to environmental noise in their communities. Although these studies differ from one another in many respects, there has been a remarkable similarity in some core features of their designs. Residents are interviewed about their reactions to a specified noise source at their residences using fixed-format questionnaires. The exposure at their residences from the specified noise source are measured or estimated using a variety of closely-related noise indices. The analysis is centered on understanding how residents' reactions to the specified noise, as reported through the questionnaire, are related to the estimated acoustical noise environment and to a range of personal and social characteristics. As in other disciplines, however, the results from these surveys are often difficult to compare.

It is widely recognized that inconsistencies in the reporting of research results hinder the accumulation of knowledge about social science generally [1]. Single studies almost never provide definitive evidence in any discipline. As a result, some degree of comparability in the reporting of research results is needed for determining whether study findings can be generalized to become core elements of the knowledge of a discipline. Acousticians, social scientists and other professionals involved in community noise studies have long recognized that such inconsistencies are major impediments to the accumulation of knowledge about acoustics and community response to noise [2–6]. There are many sources of such inconsistencies, but a source that could be relatively easily alleviated concerns the reporting of research results. With little or no change in research designs, funding, or research practices, the value of community noise response studies could be greatly increased if some minimal information were always contained in study publications.

2. THE EXTENT AND IMPACT OF INCOMPLETE AND INCONSISTENT COMMUNITY RESPONSE REPORTING

Examinations of previous attempts to synthesize the findings from community noise reaction surveys show that information gaps in publications result in incomplete basic information about studies, limit the number of studies that contribute to knowledge, create insurmountable barriers to the objective comparison of studies' results, lead to the misinterpretation of results, and sharply limit the conclusions that can be drawn about dose/response relationships and the effects of other variables on noise annoyance. Over 360 studies of combined acoustical and social surveys of environmental noise have been described in English language publications of which 318 were available in 1989 [7]. While many studies meet their own study goals, only a small proportion have contributed to the broader goal of developing generalizable, scientific knowledge about residents' reactions to environmental noise. Although some studies' contributions are limited by fundamental data collection and analysis decisions, a surprisingly large number of studies' contributions are limited by simple reporting practices.

The preparation of a catalog of social surveys of residents' reactions to environmental noise revealed many instances in which basic information was lacking in study reports [7].

Extensive efforts were needed through personal communication with authors to locate basic information about dates, location, sample size, study design, publications, and, in a few cases, even whether or not two publications by the same author referred to a single set of data or to multiple sets of independently collected data. When this catalog was updated in 1993 (not published), a total of 425 studies were located that had been cited in English language publications. Even after extensive attempts to locate information through personal communications, basic information about sample size, study location and study design could not be located for 65 studies. Further examination of the remaining 360 studies' publications (over 700) and personal communication with authors was needed to obtain additional, but still incomplete information. For example, the month/season and year of the social survey was determined for 245 (68%) of the surveys. Readers who were concerned about the seasonal conditions during the social survey would find that this could not be determined for the remaining 32%. The year was unknown for 9%. The difficulties in extracting additional, more substantive information from these studies are evident from reports that have attempted to synthesize the information from different social surveys.

The proportion of all studies that contribute to our consolidated knowledge about dose/response relationships is currently small even though a primary purpose for conducting most community noise surveys is to describe the reactions at different noise levels. At a time when an examination of the noise survey catalog would have identified about 160 surveys that gathered noise data and response information from moderate or large numbers of respondents ($N > 230$), the best-known large scale synthesis of survey results [8] used the published records from only 21 of these studies to produce graphs of percentage of survey respondents reporting a high degree of annoyance by noise level from equally large surveys ($N > 230$). A large amount of work was required to process these 21 studies. Personal contacts with the original researchers were needed to add the five more studies included in this 26-study synthesis that generated 29 dose/response curves. Although a brief examination of other survey reports revealed that 13 other similar surveys had been published in an appropriate format at that time [9], the primary barrier to including more surveys in such syntheses is the lack of publication of basic dose/response results in a format that can be compared across surveys. Several members of the committee of the International Commission on the Biological Effects of Noise (ICBEN) that support the reporting guidelines in the present article examined their own reports and determined that while the basic data had been collected they had not published the data in forms that were suitable for the synthesis.

