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BALTIMORE HEALTH NEWS



Published Monthly by the

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VOL. XXXVII

June, 1960

NO. 6

*The Baltimore Study On The Effects Of Housing On Health**

by

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THE presumed causal relationship between the quality of housing and health is the basic consideration which accounts for the concern of public health authorities with housing standards and with their enforcement. It is this consideration which underlies such legislation as the Baltimore City Ordinance on the Hygiene of Housing and is the basis of the rules and regulations promulgated thereunder by the Commissioner of Health. There is considerable expert opinion in support of this presumed causal relationship.

While research studies have appeared in the last 30 years that have pointed up this relationship, few have done so ruling out the effects of other, non-housing factors. Fifteen or more years ago, a joint committee consisting of Mr. Bleecker Marquette of Cincinnati and the Commissioner of Health of Baltimore and other members of the American Public Health Association and the National Association of Housing Officials began to search for valid statistical evidence for this relationship. Almost complete failure led to the planning of a study that would isolate the effects of housing *per se*. The end product was an investigation conducted in part in the Eastern Health District of Baltimore under the auspices of the Johns Hopkins School of Hygiene

* This investigation is being supported by a research grant from the National Institutes of Health, Public Health Service, U.S. Department of Health, Education, and Welfare. This is Department of Biostatistics Paper No. 329 of the Johns Hopkins School of Hygiene and Public Health.

and Public Health with material assistance from the Housing Authority of Baltimore City and the Baltimore City Health Department. Great encouragement and support for this study were received from Dr. Lowell J. Reed, Vice President of the Johns Hopkins University and from the U.S. Public Health Service. The planning of the study was accomplished during the period 1952-1954 and the field work was conducted from 1955 to 1958. Tentative findings from the mass of data collected have only just become available and several will be reviewed at this time.

The Test And Control Groups

The study population on which this report is based consisted of 600 families divided into two groups, a *test* group of 300 families (1,350 persons) who made the move from slum dwellings to a new public housing development, and a matched *control* group of identical size which was not scheduled to move from the slum. The populations under study were low income Negro families all of whom had applied for and were eligible for public housing. Measurements were made on both test and control groups from a point in time prior to the move into the public housing project to a time almost three years later. This was, then, a study of the effects of housing on health during a period of about three years. Many topics were covered in this inquiry. One of them will be covered in detail within this report, that is, physical morbidity of children, meaning persons under 20 years of age.

Morbidity information was collected in the course of eleven surveys patterned after the methods used in the National Health Survey. Data were collected in the course of interviews conducted in the home with the adult female heads of the households and covered illness experienced in the preceding two months, the medical attention received and the length and nature of disability involved, as measured by days in hospital, in bed, or away from usual activities.

Preliminary Data For Young Persons

Preliminary data for persons under 20 years of age indicate that incidence of illness and disability for test children was lower than incidence among controls in the last two years of study. Tables 1 and 2 give the details, for episodes of all disabling and non-disabling illness. Among all boys, test incidence rates were lower than control rates by 53 and 43 episodes per 100 persons, respectively, in the second and third years. Stated otherwise, the extent of illness among boys in the rehoused families was, on the average, 15 per cent lower than that experienced by boys remaining in slum housing. This figure represents the ratio of the difference in episodes to control incidence, $\frac{43}{309}$ and $\frac{53}{328}$, giving the average of 15 per cent. Among all girls, test rates were lower than control rates by 25 and 21 episodes per 100 persons, or 8 per cent, in the two periods, respectively. The table also gives age-specific rates that contribute to the totals. Limitations of space do not permit presentation of data separately for conditions of varying severity; but it may be said that similar lower test than control rates obtain in general for more serious conditions, involving either medical attention or disability, and for less serious conditions as well.

