

## THE INTRAFAMILIAL TRANSMISSION OF RHEUMATOID ARTHRITIS—VII

### WHY DO WIVES WITH RHEUMATOID ARTHRITIS HAVE HUSBANDS WITH PEPTIC ULCER?

SIDNEY COBB, M.D., STANISLAV V. KASL, Ph.D., JOHN R. P. FRENCH, Ph.D. and  
GUTTORM NÖRSTEBÖ, M.A.

Institute for Social Research, The University of Michigan, Ann Arbor, Michigan

(Received 21 December 1967; in revised form 26 August 1968; further revised 6 January 1969)

SOME years ago the senior author publicly expressed [1] the hypothesis that women with rheumatoid arthritis should, with undue frequency, be married to men with peptic ulcers. The reason given for this speculation was that it seemed likely that the hostility in these marriages [2, 3] would leave unmet the husbands' needs for emotional support and the wives' needs for ego support. When in the course of the study of the intrafamilial transmission of rheumatoid arthritis it became apparent that this prediction of association of rheumatoid arthritis and peptic ulcers across the marriage would be supported, it was decided to devote most of the third interview to those variables relevant to this hypothesis.

#### METHODS

The general nature of the study, the nature of the sample, the methods of data collection, and the methods of measuring rheumatoid arthritis have been described in the first two papers of this series. Peptic ulcer is measured by the index developed and validated by DUNN [4]. This index was validated in men and has been successfully used in various studies [5-7]. It is probably not useable in women because women have a variety of additional causes of abdominal pain that may wake them at night. Like other indices this is useful in the detection of associations between peptic ulcer and variables of interest but is not useful in assessing the frequency of the disease. On this scale, category 1 is a positive index and category 2 is a clear history of a radiologic diagnosis, a diagnosis made at surgical operation, or a positive index with a history of hematemesis.

The reader will remember that the sample is composed of 49 family clusters. For present purposes we are concerned primarily with the first four cluster members, namely, the key persons and their spouses, plus the siblings of these key persons and the siblings' spouses. Since one of the 49 siblings refused the last interview, complete data are available on 97 of the possible 98 married couples. This report will focus on these marriages rather than on individuals. A list of the 49 clusters identifying the key persons through whom the clusters were selected, showing the sibling structure and showing the distribution of the diseases of concern, a brief description of the most relevant psychological variables and a matrix showing their inter-correlations are provided in the appendix to this report. It should be noted that the inter-correlations are done where possible on all people in the study. However, for many

variables the number is 97 rather than the total of 211 marriages on which some data were available. It should be remembered from the first paper in this series that for 114 of the 211 marriages, one spouse was interviewed only once instead of three times.

The analytical methods involve Pearsonian correlation coefficients and the squares thereof, which are the proportion of the variance accounted for in the relationship. In addition, we have used GOODMAN and KRUSKAL's [8] gamma, an index of association specifically developed for data arranged into ordered classes. For more detail concerning this measure, the reader is referred to the fourth paper of this series. Finally, when *t*-test have been run on differences between means, one tail tests of significance were used because all the tests are of pre-stated hypotheses. When it is relevant to estimate the proportion of variance accounted for in the association, this is estimated from the formula

$$W^2 = \frac{t^2 - 1}{t^2 + N_1 + N_2 - 1}$$

as suggested by HAYS [9].

In order to remind the reader that we are dealing with the interview measures of rheumatoid arthritis and peptic ulcer, we will continue to use abbreviations. As in the earlier papers of this series, RA will be taken to mean the categories 2 and 3 on the four-point RA scale, and  $\overline{RA}$  will mean categories 0 and 1 on that scale. By the same token, PU will be used to mean categories 1 and 2 of the PU scale and  $\overline{PU}$  will mean category 0 of that scale.

## RESULTS

In presenting the results it seems well to lead the reader along the road we followed in the analysis, for taking too many short cuts will lead to confusion. The first analysis simply asked if the husbands of the female key persons with RA have more PU than the brothers and brothers-in-law from the 49 clusters. In Table 1 we see that this is true for the sample as a whole and for the National sample, but for the Clinic sample the association is quite weak. It is well to keep this difference between the samples in mind, for though it is not statistically significant with this size of sample, it will be shown below to be meaningful, and it may bear on the replicability of the study.