A second example of the effect of incomplete reporting comes from an attempt to locate all of the published evidence on 20 non-acoustical variables' effects on noise response [10]. The twenty variables included 9 demographic variables (age, gender, social status, income, education, home ownership, type of dwelling, length of residence and receipt of benefits from the noise source), 5 attitudinal variables (fear of danger from the noise source, noise prevention beliefs, general noise sensitivity, beliefs about the importance of the noise source, and annoyance with non-noise impacts of the noise source), and 6 situational variables (time at home, home insulation, low ambient noise, interviewing mode, change in noise exposure, time since a change in noise exposure). A number of these non-noise variables, for example, gender and age, are collected as a matter of course in most studies. In examining over 650 publications from 282 studies there were at least 423 instances when some information was presented about the 20 topics. The basic data were reported in such a way that clearly, comparable conclusions could be drawn about any of the 20 topics in only 121 instances. In these 121 instances, the effect of noise level had been removed from the analysis (using noise estimates or analyses of within-site differences) and the size of the impacts of the non-noise variables was measured as either a percentage difference in reactions (36 instances) or the decibel equivalent of the difference in reactions (85 instances). In the 302 other instances, only a verbal judgement was reported (67 instances), only a statistical significance test was reported (80), the effect of noise level was not removed (74), only a proportion-of-variance measure was reported (73), or there was another weakness (8). The basic data were clearly available for many more than the 121 comparable findings. The many more findings would have been very valuable since all of the enumerated studies did not come to the same conclusions on each topic.

Incomplete reporting has also led to erroneous interpretations of previous studies' data. The synthesis of 26 studies described above required considerable work, but even with this work, the authors did not locate the original wording of six surveys' annoyance questions. A later effort located the wording for five of the six questions. When the exact wordings of these survey questions were examined, it was found that three of the five questions were not consistent with the synthesis criterion and should not have been included in the synthesis data curve [9].

3. PREVIOUS GUIDELINE EFFORTS AND THE APPROACH TAKEN TO DEVELOPING THESE GUIDELINES

After individually experiencing years of frustration in attempting to extract comparable information from community noise survey reports, the members of the Community Response to Noise Team of the International Commission on the Biological Effects of Noise (ICBEN) in their 1993 meeting in Nice, France adopted a five-year objective of "Enhancing the possibilities to benefit from other researchers' data" [11]. The present article represents the product of the first of the five goals under that objective: "To develop social survey reporting guidelines."

To develop the guidelines the following activities have been pursued in co-operation with the international acoustical community: reviewing previous international guideline efforts, brainstorming on guideline content during a workshop at one international acoustical meeting [12], reviewing draft guidelines at a second international acoustical meeting (1995 International Congress on Acoustics), reviewing drafts in more than 70 letters with international experts, and securing notes of support in a final round of correspondence with the ICBEN Community Response to Noise Team and the co-operating professionals listed at the end of this article.

A review of previous proposals for standardized approaches to noise/response surveys identified several attempts to develop data collection guidelines [2, 13] but no attempts to develop reporting guidelines. Professional standards for the reporting of social survey data have been established by public opinion organizations [14, 15]. Professional standards for acoustical report statements are also available in ISO Standard 1996 [16]. A thoughtful, in-depth examination of the "Possibilities and Problems" of "Guidelines for Social Scientific Noise Research" by Rohrmann reviewed past guideline efforts and interviewed international experts to develop an outline of alternative guideline approaches [3–5]. Consideration of the types of issues raised in that review led to the adoption of four principles that have provided a framework for developing the present guidelines.

The four principles that were followed in developing the current guidelines are the following:

1. *Identify limited*, *achievable goals*. The present effort concerns only the publication of study results. These goals could be independently reached by researchers with no more than minimal additional resources and without time-consuming or uncertain co-operation between researchers.

