THE ASSOCIATION OF HEALTH AND SOCIAL WELFARE PROBLEMS IN INDIVIDUALS AND THEIR FAMILIES

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INTRODUCTION

A SIZABLE body of information has been accumulated which suggests, with varying degrees of certitude, a positive correlation between physical illness and various aspects of social pathology (1). About this relationship it has often been stated that an analysis of the characteristics of individuals is not sufficient to describe its nature but that it is necessary to consider the families to which the individuals belong. So far, however, few empirical data have been analyzed in this fashion.

This study attempts to evaluate the nature of some of the interactions between the health experience of the members of a family and their social welfare problems which have required attention of community agencies. Two specific questions are considered. The first one can be stated as: What effect do age, sex, size of family, and the nature of the social problem have on the association of health and social welfare problems in individuals? The second question relates to the main interests of this work and can be phrased as follows: Given specified relationships of health and social welfare problems in individuals, what can be said about the association of these problems in families?

SOURCES OF DATA

The present study is an outgrowth of a broad research program carried on by the Department of Biostatistics, Graduate School of Public Health, University of Pittsburgh (2). As a part of this program, 2,370 families obtained by a random sampling of the Arsenal Health District in Pittsburgh, Pennsyl-

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vania, were interviewed in the summer of 1951 and again in the summer of 1952. The interviews provided identifying information on these families and data on their health experience. A responsible adult was questioned in each household of the survey sample about the health of all members of the family. From these reports, data were obtained concerning *health problems.* An individual was considered ill if he was reported as having one or more of the following in either the 1951 or the 1952 survey: illnesses during the past month; accidents, injuries, and hospitalizations in the past year; chronic diseases or physical impairments of long standing (3).[2] Experience in this and similar studies has shown that collecting information in this fashion provides a sufficiently accurate indication of the total amount of sickness in a population. However, the technique may be inaccurate for calculating the frequency of specific diseases. For example, it was found that some under-reporting occurs with respect to venereal diseases and psychiatric conditions (4). For this reason no effort is made in the present work to examine the data by specific diagnostic groupings.

By using the identifying information obtained in the health survey we were able to clear all the families in the sample with the Social Service Exchange and so to determine their social welfare status. The definition of a social welfare problem is therefore independent of the definition of a health problem. It is based on a separate source of information—the Social Service Exchange. This Exchange registers new cases opened by each of the 105 member agencies in the Pittsburgh area and its clearings provide an adequate coverage of the social services rendered in the community. The registering agencies include the Department of Public Assistance, family agencies, courts, social service departments of hospitals, sectarian welfare agencies, and a variety of others.

To collect information about social problems, case records for the families known to the Exchange were located at the

[2] Exclusive of pregnancy, delivery, and health examinations.

registering agencies and abstracts of the records were made. Information was obtained regarding data of initial contact, nature of the problem, and disposition of the case. Medical facts which were related to the social problem and verified by a physician were also recorded (4).

Demographic and socioeconomic characteristics of the population of the Arsenal Health District, and of the sample drawn from it, were described by Horvitz (3). Some characteristics of the persons considered as having social problems will be described in this paper. In general, most of the recipients of social welfare services are found in the lower socioeconomic groups.

QUESTIONS RAISED BY PREVIOUS FINDINGS

From the analysis of information on the health and social welfare experience of the families, Ciocco et al., found that those reporting any health problems in the household survey had a greater risk of being known to the Social Service Exchange than the families not reporting health problems. It was found further that this excess risk also existed when the definition of registration with the Exchange was restricted to families who contacted social agencies for reasons not involving health (5). The analysis also indicated that the association of health and social problems in families was strongly affected by various social characteristics of the family (4).

These findings, while of considerable interest, raised questions concerning their meaning and proper interpretation. Illness, as defined in the survey, was essentially based on experience of individuals, and social problems arose as a result of associations, actions, and characteristics of individuals. However, a large number of patterns in the experience of groups of persons (i.e., families) could produce the association observed on a family basis. For instance, a family was considered as having both a health and a social problem if:

    a. One or more persons in the family were reported as having a health problem and if the needs of one or more of these

ill persons brought the family into contact with a social agency.

b. One or more persons in the family were reported as having a health problem, and one or more persons *without health problems* precipitated contact with a social agency.

Situations "a" and "b" may exist in a variety of combinations, all of which class the family as having both a health and a social problem. The analysis presented in this paper was undertaken to evaluate and clarify the contributions of such different patterns to the existence of the association.

DEFINITION OF SOCIAL PROBLEMS IN INDIVIDUALS

In the previous studies conducted by the Department of Biostatistics of the Pittsburgh School of Public Health, it was possible to consider registration with the Social Service Exchange alone as a sufficient indication of the presence of a social welfare problem in a family (4). In the present study it was necessary to relate the problem situation in the family to one or more individuals centrally involved with the problem. We have attempted to single out the person or persons in the family whose needs, behavior, or experience *immediately preceding the application* for social services made the application necessary.

