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COMMUNITY NOISE AND CHILDREN: COGNITIVE MOTIVATIONAL AND PHYSIOLOGICAL EFFECTS

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We are conducting two longitudinal studies, the first on the effects of aircraft noise, and the second on the effects of traffic noise on elementary school children. The emphasis of the studies is to determine the impact of prolonged noise exposure on attentional strategies, generalized expectancies concerning control, and physiological effects related to health. Testing sessions are conducted under quiet conditions and thus our emphasis is on the aftereffects of noise—effects occurring outside of (after) noise exposure. The designs of both studies are identical. Both involve testing children attending noise-impacted schools and then retesting the same children one year after noise abatement work is completed in their school.

Design

We are gathering the described data: (1) before the architectural interventions are made, and (2) again one year after the interventions are completed; each child is tested twice. The children tested are from schools that: (1) remain noisy for the entire duration of the study (noise-noise schools), (2) remain quiet for the entire duration of the study (quiet-quiet schools), and (3) that begin noisy and become quiet (noise-quiet schools). Quiet schools are matched with noise schools for grade level, ethnic and racial distribution of the children, and the income, education, and occupation of the parents.

Subjects

Each study includes children from all noise-impacted third and fourth

grade classrooms in each noise-quiet school as well as children from an equivalent number of classrooms in noise-noise schools and in quiet-quiet schools. Children with hearing losses were excluded. There are approximately 275 subjects in each study.

Noise Measures

Interior noise levels (without children) are measured inside each classroom with Community Noise Level Analyzers, and child and teacher perceptions of classroom noise level are assessed by questionnaire. Noise contour maps provide us with a reasonable approximation of the sound level outside of each child's home, and parent and child perceptions of home noise levels are also assessed by questionnaire. Parent questionnaires and school files are used to determine how long the child has attended the school and how long the family has lived at their present address. This provides a measure of duration of noise exposure.

Assessing Attentional Strategies

Attentional focusing: Laboratory studies indicate that noise often results in a focusing of attention on aspects of the environment most relevant to task performance (Broadbent, 1971). We are interested in determining (1) whether children undergoing prolonged noise exposure tend to employ an attention-focusing strategy, and (2) whether focusing is adopted as a permanent strategy--used under quiet and noise conditions. An incidental memory task, in which the children's memory for task cues not relevant to primary task performance is contrasted with their primary task performance, is used to assess the degree of attentional focusing.

Selective inattention: There is suggestive evidence that children reared in noisy environments selectively filter out acoustic cues, which results in deficits in auditory discrimination, and as a consequence, in reading ability (Cohen et al, 1973). To clarify the relationship between selective inattention and verbal skills, we are collecting data on selective inattention strategies (distractibility), auditory discrimination, and reading achievement.

Measures of Expectancy to Control

It has been suggested (Cohen, Glass, and Phillips, 1979) that prolonged noise exposure may lead to perceptions of external control and even helplessness. We are assessing generalized perceptions of control by questionnaire (Intellectual Achievement Responsibility Questionnaire) and by observing reactions to a failure (versus success) experience—a standard helplessness experiment.

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We are employing multiple
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Health

Both laboratory studies demonstrating physiological changes under high-intensity noise and recent epidemiological studies indicate the possibility of a negative impact of noise on health (Welch and Welch, 1970). Moreover, it has been suggested that children may be especially susceptible to community-noise effects on health (Cohen et al, 1979).

We are employing multiple measures of health. The child's (resting) blood pressure (systolic and diastolic) is taken on a Physiometrics Blood Pressure Machine. Each child's height and weight are also measured and data on absenteeism are collected from school files.

Statistical Controls

In addition to matching schools on race and social class indices, all data analyses include controls (these factors are partialled out by forcing them into the regression before noise) for individual subjects' social class (parents' education and number of children in family), grade in school, months enrolled in school, and race. In addition, the blood pressure analysis includes controls for ponderosity (weight/height^3) and height. School achievement analyses include a control based on the average aptitude for the child's class on entering first grade. Significant effects reported in the results section are (1) significant after these factors are partialled out, and (2) from multivariate clusters in which the multivariate F is significant.

SUMMARY OF RESULTS: AIRPORT STUDY—PRENOISE ABATEMENT

Analysis of data from the first phase (prenoise abatement) of the airport study has been completed. In general, the results are consistent with laboratory work on physiological response to noise and on uncontrollable noise as a factor in helplessness. Thus, children from noisy schools have higher systolic and diastolic blood pressure than those from matched control (quiet) schools. Noise school children are also more likely to fail on a cognitive task and are more likely to give up before the time to complete the task has elapsed. The development of attentional strategies predicted from laboratory and previous field research was, on the whole, not found. In fact, contrary to prediction, increased years of exposure led children to become more distractible rather than less. Auditory discrimination and reading achievement were unrelated to noise. Examination of the relationship between noise and the criterion variables at different lengths of exposure suggests that, except for some physiological habituation, children do not adapt to the noise stress over time. Moreover, parents living in the air corridor, rather than reporting less noise as their length of exposure increases, report more.

ACKNOWLEDGMENT

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