2. *Provide a tool to be used by qualified professionals*. The guidelines should provide a community noise specialist with a checklist to supplement professional judgment. Guidelines are not meant to provide basic training in acoustics or survey research.

3. *Do not inhibit innovation*. The guidelines should not dictate particular analysis methods or emphases. The guidelines attempt to identify only a minimum amount of information to be interwoven within any reporting or analysis style to ensure that the findings from one report can be readily compared with other reports. The primary organization and focus of any study report should be driven by the purposes of the particular study, not by any external reporting guidelines.

4. *Consolidate an emerging consensus among practitioners*. The international community of researchers and users should be involved in the development and review of the guidelines through workshops and correspondence.

4. RECOMMENDED MINIMAL REPORTING GUIDELINES

Guidelines for reporting research results are presented for 18 topics in Table 1. For each of the 18 topics, three levels of information disclosure are suggested that define the minimal requirements under normal circumstances for publications of three different lengths. Level I, "Limited" information disclosure, is proposed for conference papers. Level II, "Basic" information, is for journal articles. Level III, "Extended" information, is for research reports. The division of the information into three levels is to some extent arbitrary. Space permitting, the more information that is given at any level the more valuable the publication will be for comparative purposes. In addition, the particular methodological issues faced in particular studies will require more complete reporting on some topics than is recognized in Table 1.

Most of the guidelines in Table 1 are clear from the short phrases in the table. The remainder of this section gives details where the short phrases may not be clear and provides the rationale for any guidelines that are not self-evident. The discussion is organized around the six "Topic areas" in the first column of Table 1.

4.1. OVERALL SURVEY DESIGN

The information about the date, country, and primary noise source uniquely identifies a survey. Additional detailed information about locations of study sites is recommended for extended reports for small numbers of sites, if the information does not compromise the confidentiality of individual respondents' answers. If large numbers of sites preclude the description of each site, the types of sites can be summarized and maps can be presented for only a few examples of different types of sites. Maps are an efficient communication tool for displaying the diverse settlement patterns found in, for example, suburbs in the United States, city centers in established cities in continental Europe and residential areas in Japan.

4.2. SOCIAL SURVEY SAMPLE

The numbers of sites and the methods for selecting survey sites and respondents provide the background needed to understand the limits on a survey's scope and to identify the important methodological issues for a survey. The strictest definition of a response rate is the ratio of completed questionnaires to all sample selections that could *not* be definitely excluded as ineligible. This definition implies that sample selections are made without respect to respondent availability and appear in the denominator of the response rate even if residents could not be contacted. Since definitions of published response rates are often

TABLE 1

Minimal guidelines for three levels of information disclosure (Guidelines for higher levels include those from lower levels)

Topic area	Item	Topic	Level I: Limited (Conference papers)	additions for Level II: Basic (Journal articles)	additions for Level III: Extended (Reports)
Overall survey design	1.	Survey date	Year and season of social survey	Months of social survey	Dates of interviews
	2.	Site location	Country and city of study sites	Describe any important, unusual characteristics of the study period or sites	Map or description of study site locations relative to the noise source
	3.	Site selection	Rationale for site selection	Site selection & exclusion criteria ⇒	⇒⇒⇒[*Level I & II guidelines always apply*]
	4.	Site size	Number of study sites ⇒	⇒⇒⇒[*Level I guidelines always apply to Levels II & III*]	Number of responses by site
	5.	Study purpose	Identify sponsor	State original study goals	⇒⇒⇒
Social survey sample	6.	Sample selection	Respondent sample selection method (probability, judgemental, etc.)	Respondent selection procedures and exclusion criteria (age, gender, length of residence, etc.)	Sample selection forms and instructions
	7.	Sample size	Initial selected sample size	Response rate	Reason for non-response for all initial selections
Social survey data collection	8.	Survey methods	Method (face-to-face, telephone, etc.)	Interviewer training & qualifications	Interviewer & questionnaire instructions
	9.	Questionnaire wording	Exact wording of primary questionnaire items (including answer alternatives)	Exact wording of analyzed questions in both the respondents' and publication's languages	Reproduction of complete questionnaire(s), contact letters and interview & follow-up procedures
	10.	Precision of sample estimate	Number of responses for main analyses	Confidence intervals & significance tests for major results	Confidence intervals & tests for all findings
Nominal acoustical conditions (i.e., the the common reference positions and conditions that the acoustical estimates represent)	11.	Noise source	Type of primary noise source (aircraft, road traffic, etc.)	Types and levels of noise source operations that are included or excluded	Protocols to define the noise source (e.g., minimum level, operations, days of week)