TABLE NO. 1
TOTAL EPISODES OF ILLNESS FOR MALE CHILDREN, BY AGE
THE BALTIMORE STUDY ON THE EFFECTS OF HOUSING ON HEALTH
1955-1958

Number of persons	Age	Study Period					
		Interim		Early After (second year)		Late After (third year)	
		Test	Control	Test	Control	Test	Control
412	All, under 20	208	191	276	329	266	309
113	Under 5	264	217	355	379	319	332
201	5 - 9	214	193	263	337	265	317
98	10 - 19	130	164	212	270	205	275

Number of persons	Age	Test Control					
		Episodes per 100 Persons, per Period		Differences in Rate per 100 Persons*			
		Test	Control	Test	Control	Test	Control
412	All, under 20	-17		+53		+43	
	Under 5	-47		+24		+13	
	5 - 9	-21		+74		+52	
	10 - 19	+34		+58		+70	

* Plus indicates that test rates were lower; minus, that test rates were higher.

TABLE NO. 2
TOTAL EPISODES OF ILLNESS FOR FEMALE CHILDREN, BY AGE
THE BALTIMORE STUDY ON THE EFFECTS OF HOUSING ON HEALTH
1955-1958

Number of persons	Age	Study Period					
		Interim		Early After (second year)		Late After (third year)	
		Test	Control	Test	Control	Test	Control
444	All, under 20	207	192	275	300	275	296
138	Under 5	236	234	301	339	291	326
193	5 - 9	196	172	264	287	261	282
113	10 - 19	191	173	262	273	279	280

Number of persons	Age	Test Control					
		Episodes per 100 Persons, per Period		Differences in Rate per 100 Persons*			
		Test	Control	Test	Control	Test	Control
444	All, under 20	-15		+25		+21	
	Under 5	-2		+38		+35	
	5 - 9	-24		+23		+21	
	10 - 19	-18		+11		+1	

* Plus indicates that test rates were lower; minus, that test rates were higher.

BALTIMORE HEALTH NEWS
Published Monthly by the
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Commissioner

Type of Disability—Days	Study Period					
	Interim		Early After (second year)		Late After (third year)	
	Test N: (412)	Control (449)	Test (412)	Control (449)	Test (412)	Control (449)
Total days of disability	306	210	288	343	381	371
Days in hospital	11	5	17	31	11	23
Days in bed	153	104	191	179	227	309
Days kept from usual activities	141	102	80	134	142	239

Disability findings for persons under 20 years of age tend generally to follow the direction and also the magnitude of the incidence data, although refined age groups in both sexes show some irregularities. Tables 3 and 4 give the detailed rates for all children together for total days of disability and for the various types separately. Among males, test rates were lower than control rates by 55 and 190 days per 100 persons in the second and third years, respectively. Among females, the figures for comparable periods were 35 and 47 days per 100 persons. Episodes were classified according to type of illness, using definitions of the *International Statistical Classification of Diseases, Injuries, and Causes of Death*. Five categories of conditions comprised 90 percent of the episodes occurring among children. In the last two years of observation, test rates were regularly lower than control rates in three categories: *infective and parasitic conditions, mainly the communicable diseases of childhood; digestive conditions, and accidents*. In at least one of the two years, test rates were also lower than control rates in respiratory conditions, and allergic, endocrine, and metabolic episodes.

The data for the "interim" period—a period of months following the resettlement of test families into their new quarters—is of considerable interest to epidemiologists. Tables 1 through 4 show that in that period, test rates of illness and disability for almost every age-sex group were *higher* than control rates. Further examination of "interim" period data by classification of disease reveals that the higher test rates were entirely accounted for by three categories of conditions: infective and parasitic, respiratory, and digestive, all of which have communicability as a principal feature. The most likely explanation is that the test families, newly assembled into the housing project, were strangers to one another in more than just a social sense, and lacked group immunity to common communicable diseases. A similar phenomenon has been observed in the rise of infectious disease in other newly assembled groups, as, for example, army recruits.