To maintain consistency in the assignment of social problems to individuals, the decisions taken in each case were recorded. When the preliminary assignment of problems was completed, the record was reviewed and a set of general rules was abstracted. The individual decisions were then re-examined to assure consistency in the application of the rules. The assignment took into account the nature of the social problem, the agency involved, characteristics of the person requesting social services, etc. The following paragraphs contain a brief resume of the principles embodied in these rules and a few examples of their application.

The various reasons for application to social agencies were coded according to a detailed classification developed by the Family Service Association of America. Using this system, in-

dividuals with social problems were then classified into the following broad groups:

1. Persons who had contact with social welfare agencies primarily for *health reasons.*

In general, situations in which the main reason for the social agency contact was difficulty in providing medical care are considered social problems related to health and are attributed to the ill person. Other situations in which social agency help was needed are classed here if they arose directly because of illness of the individuals in question.

Included among persons with social problems due to health reasons are those receiving services from the Visiting Nurses Association, those on the Aid to the Disabled program of public assistance, and others who required social services from various agencies because physical or mental illness interfered with their proper functioning.

2. Persons whose *behavior* produced a need for social services. (The recipient of the service is not necessarily classed as having a social problem.)

Marital difficulties, police intercessions which led to social agency services, contacts with social workers of the courts, and similar situations belong in this category. A frequent marital problem included here is a wife's complaint to a social agency or court regarding her husband's drinking, abusiveness, and non-support. In these situations, the husband is considered as the individual with the social problem. Cases of neglect of children are generally considered as social problems attributable to the mother, unless there was a complaint of non-support against the father. In situations which were not clear-cut, each spouse is classed in the category of *other* problems (see below). Where services of social agencies were needed because of juvenile or adult delinquency, the problem is of course attributed to the delinquent person.

3. Persons who had contact with social welfare agencies for *combinations of major reasons* or several contacts each for a

different reason, when one or more of these reasons was *related to health* (as defined in No. 1 above).

4. Persons who had contacts with social welfare agencies for reasons *other* than those classified under 1, 2, and 3, and problems which could not readily be classified elsewhere.

In this category, most of the problems relate to employment, some to housing, and others to need for legal advice in matters which could not be considered behavioral problems, etc.

An example of persons in this category is given by the healthy wage-earner of a family who lost his job and applied for public assistance. Also classified here is the person whose house burned and for this reason social welfare services were extended to him, or the person who required aid in legal difficulties arising in the course of his business and who could not afford services of a lawyer. The category also includes persons in poorly defined social situations requiring agency assistance in which it could not be determined definitely whether they or someone else should be considered as causing the need for service. All individuals who were directly involved in these ambiguous situations were classified in this category.

FINDINGS ON INDIVIDUALS

Of the 2,370 families in the sample on which information was available in the survey, 2,248 are white. Previous reports on these data included information on 122 nonwhite families (4, 5). The nonwhite families are not included here because there are too few of them for analysis. Of the 2,248 white families, 661 were known to social agencies and case record information was available for them. An additional 150 families were registered with the Social Service Exchange but no further information was available regarding their social welfare experience. There are 1,437 families in the survey sample who were not registered with the Social Service Exchange.

Altogether, the 2,248 families include 3,997 males and 4,187 females. On the individual basis, a slightly higher percentage

SOCIAL PROBLEM STATUS	MALES		FEMALES	
	Total Number	Per Cent Reporting Health Problems	Total Number	Per Cent Reporting Health Problems
Persons With Social Problems	404	40.1	312	50.3
Persons With No Social Problems	3,346	35.0	3,595	38.4
Persons From Families With Nature of Social Problem Not Ascertainable (PNA)	247	38.9	280	40.4
TOTAL	3,997	35.8	4,187	39.5

Table 1. Per cent of individuals with health problems by the presence of social problems and sex, and the number on which each percentage is based.

of females than of males reported health problems (Table 1).[3] Persons considered as having social problems reported illness in the survey somewhat more frequently than those without social problems. This increase of risk of a health problem with the presence of a social problem is more pronounced for females than males.[4]

From Table 1, it can also be seen that individuals in families registered with the Exchange but for whom no further social-problem information was available (PNA) exhibit percentages of health problems falling between those for persons with and without a social problem. This supports the assumption that no undue bias was introduced by the missing information. The PNA cases are, in general, those which have been inactive with the social agency for several years and consequently the case records relating to them had been destroyed. Compared with the rest of the sample, the PNA families tend to be somewhat smaller and tend to be composed of older persons (median age 37.4 years vs. median age 29.9 years in the rest of the sample). The characteristics of these families are analyzed more fully in a paper by Ciocco (4).

The age of individuals has some relation to the presence of

[3] P < 0.01 that the difference between 39.5 and 35.8 is due to sampling.