TABLE 1—*Continued*

Minimal guidelines for three levels of information disclosure (*Guidelines for higher levels include those from lower levels*)

Topic area	Item	Topic	Level I: Limited (Conference papers)	additions for Level II: Basic (Journal articles)	additions for Level III: Extended (Reports)
	12.	Noise metrics	Give the complete standard label for any noise metric reported	Provide $L_{Aeq24hr}$ & DNL (or $L_{A_{eq}}$ by time period) ...OR... Conversion rule(s) to estimate $L_{Aeq24hr}$ & DNL under the specific study conditions from the study's preferred metric	Give $L_{A_{eq}24hr}$ and DNL for all locations ...OR... Discuss the adequacy of the conversion rule(s)
	13.	Time period	Hours of day represented by noise metric	Period (months, years) represented by noise metric	⇒ ⇒ ⇒
	14.	Estimation /measurement procedure	Estimation approach (modelling, measurement during sampled periods etc.)	Present or cite model version and input data ...OR... Describe sampling, measurement and estimation program	Discuss application of model ...OR... Describe noise measurement protocols, equipment, weather, etc.
	15.	Reference position	Nominal position relative to the noise source and reflecting surfaces	Present exposure (or give conversion rule) for noisiest facade excluding sound reflected from the facade	Describe measurement protocols and adjustment rules
	16.	Precision of noise estimate	Unusual factors affecting accuracy and ability to estimate long-term exposure	Best information available on accuracy of noise exposure estimates	Description of methodology for evaluating the accuracy of long-term noise exposure estimates
Basic dose /response analysis	17.	Dose/response relationships	Reactions within each category of noise exposure	Tabulation of each degree of reaction for each category of noise exposure	Answers for each response at each site Characteristics of each site
Explanatory variable	18.	Non-noise variables' impacts on reactions	Give conclusions for all variables examined (even if no effect is found)	Present the size of variables' effects controlled for noise level and in units or graphs that permit comparisons to the size of effects from noise exposure Compare the ability of noise level alone and of all explanatory variables together to explain response (e.g., correlation (r^2) and multiple correlation coefficient (R^2))	Present full regression equations for all estimated effects Give logic for selecting and excluding variables Display differences in dose/response relation for most important effects

ambiguous, the Level III report includes the response rate definition together with a detailed tabulation of the reasons for non-response.

4.3. SOCIAL SURVEY DATA COLLECTION

The single most important gap in survey reporting could be eliminated by reproducing relevant questions from the questionnaire in accord with the ethical standards for minimum reporting that are set for opinion research [14, 15]. The exact wording of the basic noise/reaction question can often resolve readers' questions about the wording of responses, possible biases in phrasing, the time period to which the question refers, the person being asked about (the respondent or family members), the identity of the noise source, and the location referenced. The questionnaire is reproduced in the original language of administration as well as in the language of publication.

A critical feature of this guideline is the request for statistical confidence intervals in addition to the less informative, dichotomous "significant"/"not significant" test results. A confidence interval shows the range of values that are consistent with the data. For a small sample, the simple "not significant" test result can suggest that the study results are inconsistent with a strong relationship, whereas the confidence intervals can show that the small sample's results are still consistent with a strong relationship. A sample may just be too small to detect moderate or even very large effects.