The findings in respect to accidents are especially important and clear. Accidents were one-third lower in the housing project as contrasted with the slums. The data show general confirmation of this fact among all age and sex groups in the two final years of the study. It is as yet too early to tell which particular elements of good housing are responsible for the general lower test than control rates in the final two years of the study. It is likely that in connection with communicable disease, the reduction in crowding and eliminating of doubled-up families has played a role, limiting the introduction and transmission of infecting material into the dwelling unit. Probably also involved are the adequate toilet, bath, and washing facilities available in the housing project and either unavailable, in poor repair,

TABLE NO. 3
 TOTAL DAYS OF DISABILITY FOR MALE CHILDREN
 THE BALTIMORE STUDY ON THE EFFECTS OF HOUSING ON HEALTH
 1955-1958

Type of Disability—Days	Study Period					
	Interim		Early After (second year)		Late After (third year)	
	Test N: (444)	Control (424)	Test (444)	Control (424)	Test (444)	Control (424)
Total days of disability	273	244	284	319	481	528
Days in hospital	32	12	11	12	9	21
Days in bed	128	114	166	151	270	283
Days kept from usual activities	113	117	107	156	203	224

Type of Disability—Days	Study Period					
	Interim		Early After (second year)		Late After (third year)	
	Test N: (444)	Control (424)	Test (444)	Control (424)	Test (444)	Control (424)
Total days of disability	-29	-20	+35	+1	+47	+12
Days in hospital	-14	-14	-15	+49	+13	+21
Days in bed	+4	+4	+49	+49	+49	+49
Days kept from usual activities						

*Plus indicates that test rates were lower; minus, that test rates were higher.

Type of Disability—Days	Study Period					
	Interim		Early After (second year)		Late After (third year)	
	Test N: (444)	Control (424)	Test (444)	Control (424)	Test (444)	Control (424)
Total days of disability	-29	-20	+35	+1	+47	+12
Days in hospital	-14	-14	-15	+49	+13	+21
Days in bed	+4	+4	+49	+49	+49	+49
Days kept from usual activities						

*Plus indicates that test rates were lower; minus, that test rates were higher.

or shared with other families in the slums. In connection with accidents, crowding and extent of dilapidation are the pertinent factors being examined.

Data On Adults And On Social Adjustment

Other information than that reported above has also been studied and will be mentioned briefly. Morbidity data for adults show, in general, less consistent effects than those described for children and the effects observed are less related to the communicable diseases. Of particular interest is the observation that for adults there were lower test than control episode and disability rates among young adult women of child-bearing age, from 20 to 34 years. In this connection, there appears a tendency to lower birth weights among infants born alive to control mothers than to test mothers, and also an attendant higher rate of prematurity. The background of this tendency has not yet been tracked down.

Other data have also been collected relating to social adjustment, such as family life, relations with neighbors, and morale. Among the chief findings in this regard, as perceived by the respondents, are: (1) only 1 per cent of children in the test group played in "unsafe" places as contrasted with 53 per cent for children in the control group; (2) the extent to which mutual assistance was offered and received among families in the test situation was significantly increased over that which was experienced by control families, and (3) the test and control families at the end of observation were less differentiated on two important characteristics, namely, the concept of social status and psychological state which includes such items as nervousness, mood and adequate emotionality.

Additional elements of the study will assess the impact of change in housing on school performance of children and youthful delinquency and adult crime. These topics will be the subjects of future reports. All the reports, taken together, will represent a major effort to evaluate the social changes which can be expected as a consequence of extensive opportunity for underprivileged families to move from slum type housing to more adequately constructed and maintained homes.

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Commissioner Of Health Of Baltimore

Statement Of The

On The Matter Of

Lung Cancer, Cigarette Smoking And Air Pollution

May 17, 1960

THE Baltimore City Health Department has under continuous study the accumulating evidence on the relationship of atmospheric pollution to the health of city residents. Such incidents as 'Donora' and occasional severe and prolonged fogs in the London area indicate that under unusual circumstances, the composition of the air in the atmosphere can produce a short range increase in deaths among the exposed population. It is common knowledge that from time to time in Los Angeles the concentration of certain elements in the air reaches levels sufficient to cause smarting of the eyes and other disagreeable symptoms. This practically never happens in Baltimore where the local topography allows our atmosphere to wash itself clean.