[4] P < 0.05 and P < 0.01 that the differences in these percentages for males and females respectively are due to sampling.
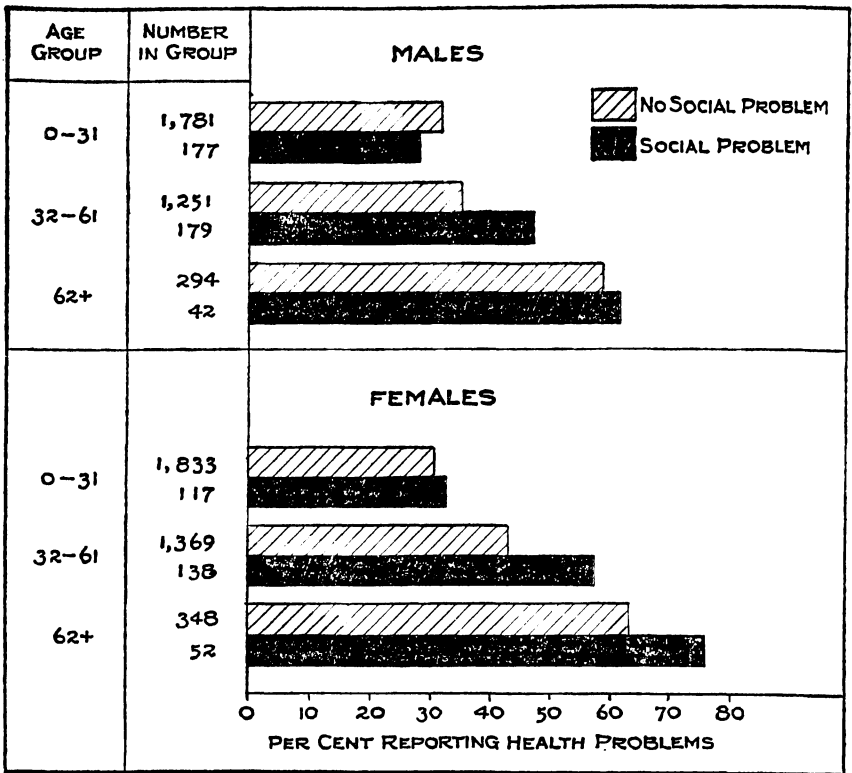
Fig. 1. Per cent of persons who reported health problems in groups of given age, sex, and social welfare status.

health and social problems (Figure 1). The percentage of persons reporting health problems on the survey is greater in the older age groups. Furthermore, only in the older age groups is there a distinct positive association between health and social problems.

The size of the family in which a person lives has no appreciable effect on the slight association of health and social problems among men or on the higher association of these problems among women (Figure 2).

The examination of the data up to this point raises a question about the meaning of the excess of health problems among persons with social problems. The idea readily suggests itself that many of the social agencies render services in connection with health problems, and, therefore, the population which they
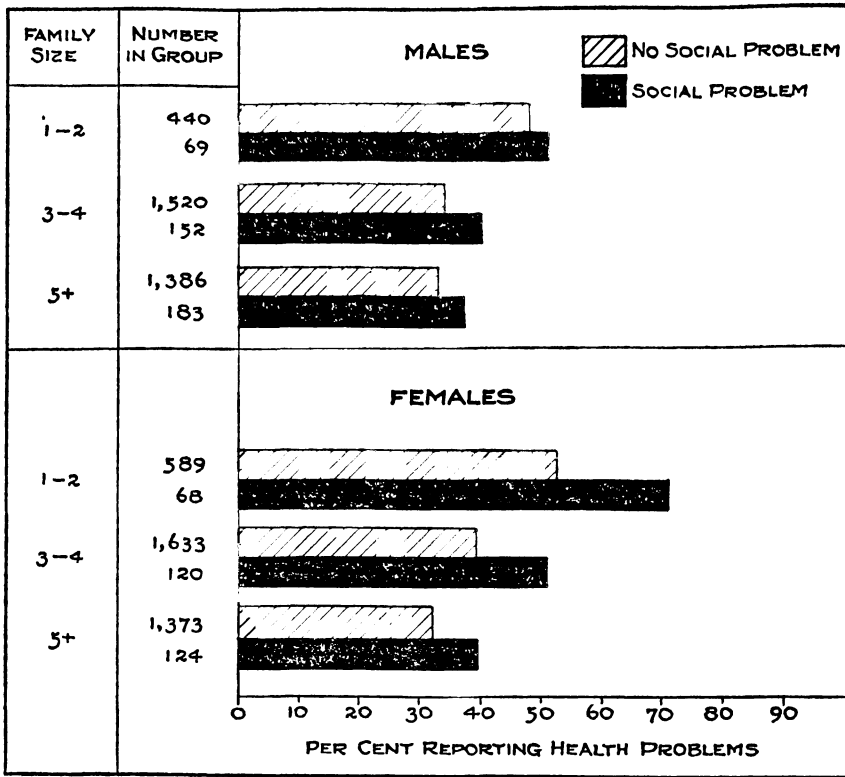
FAMILY SIZE	NUMBER IN GROUP	MALES			No Social Problem / Social Problem
1-2	440 / 69				
3-4	1,520 / 152				
5+	1,386 / 183				

FEMALES

1-2	589 / 68
3-4	1,633 / 120
5+	1,373 / 124

0 10 20 30 40 50 60 70 80 90

PER CENT REPORTING HEALTH PROBLEMS

Fig. 2. Per cent of persons who reported health problems in families of given size, by sex and social welfare status of person.

serve would be selected on this basis. This possibility was explored in a previous paper (5). The findings published in that source indicate that when families are taken as units, the observed association can be explained in a large part by this type of selection. However, an excess of health problems was also observed in families who were known to the Social Service Exchange for behavior problems only. To explore this same question on an individual basis, Tables 2 and 3 are presented.