At this point we turn from a focus on the individual to a focus on the marriage as

TABLE 1. THE FREQUENCY OF PU AMONG THE HUSBANDS OF FEMALE KEY PERSONS WITH RA COMPARED WITH THE FREQUENCY IN THEIR BROTHERS AND BROTHERS-IN-LAW

	National sample			Clinic sample		
	PU	$\overline{PU}$	Total	PU	$\overline{PU}$	Total
Husbands of female key persons with RA	11	6	17	5	7	12
Brothers and brothers-in-law	6	22	28	5	16	21
Total	17	28	45	10	23	33
	$\chi^2_c = 6.69$ $p < 0.01$			$\chi^2_c = 0.46$ n.s.		

Collapsing National and Clinic Samples  $\chi^2_c = 7.23, p < 0.01$ .

TABLE 2. THE ASSOCIATION OF RA AND PU IN THE MARRIAGE

Husband		Wife		Total
		RA	$\overline{RA}$	
RA	PU	4	6	10
	$\overline{PU}$	0	5	5
$\overline{RA}$	PU	16	10	26
	$\overline{PU}$	20	36	56
Total		40	57	97

## Significance tests:

Husband RA vs. husband PU	$\chi^2_e = 5.23, p < 0.05.$
Wife RA vs. husband PU	$\chi^2_e = 3.95, p = 0.05.$
Husband RA vs. wife RA	$\chi^2_e = -0.92, n.s.$

the unit of study. Whereas in Table 1 the concern was with the proportion of men with ulcers, in Table 2 the concern is with the frequency of marriages of 8 types: wife with and without RA; husband with and without RA; and husband with and without PU ( $2 \times 2 \times 2 = 8$ ). It should be reiterated that PU was neither sufficiently satisfactorily measured in the wife nor sufficiently frequently reported to be useful in this analysis. However, one might just mention that PU in women seemed more frequent among women with RA. In this table one notes first the already known association of RA and PU in men [10]. Second, there is demonstrated the excess frequency of marriages in which the wife has RA and the husband has PU. Third, in this sample at least, there is no excess frequency of marriages in which both husband and wife have RA; in fact, there is a slight but insignificant deficit of such marriages. In this connection, it is useful to note that there is no accumulation of RA or PU in siblings, nor is there any tendency for the sisters to have RA and the brother to have PU. The reader who wishes to examine these matters in more detail is referred to Table A of the appendix.

One naturally asks about the timing of the onsets in relation to the date of marriage. The most important point is that dating onsets is very difficult since both RA and PU tend to have insidious beginnings. Such dates as are available suggest a slight tendency for the RA in the wife to antedate the PU in the husband. There are no cases in which the husband's PU antedated the marriage but there are a few in which the wife's RA did. Furthermore, it is curious that of the 9 marriages for which date of onset for both diseases are available, the year is the same for 1, and within 4 yr for an additional 3. These observations, though not statistically significant, suggest that a future study might profitably give careful attention to temporal relationships and the health of previous spouses.

Table 2 is the key to understanding the results to follow, for it provides the numbers of marriages in each of the various cells to be studied. Because the number of marriages in which the husband has rheumatoid arthritis is small, because 11 of the 15 families came from the clinic sample, and because these marriages are often different in their characteristic from the marriages in which the husband is not a rheumatoid, most of the analysis will be confined to the 82 marriages in the lower half of the table.

The mean age for the 194 persons in the sample is 50.4 yr. Because of the nature of the sample, the frequency of RA is independent of age. On the other hand, the marriages in which the man has PU are slightly older, averaging 51.7 yr, than the others, averaging 48.8. This difference is too small to be taken into consideration when relating PU to the psychological variables, none of which are strongly age dependent.