Two possible effects of pollution of the air thus are of concern to us; the possibility that such pollution can occasionally be a nuisance and the possibility that prolonged exposure to benzpyrene and related chemical products may increase the risk of lung cancer.

The occasions during which the composition of the air in Baltimore City causes a wide spread nuisance are so rare that I am convinced that the City Health Department air pollution control program is an adequate one.

The long range effects of measurable quantities of benzpyrene and all other potential carcinogenic agents in the air are of great concern. However, it must be understood that no relationship has been found to date between benzpyrene in the air and lung cancer in human beings, even though this substance is known to have caused cancer in test animals.

On the other hand, there is overwhelming epidemiological evidence in support of the relationship between the excessive use of cigarettes and lung cancer. At this point in time, if it is lung cancer with which we are concerned it is the excessive use of cigarettes that must be incriminated as the most important cause of lung cancer.

We will continue to watch carefully the question of pollution of the air with potential carcinogenic agents. However, in doing so we should not becloud the public's comprehension of the importance of excessive cigarette smoking as the principal cause of lung cancer.

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number of test than control mothers reported not having to scold or fuss about children spending too much time away from home, and there was a correspondingly lower amount of husband-wife friction over children in the test group.

On the other hand, 8 per cent more test than control families quarreled over services ("way I fix his food," "not helping around the house") and 3 per cent more quarreled over personality traits ("I am mouthy," "nasty," "drinking," "jealousy," "gambling").

Pride In Area

Respondents in the housing project showed more pride in their immediate neighborhood, reported more activities devoted to keeping up the neighborhood than the control group did, and gave far more favorable views regarding its adequacy as a place to live and raise children. At that, though, only two thirds considered the neighborhood "very good" as a place to live, and only 59 per cent thought it "very good" for raising children. Only 63 per cent considered Baltimore itself a "very good" place to live. Only a third had voted in the last national election.

One of the interesting assumptions made in the study was the expectation that a move to better housing, even without a change of income, might make families feel that they were coming up in the world and, in turn, upgrade their aspirations for themselves and children. Again, the data only partially confirmed the hypotheses. Asked both "before" and "after" whether they considered themselves better off than three or five years previously, 17 per cent more test than control families said they were better off in 1958 than in 1955, mostly frequently giving reasons related to housing.

More of the project families also grouped themselves as "people going up in the world," although the difference was not as great: 72 per cent felt that way in contrast to 63 per cent of the slum families.

As for aspiration, only 27 per cent of the husbands in the project were reported to be thinking or doing anything about getting a better job, whereas 31 per cent of the slum husbands were so described. Only 54 per cent had hopes of sending their children through the twelfth grade, and only 44 per cent thought the chances of doing so were "very good."

The percentages, however, were higher than when the same families were interviewed before being rehoused. More control than test families thought their chances good to send children to college, but significantly more of the project families felt there was a good chance that their children would get a Government job.

Feeling Of Optimism

Findings for a series of ten "psychosocial" scales tended to show that the women in the housing project benefited from the move away from their previously depressed and deprived environment. The differences were likely to be more significant in terms of optimism, satisfaction with personal state of affairs and potency (efficacy of self-help) than in terms of moodiness, temper outbreaks and nervousness.

The final set of comparisons by the researchers dealt with the school performance of children, of which there were 293 of school age in the test group and 287 in the control group. The children offered a fair degree of comparability in terms of

age, sex and grade distributions, and when their school records were examined before the test children were rehoused, they also were much alike in their scores on three types of tests: intelligence, arithmetic achievement and reading achievement.

Achievement Levels

The assumption was that the children in the housing project would perform better in school than the slum children because they would have more and quieter room to study and, perhaps, upgraded ambitions. This was not borne out. In their "after" tests the children again had similar scores. In fact, when the test scores were adjusted for grade level, the project children and slum children had identical mean scores in reading and arithmetic. Oddly enough, though, the project children were considerably more likely to be promoted at a normal pace, while control children more often were held back one or more semesters.