The findings of Table 2 indicate that the frequency of the different types of social problems varies with age and sex. In every age group, females are more likely than males to receive social services in connection with a health condition. Social problems related to health also occur most frequently in the age group 62 years and older for each sex. Among females in

Table 2. The percentage distribution of persons by their social problem status for each age-sex group.

Social Problem Status	Males					Females				
	<21	22–41	42–61	62+	Total	<21	22–41	42–61	62+	Total
Health Alone	1.4	1.5	1.2	2.5	1.5	2.4	5.2	3.1	7.3	4.0
Behavior Alone	4.3	6.5	4.0	3.3	4.8	1.2	1.6	1.7	1.6	1.5
Health in Combination With Other Problems	0.5	2.5	2.6	3.6	1.9	0.1	1.1	1.2	1.8	0.9
Other Than Above	0.4	2.6	3.2	2.2	1.9	0.4	1.4	1.8	1.1	1.1
All Social Problems	6.6	13.1	11.0	11.6	10.1	4.1	9.3	7.8	11.8	7.5
PNA (All Persons From These Families)	4.6	5.4	8.7	7.9	6.2	5.5	5.6	8.8	8.9	6.7
No Social Problem	88.8	81.5	80.3	80.5	83.7	90.4	85.1	83.4	79.3	85.8
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number in Age Group	1,470	1,178	955	365	3,997[1]	1,412	1,328	954	439	4,187[2]

[1] Includes 29 persons of unknown age.
[2] Includes 54 persons of unknown age.

SOCIAL PROBLEM STATUS	PER CENT WITH HEALTH PROBLEM		NUMBER IN SOCIAL PROBLEM GROUP	
	Males	Females	Males	Females
Health Alone	42.4	54.9	60	167
Behavior Alone	27.9	47.4	192	62
Health in Combination With Other Problems	58.9	50.0	76	36
Other Than Above	50.0	40.4	76	47
No Social Problem	35.0	38.4	3,346	3,595

Table 3. Per cent of persons reporting health problems in the survey by sex and social problem status.

the age group 22–41, the percentage with social problems re-lated to health (5.2%) is somewhat higher than in the age groups under 22 years and 42–61 years. The increase may be partly attributable to the greater need for social services aris-ing from pregnancy and childbirth.

Problems relating to behavior are found more frequently among males than among females. They are especially numer-ous among men in the age group 22–41, and they are found less often in the older age groups. Among females, age has no apparent relationship to the frequency of social problems due to behavior.

Men are classified in the category designated *health in com-bination with other problems* somewhat more frequently than women, but the proportion of both men and of women in this group increases with increasing age. The social problems grouped here include a health component and therefore it is of some interest to add them to the corresponding percentages in the category designated *health alone*. The relationships evi-dent from such a combination are essentially the same as those discussed above for the category of *health alone*.

Under the heading of "Other than above" in Table 2 are found problems related to employment or social problems which could not be readily classified. The numbers in this category are fairly small, but it seems that males have em-ployment problems and unclassified problems more frequently

than females and that these problems occur primarily in the middle age groups. This finding reflects partly the fact that some of these problems arise directly or indirectly from occupational pursuits common to adult men.

The percentage of persons reporting health problems in the survey is given in Table 3 for each category of social problems and for the *no-social-problem* group. Since age differences affect the frequency of various types of social problems and also of health problems, age should be taken into account when the various social problem groups are compared with the *no social problem* group. This was done by age adjusting the percentage of survey health problems for persons with no social problems (35.0% for males and 38.4% for females) to the age composition of each of the social problem groups. Such an adjustment does not substantially change the percentages for the *no social problem* group. No different or new relationships become apparent by including the age-adjusted percentages, and therefore only the crude percentages are presented here.

As the data in Table 3 indicate, men who had social problems related to *health in combination with other social problems* and women who had social problems related to *health alone* reported illness on the household survey most frequently. Among men with the *behavior* type social problems, reports of illness on the survey are somewhat less frequent than in the *no social problem* group. Women in the *behavior* social problem group reported illness on the survey with only a slightly lower frequency than women in the social problem groups involving health.

It may be noted that illness was reported in the survey for only half of the persons who were known to social agencies because of health reasons. The major factor in this discrepancy is time. Persons were considered as having a health problem in the survey on the basis of their health experience during the two years prior to June 1952. However, the data on social problems were obtained from case records of social agencies and often refer back for several years. We examined the frequency

with which illness was reported in the survey for people who were in touch with social agencies during the survey period for reasons of health alone. We found that 79 per cent of them reported health problems in the survey interviews.