4.4. NOMINAL ACOUSTICAL CONDITIONS

The "nominal" acoustical conditions refer to the standard positions and operating conditions that the noise exposure estimates represent in this survey. For co-ordinated analyses with the social survey data, the acoustical descriptors should represent the time period and conditions specified in the noise reaction survey questions even if this requires adjustments to the directly-acquired acoustical data. If the noise is directly measured, full descriptions of noise measurement procedures and noise measurement equipment are needed together with an adherence to the types of reporting guidelines found in ISO Standard 1996 [16].

The guidelines make no attempt to dictate the primary noise metric and microphone location that are to be used in a report. Country-specific conventions often dictate the noise metrics and microphone placement conventions for a particular noise source for applied surveys. Developing new insights into communities' reactions to noise may dictate innovative metrics for other studies. All studies should consider a wide range of metrics. A study, for example, with a low number of noise events per day would be expected to consider the independent effect of numbers of noise events and the levels of those events. The guidelines do, however, specify a standard noise metric and nominal measurement position to be discussed in every Level II or Level III publication, even when other metrics or positions are the primary ones presented for a study.

The Level II and III guidelines for "noise metrics" and "estimation/measurement procedures" in Table 1 propose that reports should provide either data, rules of thumb, or conversion rules to estimate 24 h L_{Aeq} and DNL at the noisiest facade after excluding sound reflected from that facade. Several conversion rules might be needed if the survey was conducted for several noise sources or under several dissimilar operating conditions. The proposed nominal position has the advantage of making data that are often collected near facades (e.g., road and railway noise data) more comparable with aircraft noise data that are almost always measured away from reflecting surfaces. The exposure at the proposed position is relevant for most respondents as well, as it is similar to that experienced at an open window. The proposed metrics for cross-survey comparisons are the equivalent continuous sound level (24 h L_{Aeq} or each subsumed time-period L_{Aeq}) and the day-night average sound level (*DNL*). These are the two metrics that are most widely used internationally and that have been used in the most extensive dose/response synthesis reports [8, 17].

Topic 16, the precision of noise estimates, refers to the estimate of the long-term noise environment that is the subject of the social survey questionnaire. When short-term monitoring is used, this precision may be affected more by the sampling error inherent in sampling a few days from a day-to-day fluctuating noise environment than it is by the accuracy of the noise measurements during periods when noise measurement equipment is operating. Making accurate estimates from short-term monitoring can be difficult [18]. In the absence of a well- established, universally-accepted standard for rating the precision of estimates of long-term average acoustical environments, the guideline recommends only that the estimation methodology be fully disclosed.

4.5. DOSE/RESPONSE ANALYSIS

If one purpose of a study is to describe dose/response relationships then simple tabulations of responses by nominal noise exposures are advocated to allow other researchers to explore the form of the dose/response relationship. If sufficient interviews are available then tabulations by study site or relatively small ranges of noise levels (e.g., 3 dB) are recommended.

4.6. EXPLANATORY VARIABLE ANALYSIS

To ensure that the scientific literature faithfully presents a balanced view of research findings, survey reports should contain the results of all analyses of non-noise variables even when they are found to not be related to response. For Level II and Level III publications it is important to present the results in a way that ensures that the effects of noise level have been removed and that the sizes of the effects can be compared across surveys. Given the lack of consistency in the scales for response measures and the relative consistency in the decibel scales used for noise- exposure measures, it is recommended that an analysis be included that permits the reader to gauge the relative impact of any explanatory variable against the impact of measured amounts of noise exposure. A simple graph of the dose/response relationship within categories of an explanatory variable presents this information as do relationships between regression coefficients in more complex linear or non-linear regression analyses [19]. Because the variances of explanatory variables and the units of annoyance scales are not constant across surveys, neither correlations nor regression coefficients from bivariate analyses provide measures of the impact of explanatory variables that should be compared across surveys. Within a single survey the measure of the independent effect of explanatory variables is provided by the comparison of a measure of the ability of noise level alone and all explanatory variables (including noise level) to explain noise response. For conventional, least-squares regression the proportions of explained variance can be compared with the squared, bivariate product-moment correlation coefficient (r^2) and multiple correlation coefficient (coefficient of determination, R^2). Somewhat analogous measures are available for other measures of association.

