

inter.noise 2000

*The 29th International Congress and Exhibition on Noise Control Engineering
27-30 August 2000, Nice, FRANCE*

I-INCE Classification: 6.6

INTERPRETING THE FINDINGS OF SOCIAL SURVEYS OF NOISE-INDUCED ANNOYANCE

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Keywords:

DOSAGE-RESPONSE RELATIONSHIP, ANNOYANCE

ABSTRACT

Much of the rationale for policy positions taken by regulatory agencies concerning habitability of residential areas and compatibility of land uses with transportation noise is supplied by analyses of social survey findings. These findings admit of more than one interpretation, are easily over-interpreted, and are widely mis-understood. Under such conditions, dosage-response relationships derived from the corpus of social survey findings can be little more than de facto policy statements. Because their work may have a direct bearing on the public interest, those who conduct primary and secondary analyses of findings in this area should be knowledgeable and cautious about the uses to which their work may be put.

1 - INTRODUCTION

Much energy has been spent in recent years on efforts to standardize aspects of the form, wording and reporting of questionnaire items and findings of social surveys of the annoyance of noise exposure. One goal of this effort has been to encourage improvement in survey methods used to assess community response to noise exposure. Another apparent goal has been a desire to facilitate secondary analyses of the findings of disparate studies, both to test hypotheses of interest to researchers and to promote potential alternate interpretations of survey findings.

These are worthy goals in principle, but even if attained, would not necessarily greatly affect interpretations of noise effects studies for regulatory and policy purposes (they may also have side effects such as stifling innovation, encouraging researchers to cross the thin line between useful meta-analysis and data dredging, and re-directing research funding). In practice, objective information about noise effects may play only a minor role in the development of regulatory policy. To understand why this is so, it is helpful to recall 1) the function of regulatory agencies, and 2) the rationale on which policy decisions about the "acceptability" of transportation noise exposure are ostensibly based.

2 - DISCUSSION

Regulatory agencies are created by legislatures to balance competing public interests (Fidell, 1999). In the case of airport-related noise, regulation attempts to balance national interests in efficient air transportation against local interests in habitable and comfortable residential environments. Regulatory agencies are often single purpose organizations with legislative charters confined to a narrow range of public interests. In the United States, for example, Congress established the Federal Aviation Administration to foster the growth of civil aeronautics – not to preserve or strengthen communities, nor to broadly enhance public health and welfare, nor to minimize noise intrusions in parks or wildernesses. It is hardly surprising that policies adopted by regulatory agencies with narrow charters tend to favor narrow conceptions of the public interest. No matter how narrow the charter of a regulatory agency may be, and no matter how greatly its charter may be at odds with charters of other agencies with different conceptions of the public interest, it is undeniable that a regulatory agency's charter reflects a *bona fide*, legislatively-defined conception of public interest.

The same cannot be said of the views of individual researchers, or of quasi-governmental and standards organizations, that publish interpretations of social survey findings about aircraft noise effects. The latter sometimes reflect narrow or idiosyncratic conceptions of public interests not based on either legislative

mandates nor on technological or economic feasibility. Such individual views, not to mention self- and organizational interests, can color interpretations of the findings of noise effects studies and secondary analyses of them (*cf.* Staples, 1998). As noted by Fidell *et al.* (1998), expertise in data analysis should not be confused with expertise in policy making: "Neither expertise in the measurement and prediction of aircraft noise, nor expertise in any social science subspecialty, automatically confers any particular skill, insight, or privilege in policy-related matters."

When pressed to defend policy decisions, regulatory agencies seek comfort and technical legitimacy in numbers (*i.e.*, committees), precedent, and standards as available. In the United States, federal agencies with interests in environmental noise effects formed a strategic alliance known from 1979 to 1990 as the Federal Interagency Committee on Urban Noise (FICUN). FICUN and its successors FICON (Federal Interagency Committee on Noise, 1990 -1992) and FICAN (Federal Interagency Committee on Aircraft Noise, 1993 – present) were established explicitly – albeit somewhat circularly – to serve as citable authority for the member agencies' noise-related policy decisions.

FICON's (1992) publication of its preferred dosage-response function summarizing the relationship between Day-Night Average Sound Levels of environmental noise and the prevalence of annoyance in communities is one example of this strategy. FICON's relationship is commonly cited and widely believed to be an important basis for policy decisions about tolerable noise levels in communities (*cf.* Finegold *et al.*, 1994). FICAN's adoption of a preferred interpretation of the relationship between sound exposure levels of nighttime noises and disturbance of the sleep of individuals is another effort to establish an authoritative interpretation of the results of noise effects research that can be cited in support of policy decisions by regulatory agencies.