Some of the health conditions for which services were being given by social agencies were not detected in the survey. This is due apparently to a bias in the reporting of certain conditions (e.g., mental illness, venereal disease) and due to slight differences in definitions used in the survey and by the agencies. The subject is discussed in another paper (5).

ASSOCIATION OF HEALTH AND SOCIAL PROBLEMS WITHIN FAMILIES

The preceding discussion pointed out that the association of health and social problems in individuals is affected by such variables as age and sex of the person and the nature of the social problem. We can now turn to the question of the effect of the experience of other members of his family on the association of health and social problems in the individual himself. An elemental analysis of these relationships is contained in Table 4.

Assuming the existence of a positive association, we would expect, a priori, that persons who are ill (and consequently from families reporting illness) would have the highest per-

Table 4. Per cent of persons with social problems by the health status of the individual and his family; for families of 2 to 6 persons.

HEALTH STATUS IN SURVEY		NUMBER OF PERSONS (FAMILIES 2–6 PERSONS)	PER CENT WITH			
Of Individual	Of Family[1]		Any Social Problems	Social Problems Related to Health[2]	Social Problems Related to Behavior[2]	Social Problems Related to Behavior Which Were Active June 1950 to Dec. 1951[2]
Health Problem	Health Problem	2,504	10.10	5.52	3.74	0.60
No Health Problem	Health Problem	2,770	8.51	3.60	4.29	1.05
No Health Problem	No Health Problem	1,272	5.50	1.74	3.16	0.39

[1] A family with a health problem is one where one or more members have a health problem.
[2] Excluding 50 persons whose social problems could not be classed as either health or behavior.

centage of social problems. The next highest percentage of social problems would be found among the well persons from families reporting illness in one or more other members. We would expect to find the lowest percentage of persons with social problems among individuals from families where no one has a health problem. The percentages presented in Table 4 indeed follow the assumed pattern when all social problems are considered.

Social problems which are due to behavior (regardless of the possible presence of other social problems) show a different relationship. For these problems, there is not much difference in the risk among persons who are themselves ill (3.74%) and those in families with no one ill (3.16%). Persons in families with health problems who are themselves free of a health problem are, however, the ones who have the highest percentage of behavior problems (4.29%). Individuals in contact with social agencies during the survey period for reasons related to their behavior show the same tendency.[5] The difference between 1.05 per cent and 0.39 per cent is not likely to be a result of sampling variation. Thus it appears that the presence of an ill person in a family was related to the risk of a behavior problem among other family members.

To study the second question which concerned association of problems within families, four hypotheses were formulated. Under Hypothesis I, families of a given size are considered to be random assortments of individuals in which each person possesses the *observed* probability of a health problem alone, a social problem alone, both problems, or neither problem. Effects of an association of health and social problems in individuals are therefore eliminated. The method employed in testing this hypothesis is described in the Appendix. It consists of computing the expected number of families in which a given

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[5] The period for which the health survey information was collected extends six months beyond the time for which the social service exchange clearings were available. A few additional families in the *no social problem* category may, therefore, have applied for social agency services in these six months. However, it is doubtful that this appreciably affects the findings presented here.

FAMILY SIZE	ALL FAMILIES		EXCLUDING FAMILIES WITH SOCIAL PROBLEMS RELATED TO HEALTH		EXCLUDING FAMILIES WITH SOCIAL PROBLEMS RELATED TO HEALTH AND ALL WITH CASE CLOSED PRIOR TO JUNE, 1950	
	X^2	$P<$	X^2	$P<$	X^2	$P<$
2	38.8	.005	7.4	.285	2.0	.572
3	59.9	.005	21.9	.009	11.7	.042
4	63.6	.005	39.1	.005	19.0	.008
5	50.3	.005	26.1	.011	15.6	.030
6	76.8	.005	—	—	19.0	.008

Table 5. X^2 comparisons of observed and expected distributions or persons under Hypothesis I, for families with various types of social problems, by size of family.

number of members experience illness or bring about a social problem. We would expect to obtain this number of families with the given outcome if families were like random groupings of the individuals in our population. The expected numbers can be compared with the observed numbers of families in which the specified combination of persons with health and social problems has actually occurred.

From Table 5 it appears that we can reject Hypothesis I even if the definition of social problems is restricted considerably. Families evidently cannot be considered as random aggregations of individuals with respect to the presence of social and health problems. This holds true even if we consider only those social problems which are connected with behavior and which also bring about registration with a social agency during the period covered by the survey.

To evaluate the nature of the deviations from Hypothesis I, two other hypotheses will be tested. Under Hypothesis II, families are regarded as random groupings of individuals when each person has the observed probability of a health problem. By expanding the $(p+q)^n$ binomial, we can determine for families of n persons how many families we would expect under Hypothesis II in which there would be no one ill, how many in which one person would be ill, and so on up to n. By summing

Number of Persons in Family Who Have Health Problem	Observed Number of Families With This Outcome	Number of Families Expected Under Hypothesis II
0	375	328.8
1	688	725.9
2	517	547.9
3 and More	235	212.4
Total	1,815	1,815.0
	$X^2 = 12.63$, d.f. $= 3$, $P < 0.01$	

Table 6. Frequency distribution of families with none, one, two, or three and more persons with a health problem, as compared with the frequency distribution expected under Hypothesis II; for families of 2 to 6 persons.

the observed numbers of families with these outcomes among families of different sizes and comparing the observed frequencies with the expected ones (summed in a corresponding fashion), we can test Hypothesis II. The results are presented in Table 6.