5. AN EXAMPLE DESCRIPTION

These recommendations are consistent with the sometimes tight space requirements for conference and journal publications. For example, the ''Limited information'' (Level I) guidelines for conference papers are met by the following paragraphs that describe a recent French road traffic survey [20]:

This study has been sponsored by the Ministere de l'Equipement and Ministere de l'Environnement and conducted by INRETS to assess the impact of road traffic noise in suburban areas during evening and night time periods. The 18 *study sites include both houses and blocks of flats within* 300 *meters of three types of roads* (*local streets, major roads, urban expressways*). *Professional survey interviewers approached about* 1,200 *dwellings between September* 1993 *and June* 1994 *to conduct face-to-face interviews with* 990 *adult residents* (*age* 18–70) *who were selected on age- and gender-based quotas. The locations of the sleeping and living rooms were noted on floor plans. Noise levels for* 22 *time periods were estimated at two-meters before house facades for living and sleeping rooms based on the measurements before the front facade for* 36 *hours* (*two nights and one day*), *the most recent yearly traffic counts, and computer prediction programs* (*Microbruit or Mithra*).

The final summarizing response questions asked: "*How annoyed are you by the road traffic noise, when you are at home during* ..(*a*) *the day*..(*b*) *the night*...: *not at all, a little, moderately, or very annoyed.*" *The percentages very annoyed during the day at the corresponding values of* $L_{Aeq_{16Hr}}$ (06:00 *to* 22:00 *hours*) *estimated at the living room facade are*: 22% *at* 59 *dB*, 39% *at* 63 *dB*, *and* 74% *at* 67 *dB*. *The corresponding percentages for the night at* $L_{Aeq_{8Hr}}$ (22:00 *to* 06:00 *hours*) *estimated at the bedroom facade are*: 24% *at* 51 *dB*, 28% *at* 53 *dB*, 54% *at* 59 *dB and* 79% *at* 63 *dB*. *Age, gender, level of education and home ownership have no statistically significant effect on the noise annoyance of residents at the same noise level. At the same noise level, annoyance is greater in flats where all windows have a direct view of the main road than in those where several windows do not have a direct view. At sites with noise barriers, the annoyance is slightly lower, but not statistically significantly lower, than at sites without barriers at the same noise level.*

6. ACKNOWLEDGMENTS AND SUPPORT FOR THE GUIDELINES

These guidelines were developed under the auspices of International Noise Team 6: Community Response to Noise, one of nine noise teams of the International Commission on the Biological Effects of Noise (ICBEN). The team's members are Ronald G. de Jong (chairman), James M. Fields (co-chairman), A. Lex Brown, Ian H. Flindell, Truls Gjestland, R. F. Soames Job, Selma Kurra, Peter Lercher, Anke Schuemer-Kohrs, Michel Vallet and Takashi Yano. These guidelines benefited from the reactions of many community noise professionals who commented on earlier drafts. The following community noise professionals support the guidelines presented in this article as minimal reporting guidelines without precluding the importance of other reporting standards: Dominique Aubree, C. J. Baughan, Bernard Berry, Martin Björkman, John Bradley, Thomas Connor, Ian Diamond, Philip Dickinson, P. E. Doak, Ken Eldred, Eugene Galanter, Juichi Igarashi, George Luz, Michel Maurin, H. M. E. Miedema, Evy Öhrström, John Ollerhead, C. G. Rice, Bernd Rohrmann, August Schick, Brigitte Schulte-Fortkamp, Kevin Shepherd, Stephen Stansfeld, Lou Sutherland, Martin Taylor, Robert Zehner.

This work was supported by the National Aeronautics and Space Administration Langley Research Center (contract NAS1-19061) and by the U.S. Air Force Armstrong Laboratory.