Do policy interpretations truly flow ineluctably from the dosage-response function seen in Figure 1? According to this dosage-response relationship, 12.3% of the urban residential population is consequentially annoyed by noise exposure at a level of $L_{dn} = 65$ dB. $L_{dn} = 65$ dB is the level of noise exposure that FAA believes warrants federal participation in funding noise mitigation measures such as acoustic insulation of homes. Policy decisions of this sort inevitably waste information by selecting action points to dichotomize an underlying continuum of costs and benefits into acceptable and unacceptable regions. They also waste information by expressing action points in "round" values, in tacit acknowledgment of a fundamentally arbitrary element of policy making. When setting traffic speed limits, for example, a 100 kilometer per hour limit may be adopted even when it is understood that a slightly higher or lower posted limit might yield a slightly more favorable ratio of costs to benefits.

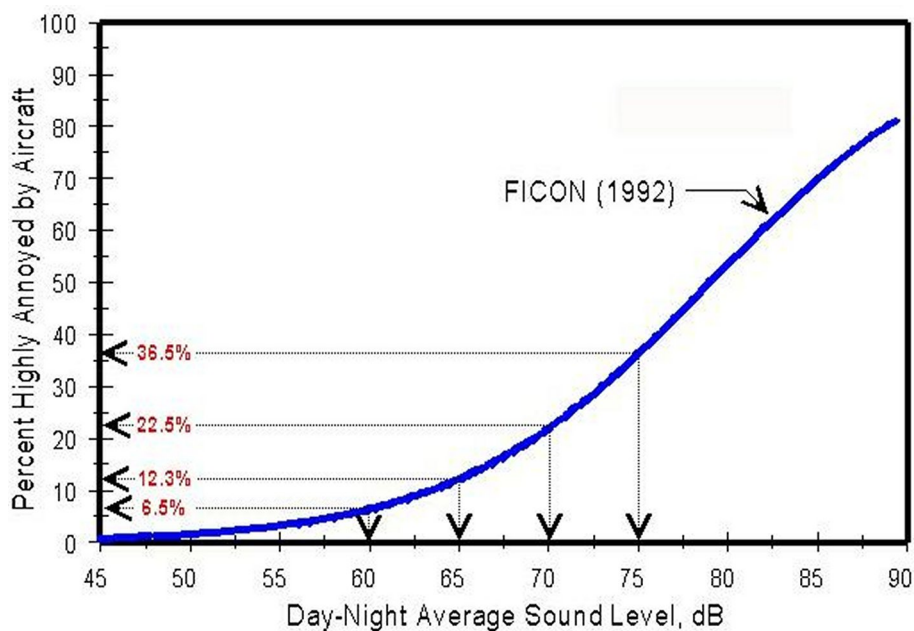


Figure 1: Relationship of noise exposure to the prevalence of high annoyance, per the dosage-response relationship adopted by Federal Interagency Committee on Noise (1992).

Uncertainties of measurement and estimation are frequently overlooked for purposes of reaching policy decisions. In the interests of producing understandable and enforceable action points, for example,

nominal values of critical variables are usually specified for policy purposes. Thus, speed limits are posted in nominal form (*e.g.*, 100 kilometers per hour rather than 100 ± 5 kilometers per hour), even though underlying safety information on which the limit is based may lack the precision necessary to distinguish between outcomes of driving at 90 and 110 kilometers per hour. Researchers must therefore be careful to avoid making minor distinctions, say, between the annoyance of civil and military vehicle noise. Not every effect that is significant for statistical purposes is significant for policy purposes.

3 - CONCLUSIONS

Nothing inherent in a dosage-response relationship (let alone a descriptive fitting function) compels a decision that noise exposure considered highly annoying by 12.3% of the population is worthy of mitigation. FICON's curve is not a step function, lacks pronounced inflection points, and leaves large amounts of variance unaccounted for in the data set from which it was developed (*cf.* Fidell *et al.*, 1991 and Green and Fidell, 1991). With the advantage of hindsight, it has become apparent that fitting functions fashioned from meta-analyses are tantamount to policy statements rather than true dosage-response relationships.

This ambiguity afflicts not only the efforts of regulatory agencies to infer policy positions from social survey findings about the prevalence of noise-induced annoyance, but also the efforts of other individuals and organizations. No amount of statistical manipulation of these data can provide an inherently superior policy interpretation of its implications. Researchers who invest great effort and ingenuity in discerning "better" dosage-response relationships in such data sets must set equally rigorous standards for the policies and actions that their interpretations implicitly encourage.

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