Findings from this analysis can be interpreted as indicating an association of health problems in families. Comparison of the observed and the expected numbers reveals that there are more families in which no one has a problem, and also more families in which three or more members have health problems, than we would expect under Hypothesis II. This excess is compensated for by fewer families in which one or two members have a health problem than we would expect under Hypothesis II. Since this table represents a summary of the relationships found in families of specific sizes, the specific pattern might vary somewhat from one family size to another. However, for each family size more families in which no one had a health problem were observed than would be expected under Hypothesis II, and also there were more families in which several members had a health problem than would be expected. Thus, the summary contained in Table 6 is truly representative of the relationships observed in families of specific sizes.

The association of social problems in families was evaluated in the same manner as the association of health problems. Hypothesis III is that families can be regarded as random

NUMBER OF PERSONS IN FAMILY WHO HAVE SOCIAL PROBLEM	OBSERVED NUMBER OF FAMILIES WITH THIS OUTCOME	NUMBER OF FAMILIES EXPECTED UNDER HYPOTHESIS III
0	1,405	1,322.1
1	295	431.4
2	89	56.8
3 and More	26	4.7
TOTAL	1,815	1,815.0

$X^2 = 94.86$, d.f. $= 2$ (combining last 2 rows), P < 0.01

Table 7. Frequency distribution of families with none, one, two, or three and more persons with a social problem as compared with frequency distribution expected under Hypothesis III; for families of 2 to 6 persons.

groupings of individuals when each person has the observed probability of a social problem. The same treatment of the data as that used for health problems yielded Table 7 when it was applied to social problems. Table 7 shows the same kind of association for social problems in families as was observed for health problems. Again there are more families in which no one has a social problem, and there are also more families in which several members have a social problem than we would expect under Hypothesis III. When the numerical values of the two chi-square (X^2) criteria are compared, it becomes apparent that the association of social problems in families is considerably stronger than that of health problems. This may be due in part to the fact that once an individual within a family gets in touch with a social agency, the agency becomes more accessible to the other family members.

The analysis presented in Tables 6 and 7 clarifies the rejection of Hypothesis I by showing that health problems alone and social problems alone are not randomly distributed in families. Before we may conclude that a *bona fide* association between health and social problems exists in families, however, we have to reject the hypothesis that the observed association of health problems in families is independent of the observed association of social problems in families. This assumption constitutes Hypothesis IV. To test Hypothesis IV, we shall consider the probability of the joint outcome of n health prob-

lems and m social problems in each family to be the product of the relative frequency of families having n health problems and the relative frequency of families having m social problems. Thus, for instance, the probability of randomly selecting a family with no health problems and no social problems under

Hypothesis IV is considered to be $\frac{375}{1815} \times \frac{1405}{1815}$ (See Tables

6 and 7.) On this basis Table 8 has been constructed.

The analysis in Table 8 is based on all social problems regardless of their type or date of registration. It indicates that the presence of social problems in families is not independent of the presence of health problems in families, and the resulting

Table 8. Frequency distribution of families with the specified number of persons who have a health problem and a specified number of persons who have a social problem as compared with the frequency distribution expected under Hypothesis IV; for families of 2 to 6 persons.

NUMBER OF PERSONS IN FAMILY WHO HAVE THIS PROBLEM		OBSERVED NUMBER OF FAMILIES WITH THIS OUTCOME	NUMBER OF FAMILIES EXPECTED UNDER HYPOTHESIS IV	SIGN OF DIFFERENCE BETWEEN OBSERVED AND EXPECTED NUMBER
Social	Health			
0	0	318	293.4	+
0	1	536	538.5	−
0	2	394	399.8	−
0	3+	157	173.7	−
1	0	46	59.7	−
1	1	116	109.6	+
1	2	80	84.2	−
1	3+	53	41.4	+
2	0	9	17.8	−
2	1	31	32.3	−
2	2	36	25.4	+
2	3+	13	13.4	−
3+	0	2	4.2	−
3+	1	5	7.4	−
3+	2	7	7.6	−
3+	3+	12	6.6	+
		1,815	1,815.0	

$$X^2 = 25.98$$
$$d.f. = 15$$
$$P = 0.038$$

deviations are greater than we would expect from the knowledge that health problems and social problems separately are themselves associated in families. It can be noticed that outcomes in which the number of persons with a social problem was the same as the number with a health problem have an excess of observed families over the expected number. For instance, there is a greater number of observed than of expected families in which there are no social problems and no health problems, and also of families in which there is one social problem and one health problem, two social problems and two health problems, three social problems and three health problems. It is also interesting that with one exception, i.e., one social problem with three or more health problems, the above-mentioned outcomes of like numbers of social and health problems are the only ones in which there is an excess of observed over the expected number of families. For all other outcomes, we observe fewer families than we would expect under Hypothesis IV. Thus, it becomes apparent that the patterns of association of social problems in families are not independent of the patterns of association of health problems in families. From the value of the chi-square criterion, it appears that these relationships are not likely to be due to sampling variation.