REFERENCES

1. K. W. WACHTER and M. L. STRAF (Editors) 1990 *The Future of Meta-analysis*. New York: Russell Sage Foundation.
2. ERLAND JONSSON and PETER ATTESLANDER 1963. *Social Surveys on Reactions to Aircraft Noise*. Report Number SR(63)27 Paris, Organization for Economic Co-operation and Development (OECD), Directorate for Scientific Affairs.
3. BERND ROHRMANN 1984 *Richtlinien für Sozialwissenschaftliche Lärmforschung? Ziele, Möglichkeiten, Probleme, Emphehlungen* (Guidelines for social-scientific noise research? Aims, possibilities, problems, recommendations). Berlin: Forschungsbericht für das Umweltbundesamt.

4. Bernd Rohrmann 1985 *Proceedings of Inter Noise* 85, 145–148. Guidelines for social-scientific noise research?: possibilities and problems.
5. Bernd Rohrmann 1986 in *Contributions to Psychological Acoustics*: *Results of the Fourth Oldenburg Symposium on Psychological Acoustics* (A. Schick, H. Höge and B. Lazarus-Mainka, editors), 285–298. Comparability problems in the design of social-scientific research of environmental stressors.
6. Juichi Igarashi 1992 *Journal of the Acoustical Society of Japan* (*E*) **13**, 301–309. Comparison of community response to transportation noise: Japanese results and annoyance scale.
7. J. M. Fields 1991 *An Updated Catalog of* 318 *Social Surveys of Residents' Reactions to Environmental Noise* (1943–1989) NASA CP-187553. Washington D.C., National Aeronautics and Space Administration.
8. S. Fidell, D. S. Barber and T. J. Schultz 1991 *Journal of the Acoustical Society of America* **89**, 221–233. Updating a dosage-effect relationship for the prevalence of annoyance due to general transportation noise.
9. J. M. Fields 1994 *A Review of an Updated Synthesis of Noise/Annoyance Relationships*. NASA CR-194950. Washington D.C., National Aeronautics and Space Administration (see especially page 17 and Table 1).
10. J. M. Fields 1993 *Journal of the Acoustical Society of America* **93**, 2753–2763. Effect of personal and situational variables on noise annoyance in residential areas.
11. R. G. de Jong and J. M. Fields 1994 *Noise and Man* '93: *Noise as a Public Health Problem* (*Proceedings of the Sixth International Congress*) **3**, 450–453. Chairman's summary: International Noise Team 6: Community Response to Noise. INRETS, Arcueil, France.
12. Committee on the Challenges of Modern Society 1994 *Symposium on Aircraft Noise Abatement Receiver Technology*: *A Compilation of Presentation Material* (Baltimore, Maryland, May 16–20, 1994), in two volumes. NATO.
13. Seiichiro Namba, Juichi Igarashi, Sonoko Kuwano, Kazuhiro Kumo, Minoru Sasaki, Hideki Tachibana, Akihiro Tamura and Yoshiaki Mishina 1996 *Journal of the Acoustical Society of Japan* (*E*) **17**, 109–113. Report of the committee of the social survey on noise problems.
14. AAPOR (American Association for Public Opinion Research) 1996 *Directory of Members*, Ann Arbor, Michigan.
15. WAPOR (World Association for Public Opinion Research/Association Mondiale de Recherches sure l'Opinion Publique) undated *Code of Professional Ethics*: *Rules of Practice Regarding Reports and Survey Results*. Chapel Hill, North Carolina.
16. ISO (International Organization for Standardization) 1982 *ISO Standard* 1996 *Part* 1: *Acoustics—Description and Measurement of Environmental Noise*.
17. T. J. Schultz 1978. *Journal of the Acoustical Society of America* **64**, 377–405. Synthesis of social surveys on noise annoyance.
18. P. D. Schomer and R. E. DeVor 1981 J*ournal of the Acoustical Society of America* **69**, 713–719. Temporal sampling requirements for estimation of long-term average sound levels in the vicinity of airports.
19. J. M. Fields 1990 *Environment International* **16**, 501–514. Policy-related goals for community response studies.
20. M. Vallet, I. Vernet, P. Champelovier and M. Maurin 1996 *Proceedings of Inter Noise* **96**, 2345–2350. A road traffic noise index for the night time.