With respect to mean education level the groups in the lower half of Table 2, husbands RA, are not significantly different from one another. For the very small group of marriages with all three conditions the education level is very much lower. We do not attach any particular significance to this finding beyond a further encouragement to be wary of the findings with regard to the families in which the husband has RA. Fortunately, as seen in the appendix, none of our psychological variables are importantly related to education, the average correlation being 0.07 ignoring the sign, and the largest being 0.13; so we can safely neglect education as a possible confounding variable. On the other hand, the question of complaint level might be an important issue, for it is related to a variety of the psychological variables and could conceivably be related to classification error with respect to RA and PU. It has been demonstrated in the second paper of this series [5] that the errors in classification of the RA measure are not significantly related to complaint level and the percentage of variance accounted for is probably so small as to be negligible. No data on this subject are available for classification errors in PU, but PU is not significantly associated with complaint level. Therefore, the possibility that the results here reported are simply due to classification error related to complaint level is reasonably excluded.

Turning now to the rather complicated psychological hypothesis, it is first appropriate to see if marital hostility is in fact high in those families in which the wife has RA and the husband has PU. To this end we will work with a set of marriage variables, the inter-relationships of which are shown in Fig. 1. The correlation coefficients come from the correlation matrix in the appendix, and the items contributing to

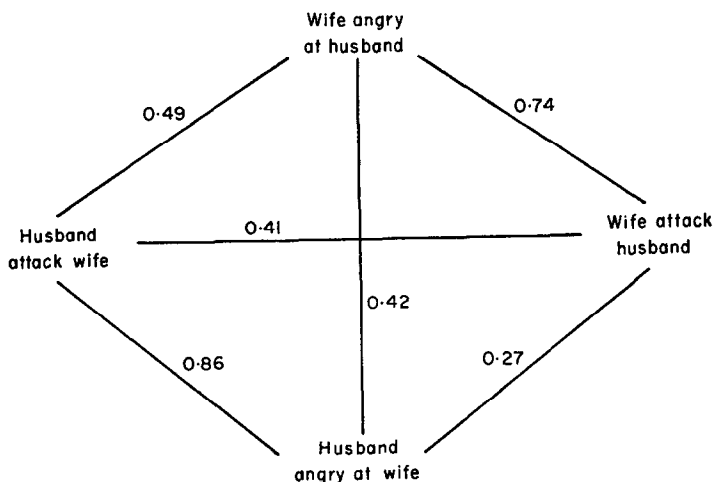


FIG. 1. A correlogram showing the interrelationship among the 'marital hostility' variables. The numbers are correlation coefficients from Table B of the Appendix.

TABLE 3. THE RELATION OF MARITAL HOSTILITY TO THE PRESENCE OR ABSENCE OF RA IN THE HUSBAND

	Marital hostility			Total
	High	Mixed	Low	
Husband RA	1	6	8	15
Husband $\overline{\text{RA}}$	24	37	21	82
Total	25	43	39	97

$$\text{Gamma} = 0.55^* \quad t = 2.25 \quad p < 0.02$$

\*The gamma value is somewhat inflated by the inequality of the marginal totals but the significance test, which uses a correction for continuity, is not.

each measure are listed there. The strength of these correlation coefficients is in part due to the similarity of the items, but it is noteworthy that the relationships fit well with theoretical expectations. For example, 'anger at spouse' and 'attack spouse' are significantly more strongly related than 'attack spouse' and 'anger of spouse' thereby aroused. Furthermore, the husband's attack on the wife is more strongly related to the wife's anger toward him than is the wife's attack on husband to the husband's anger at his wife. These 2 observations fit well with the notion that both husband and wife have sources of spouse specific anger other than attacks from spouse and that this is particularly true of the husband.

With these variables in mind we proceed to the definition of a marriage with high hostility which for present purposes is any marriage for which all 4 of these hostility variables are at or above the estimated median. By the same token, a marriage with low hostility has all of these variables at or below the median, and those families with mixed patterns are in the intermediate group.

Before proceeding to use this classification of marital hostility in relation to our main focus on RA in the wife and PU in the husband, it is important to remember from the fifth paper in this series that there is a difference between men and women with rheumatoid arthritis with respect to the frequency of their general anger-irritation, the men being significantly lower than the women. This leads us to Table 3 which shows that in those families in which the husband has RA the level of marital hostility is significantly lower than in the remaining families. For this reason, the 15 husband RA marriages are eliminated from consideration before proceeding.