The same type of analysis was applied to families in which persons were known to social agencies only for reasons due to their behavior and had also been registered with Social Service Exchange during the survey period (June 1950 to December 1951). This analysis reveals a pattern quite similar to the one presented in Table 8, but because of the small number of persons with social problems of this kind Hypothesis IV is not rejected (chi-square = 8.35 with 9 degrees of freedom). However, we can not conclude that the relationships seen in Table 8 do not apply to families who are currently registered with the Social Service Exchange and are known because of behavior problems only.

DISCUSSION

The foregoing tests of our four hypotheses show that even

after we account for the association of health and social problems in individuals, the distribution of persons with these characteristics in families does not approximate that which we would expect by randomly assigning persons into families. It is shown that the presence of a social problem in one of the family members is more often accompanied by the presence of a social problem in other family members than we would expect on the basis of a random distribution of social problems in the population. This relationship also appears to be true for health problems. Another interesting conclusion is that the observed distribution of persons with health problems in families is not independent of the observed distribution of persons with social problems in these families. By rejecting the hypothesis of the independence of these distributions, we can conclude that in addition to factors which produce a clustering of sick persons in families and factors which independently produce a clustering of persons with social problems in families, there are factors which affect both jointly.

The relationship of health and social problems among members of the same family is further clarified by the following finding: In families reporting illness the healthy members had a greater risk of a social problem due to behavior than persons from families not reporting illness (Table 4). This may help explain the observations of other investigators who found that a small number of families in one community received the largest proportion of the welfare services (9). This possibility justifies a further search for the causal elements involved in this association.

The workers in the fields of social welfare and public health have realized, primarily on an a priori basis and by unsystematic observation, that they share an area of common concern. It is of importance to verify this realization by the use of systematically collected data. A further clarification of the relationship between health and social welfare problems among family members should make it possible to formulate more effective social welfare and public health measures.

SUMMARY AND CONCLUSIONS

This investigation was carried out as a part of a broader research project conducted by the Department of Biostatistics, Graduate School of Public Health, University of Pittsburgh. In these previous studies, families were used as units of observation. On this basis it was found that families reporting health problems on a survey had a greater risk of being known to the Pittsburgh Social Service Exchange than those not reporting health problems.

The objective of the present work is an analysis of the association between health and social problems in terms of individuals. Two specific questions receive special attention. First, what effect do age, sex, size of family, and the nature of the social problem have on the association of health and social problems in individuals? Second, given specified relationships of health and social problems in individuals, how can we account for the association of health and social problems in families?

Findings related to the first question indicate that age, sex, and nature of the social problem affect the association of health and social problems in individuals. This association does not vary appreciably with differences in size of family.

Findings related to the second question of this study are quite conclusive. They indicate that even after the relationship of health and social problems in individuals is taken into account, families cannot be regarded as a random assortment of individuals. The nature of the deviations from non-randomness is complex, but some of its aspects have been singled out. It is shown that the presence of a health problem in one of the family members is accompanied by the presence of health problems in the other family members more often than we would expect if health problems were randomly distributed in the population. The same kind of relationship also appears to be true of social problems. A basic finding is that *healthy* persons in families reporting illness had a greater risk of being known

to social agencies for reasons of behavior than persons in families not reporting illness.

Further, it is found that the observed distribution of health problems in families is not independent of the observed distribution of social problems in these families. Therefore, we can conclude that, in addition to factors which affect the health experience of individuals in families and factors which independently affect the social welfare experience of individuals in families, there are factors which affect both jointly. Such a conclusion calls for further research into the mechanisms which produce this association.

APPENDIX

The testing of each of the four hypotheses employed above is based on a common principle. Families of a given size are classified according to the combination of people with the health and social characteristics which they contain. The procedure used in the categorizing of families is presented in this appendix.

The status of any one person with respect to health and social problems is described in terms of four mutually exclusive categories. An individual can have: (1) both a health and a social problem; or (2) a social problem only; or (3) a health problem only; or (4) neither a health nor a social problem. Each person from a family of a specified size is classified into one of these four categories, and the number in each category is determined. From the counts are obtained estimates of the probability associated with each of the four categories. The subsequent treatment of the estimated probabilities is determined by the nature of the hypothesis tested.

In formulating Hypothesis I we say, in effect, that the social and health experience of families size n can be described by randomly selecting groups of n persons. These are to be selected from a population in which there is the same proportion of persons in each of the four categories as in the families which we observed. Since these categories describe the joint outcomes of health and social problems in individuals, the corresponding probabilities will reflect any association between health and social problems in the individuals themselves. If these estimates are used in testing Hypothesis I, the association between health and social problems in

individuals will not affect the test, since this association has already been isolated by determining the probabilities of the four joint outcomes in individuals. The procedure used in testing Hypothesis I is illustrated using families of two persons.