The reason the researchers suggest for the anomaly of one set of school children being promoted more frequently than another, even though their achievement levels are the same, is that the project pupils attended schools more regularly because they had less illness. "The data," the authors say, "suggest a modest but specific illustration of the interweaving of environmental, physical and social variables."

The authors are listed as Daniel M. Wilner, who directed the study, and Rosabelle Price Walkley, his chief assistant, both of whom are now at the University of California. Also Thomas Pinkerton, of the Johns Hopkins biophysics department, and Matthew Tayback, Baltimore's assistant health commissioner.

$$\text{Var}(\bar{y}) =$$

$$\frac{(\sum M_i)^2 (\sum Y_i^2) - 2(\sum M_i)(\sum Y_i)(\sum M_i Y_i) + (\sum Y_i)^2 (\sum M_i^2)}{(\sum M_i)^4}$$

where M_i is the cluster size, the number of persons of a selected class in the i th family, e.g., the number of males ages 5 to 9 in the i th family;

$\sum M_i$ is the total number of persons in the selected class, e.g., males ages 5 to 9, summed over all N families;

Y_i is the total of the variable (episodes, days) in the i th family cluster;

$\sum Y_i$ is the grand sum of the variable for all family clusters, summed over all N families;

$\sum M_i Y_i$ is the sum of the family cluster totals Y_i , each weighted by its cluster size M_i ; and

\bar{y} is the grand mean of the variable per person, i.e., $\sum Y_i / \sum M_i$, for the selected class.

The standard error of the difference of the test and control means is $[\text{Var}(\bar{y}_T) + \text{Var}(\bar{y}_C)]^{1/2}$, where both variances are computed as above.

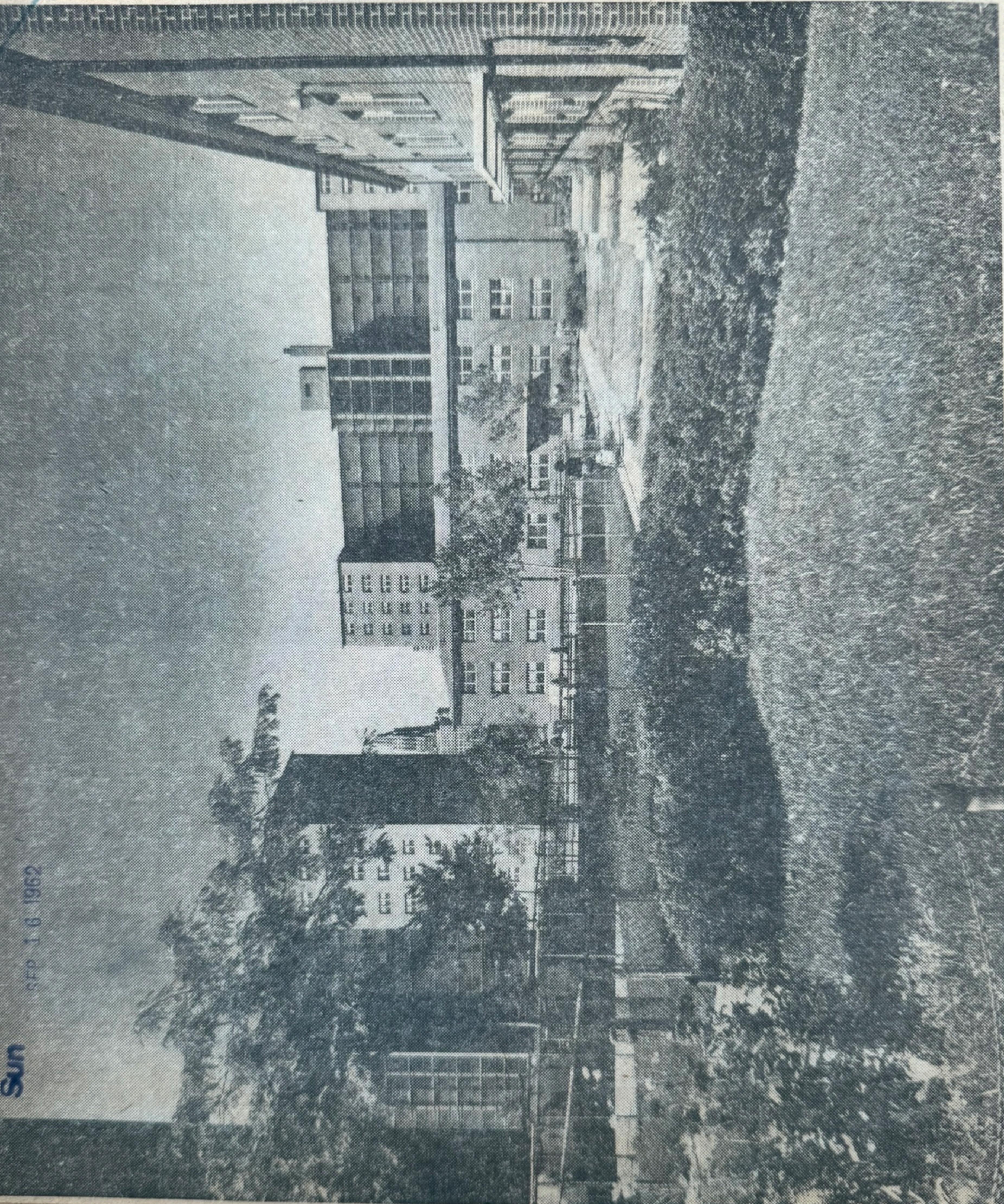
The within-family correlations were in fact found to be positive, and so the refined variance estimate was applied to all differences close to significance at the $P < 0.05$ level by the uncorrected test.