Table 4 shows the relationship of the level of marital hostility to type of marriage. It is immediately apparent that there is a large difference in the distribution of hostility levels with high levels most common in those families in which the wife has RA and the husband has PU. Here again this is more true for the National sample than for the Clinic sample. This led to the hypothesis that those high on hostility might become angry at their physicians and therefore might not remain under continuous medical care. This proved to be not quite significant for 'marital hostility'. However, those women with RA who are highest on 'anger-irritation' are significantly less likely to be under continuous medical care than those RA women who are more like normal women in their levels of 'anger-irritation'. This suggests that the differences between the Clinic sample and the National sample are real and meaningful, even if not large

TABLE 4. THE RELATION OF MARITAL HOSTILITY TO RA IN THE WIFE PLUS PU IN THE HUSBAND FOR THE 82 MARRIAGES IN WHICH THE HUSBAND IS FREE OF RA

	Marital hostility			Total
	High	Mixed	Low	
Wife RA <i>and</i> husband PU	9	4	3	16
Wife RA <i>or</i> husband PU	7	18	5	30
Neither	8	15	13	36
Total	24	37	21	82

Gamma=0.35;  $t=2.18$ ;  $P < 0.02$ .

enough to be significant. It further suggests that our findings may not be detected in clinic samples unless they were to be quite large.

We have then established the fact that marital hostility is in some way connected with the occurrence of RA and PU across the marriage. The next question is: are these generally unsatisfactory marriages or is this a rather specific phenomenon? As a partial answer to this, we can note in Table 5 that 'marital dissatisfaction', 'marital disintegration,' and 'marital distrust' are in no way related to the occurrence of these diseases in the married pair. If this is the case, the association of 'marital hostility' with 'marital dissatisfaction' must be different in the diseases families from the normal families. On examination this turns out to be the case. The easiest way of expression it is to say that among the 36 normal marriages there are no instances of high 'marital hostility' with low 'marital dissatisfaction', while among the 46 disease containing marriages there are six such instances ( $p < 0.03$  Fisher's exact test, one-tail). At this point it is appropriate to ask what are the complementarities that hold these marriages together? They might be sado-masochistic in nature. Unfortunately, we have no evidence on this point. Table 5 suggests that they are probably not in the areas of emotional support, control avoidance and self esteem support.

Next it is necessary to see something of the way that marital hostility is linked to 'anger-irritation' and 'depression', which are already known to be related to the occurrence of RA in women (See the fifth paper in this series). It is gratifying to note

TABLE 5. CHARACTERISTICS OF THE MARRIAGE THAT ARE UNRELATED TO RHEUMATOID ARTHRITIS IN THE WIFE OR PEPTIC ULCER IN THE HUSBAND

1.	Marital disintegration
2.	Marital dissatisfaction
3.	Marital distrust
4.	Average level of 'Scout Oath' behavior
5.	Agreement between spouse sent role and self sent role to avoid controlling behaviour.
6.	Role conformity to avoid controlling spouse
7.	Level of mutual avoidance of controlling each other
8.	Unmet need to avoid being controlled by spouse
9.	Agreement between spouse sent role and self sent role to be emotionally supportive
10.	Role conformity to support spouse emotionally
11.	Level of mutual emotional support

Note: The items for these measures can be obtained from the authors on request.