There were 414 families of two persons, or 828 people. Of these, 55 had both a health and a social problem; 381 had a health problem alone; 32, a social problem alone; and 360 had neither problem. Since the number of persons involved is large, we can consider the

frequencies $\frac{55}{828} = 0.066, \frac{381}{828} = 0.460, \frac{32}{828} = 0.039$, and $\frac{360}{828} = 0.435$ as

reasonable estimates of the population probabilities. In sampling groups of two persons from this population, any characteristic of the first person can be matched against any of the four possible characteristics of the second person. There are, therefore, 16 possible outcomes to the occurrence of health and social problems in families of two people. The probability of each such outcome is given by the product of the probabilities of the characteristics of the two people. For example, the probability of randomly selecting two people, the first person with a health and a social problem, and the second person with neither problem, is given by $0.066 \times 0.435 = 0.0287$. However, since we do not differentiate between the first and the second person, 0.0287 is also the probability of the outcome in which we select the person with neither problem first, and the one with both problems, second.

By the combining of equivalent outcomes, we obtain the ten outcomes listed in Table A. We then perform the indicated computations to obtain the number of families expected under Hypothesis I for each outcome. We compare the observed and expected frequencies of the different outcomes by means of the X^2 criterion (grouping outcomes No. 5 and No. 10 because of their small expected value). By this method, we get a $X^2 = 38.8$ with 8 degrees of freedom. Under the null hypothesis on repeated random sampling from the indicated population, we would obtain samples more divergent than this one with a frequency of less than one in a thousand. The infrequency of such an event forces us to reject null hypothesis for families of two persons. The same kind of analysis was performed for the other family sizes and the results are presented in Table 5.

In testing Hypothesis II, only a single variable, the presence or

Table A. Frequency distribution of persons with various health and social characteristics in families of two persons.

Outcome Number	Number of Persons in Family With Both a Health and a Social Problem	Number of Persons in Family With a Health Problem Only	Number of Persons in Family With a Social Problem Only	Number of Persons in Family With Neither Problem	Number of Families in Which This Combination Was Observed	Number of Families Expected Under Hypothesis I
1	0	0	0	2	86	$78.3 = 1 \times 0.435 \times 0.435 \times 414$
2	0	0	1	1	8	$14.0 = 2 \times 0.039 \times 0.435 \times 414$
3	0	1	0	1	159	$165.7 = 2 \times 0.460 \times 0.435 \times 414$
4	1	0	0	1	21	$23.8 = 2 \times 0.066 \times 0.435 \times 414$
5	0	0	2	0	3	$0.6 = 1 \times 0.039 \times 0.039 \times 414$
6	0	1	1	0	16	$14.9 = 2 \times 0.460 \times 0.039 \times 414$
7	1	0	1	0	2	$2.1 = 2 \times 0.066 \times 0.039 \times 414$
8	0	2	0	0	95	$87.6 = 1 \times 0.460 \times 0.460 \times 414$
9	1	1	0	0	16	$25.1 = 2 \times 0.066 \times 0.460 \times 414$
10	2	0	0	0	8	$1.8 = 1 \times 0.066 \times 0.066 \times 414$

absence of health problems, is used. The probability of a health problem among respondents from families of two persons is estimated to be $0.066 + 0.460 = 0.526$. On this basis we can determine how many families we would expect under Hypothesis II in which no one has a health problem, one person has a health problem, or two people have a health problem. To simplify the presentation, the expected number of families with a given outcome is added for families of different size. The actually observed number of families with a given outcome is added in the same fashion, and this procedure yields Table 6. To test Hypothesis III, Table 7 is obtained by treating social problems in the same fashion as was described for health problems. The procedure used in testing Hypothesis IV uses the observed numbers classified under each of the various outcomes in Table 6 and Table 7. The method employed is described in some detail in the text.

ACKNOWLEDGEMENTS

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NUMBER OF CHILDREN EXPECTED IN RELATION TO NON-FAMILIAL ACTIVITIES OF THE WIFE[1]

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UNTIL recently the studies in differential fertility have been largely descriptions of variations in fertility among significant groups in the population. More recently the emphasis has been upon the quest for predictively useful social and psychological factors affecting family size. To date only socio-economic factors such as education, occupation, income and religion have proved useful predictors.[3] At present however, it is being noted that changes are taking place in the traditionally observed inverse relationship of these socio-economic variables and fertility. These recent findings emphasize the importance of understanding not only the dynamics of this relationship but of discovering other variables that in the future may be more crucial in the prediction of fertility behavior. Thus emphasis has shifted toward the development of more inclusive hypotheses that may lead to a better understanding of fertility differentials.

This paper reports on an attempt to test one of these more inclusive hypotheses as suggested by Ronald Freedman. The general hypothesis is that "fertility differences are related to differences in the division of labor between the family and other social institutions."[4] This hypothesis is based upon