"The Housing Environment and Family Life," report on study by Hopkins School of Hygiene and Public Health, uses complex formulae like the one above to study family reactions to surroundings.



Slum or "control" families lived in areas similar to one above. Project children had one third fewer accidents

than controls, but did no better in school. Men showed slightly less ambition in project than in slums.



Sun

CFP 10 1962

Three hundred families newly resident at Lafayette Courts housing project, above, were compared with 300 matched slum families in two-year, \$500,000 study of effects of housing on illness and mental health. In projects, health was somewhat better than in the slums.

Effect Of Housing On Health

Sun

SEP 16 1962

THE most extensive and expensive study of slum-versus-good living conditions ever conducted has confirmed a long-time assumption: Health and morale are affected by housing environment. The results of the \$500,000 research project, conducted by the Johns Hopkins School of Hygiene and Public Health, are now published by the Johns Hopkins Press as a "longitudinal study" of the effects of housing on morbidity and mental health.

Subjects of the intensive interviewing were Baltimore Negro families who moved into Lafayette Courts when the new public housing project was opened in East Baltimore in 1955. Some 400 "test" families were interviewed originally in their slum locations and then tested every ten weeks for two years in their new environment. For comparative purposes, 600 "control" families who were to remain in the slums were studied during the same 1955-1958 period. All told, 10,000 persons were included in the repeated surveys of illnesses, attitudes and aspirations.

Supposedly similar studies previously had been made a number of times in this and other countries. Indeed, public-housing enthusiasts had made extravagant claims for the benefits derived from moving slum families into new environments. But previous studies had been limited in scope or had not eliminated the nonhousing factors in health changes.

Two Unrelated Sets

Some, for example, compared the incidence of disease in a housing project with the incidence on the same site before clearance took place. The figures spoke well for public housing, but actually they concerned the "before" and "after" health not of the same people but of two unrelated sets of people.

The aim of the Hopkins study, supported by a Federal health grant and backed by national and local health and housing agencies, was to isolate the effects of housing from other health factors through experimental rather than statistical control. In brief: matched pairs of families would be established, and with all nonhousing variables held constant, housing quality alone would be permitted to change.

Such a study was possible because the Baltimore Housing Authority in 1954-1955 had on file the application data for thousands of families seeking admission to public housing. From this data the Hopkins research team was able to establish hundreds of "matches"; that is, sets of families that were alike in terms of size, ages, presence or absence of husband, occupation, housing conditions, length of residence in Baltimore and other factors. Then, when Lafayette Courts opened, the researchers had a "test" group of families moving into new housing, each of whom was matched with a "control" family remaining in the slums.

By EDGAR L. JONES

Moving Poses Problem

Throughout the study the control families proved at least as interesting as those who moved to public housing and also posed the most difficulties, mainly because they could not be controlled. From 70 to 90 control families moved during each ten-week interview period for a total of 722 recorded moves among the control families in the three-year period.

Fifty-six families moved three times, while an additional 30 moved from four to seven times. Moreover, they tended to confuse matters by moving to better housing (in most cases to public projects), so that whereas half the control families initially occupied "bad" (in contrast to "moderately bad" or "good") housing, by 1958 only 17 per cent were in "bad" housing.

To solve the problems of attrition and movement, the researchers had to rework their matches to obtain a "reduced effective test sample" of 300 families with a corresponding set of 300 control families. To show how carefully the matches were made, 113 of the test families contained a boy under 5, and 113 of the control families also contained a boy under 5; 95 of the test families had a female 35 or over, and the same number of control families had a woman in that age bracket; 100 test families had a male between 20 and 34, and 101 control families also had males of that age.

The assumption was made that the health of the test families, once they had moved to better housing, would be better than that of the control families. The assumption was borne out, but not in all particulars. Upsetting the assumption, at the outset, was the fact that the children brought

together in the housing project immediately began to swap infections. During the first two interview periods boys and girls of all ages under 20 in the housing project were sick more often and for longer periods than the corresponding slum children.

"The most likely explanation," the study report says, "was that the test children . . . were strangers to one another in more than just a social sense, and lacked group immunity to common communicable diseases."

Marked Improvement

Once the germ-swapping period passed, the public housing children generally enjoyed better health than their slum counterparts. The final two years found that the test rates were regularly lower than the control rates for the communicable diseases of childhood, digestive conditions and accidents; and in at least one of the two years the test rates were lower for respiratory conditions and episodes of allergic and metabolic illnesses. Boys showed the effects of improved housing more than girls.

The findings with respect to accidents were "especially important and clear," the

researchers emphasize. Accidents were one third less in the housing project than in the slum area. The lower rate held true for both boys and girls in all age groups under 20.

Among young adults (20 to 34 years of age) the assumption regarding communicable diseases, such as respiratory and digestive conditions, was in general not borne out. However, slightly lower test than control rates of episodes were distributed over a wide range of conditions, including some that were predominantly chronic in nature, such as allergic, endocrine and metabolic diseases, mental disorders and circulatory conditions. Young female adults showed far greater and more consistent effects of improved housing than the males, having fewer sick days and less severe illnesses than their opposite numbers in the slums.

Among older persons (35 to 59 years of age) the assumption of better health broke down almost entirely. The rates for serious episodes of illness and for days of disability were higher during the final two years for males in the test group than among the controls. Among the older women

in the housing project, the rates were higher for both serious and less severe episodes of illness and for days of disability.

The unexpected results are explained in part by a finding that a disproportionate number of the test group had a relatively large number of initial sicknesses and a history of chronic illness.

Reaction To Quarters

Aside from health, other assumptions as to the effects of improved housing were made. For example, it was expected that women in public housing would show a favorable reaction to their new quarters, and they did: A larger proportion of test than control women liked their apartments, were satisfied with the safety of their children's play area, felt they were getting their money's worth in rent, found more chance of personal privacy and reported less friction and dissension directly related to space. Architects of public housing, however, might note that only 54 per cent agreed that their building looked "very nice" on the outside.

Confirmation also was found for the assumption that the rehoused families would show increased neighborliness, such as helping each other with household activities, with children and in time of illness. The women in the project were more likely than those in the slums to report both pleasant and unpleasant experiences with nearby neighbors, but they also were more likely to report new, close friendships.

Do members of a family get along better in better housing? The study in general proved inconclusive. Among the things that families quarrel about, a significantly larger

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