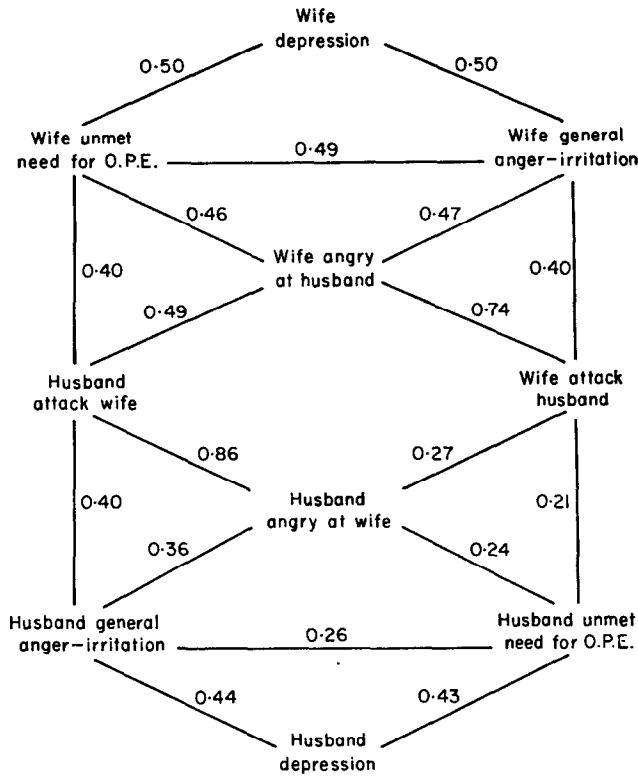


FIG. 2. The relation of 'depression', 'anger-irritation' and 'unmet need for objective public esteem' to the 'marital hostility' variables.

from Fig. 2 that the relationships are generally symmetrical even though they are somewhat stronger on the wife's side. For clarity, certain of the weaker relationships have been omitted from the correlogram, but can be filled in by the reader from the correlation matrix in the appendix, if desired. The variable 'unmet need for OPE' is the unmet need for objective public esteem, that is the degree to which the individual's self expressed need to be highly valued is unmet by his/her spouse's evaluation of him/her. It is assumed that this contributes negatively to self esteem, and in fact it correlated  $-0.46$  and  $-0.45$  with self esteem for men and women respectively.

Obviously this whole region of 'unmet need for OPE', 'low self esteem' and 'depression' might be looked on as a single domain, for the intercorrelations between the three measures for men and also for women range between 0.35 and 0.50 and the concepts are clearly related. However, the pathways are stronger when the variables 'unmet need' and 'depression' are used than when any other one or pair is used. And, in fact, when all three are used, 'low self esteem' seems to dangle. Furthermore, 'low self esteem' is not significantly related to rheumatoid arthritis and the only barely significantly related to 'husband attack wife'. For these reasons, the self esteem variable has been dropped from the correlograms though it appears in the correlation matrix (see appendix). This does not mean that 'self-esteem' is considered to be an unimportant variable. It may simply be that the measure we have used is more subject to defensive distortion than the other two.

TABLE 6. THE RELATION OF WIFE'S ANGER-IRRITATION AND DEPRESSION TO HER RA AND HER HUSBAND'S PU

(a) Wife's mean anger-irritation				
Husband	Wife		Overall	
	RA	$\overline{RA}$		
PU	2.8	2.1	2.5	n.s.
$\overline{PU}$	2.6	2.1	2.2	
Overall	2.7	2.1		

$t=2.21$ ;  $p < 0.02$ ;  $W^2=0.22$ .

(b) Wife's mean depression level				
Husband	Wife		Overall	
	RA	$\overline{RA}$		
PU	3.2	2.9	3.1	n.s.
$\overline{PU}$	3.0	2.8	2.9	
Overall	3.1	2.8		

$t=2.12$ ;  $p < 0.02$ ;  $W^2=0.20$ .

In Table 6 it is demonstrated that the wife's 'general anger-irritation' and 'depression' are related to her RA, but not to her husband's PU. These variables in the man are not related either to his wife's RA, nor to his PU. The wife's 'unmet need for objective public esteem' is only marginally related to her RA. Specifically, when her husband reports on her need the relationship is significant. But, when she reports on her own need, yielding a more logical variable and the one that is used here, the association is in the predicted direction but not quite significant. It therefore seems reasonable to suppose that the wife's 'unmet need' for OPE has its effect through depression to which it is strongly related.

Turning next to 'unmet need for emotional support', we see from Fig. 3 that this variable is appropriately and symmetrically related to 'marital hostility'. Some paths through 'unmet need for OPE' and 'denigration' are interesting, but are no stronger than those shown. The reader can fill them in from the correlation matrix in the appendix if he should be curious. They are not relevant to the argument presented here. Pursuing the main theme into Table 7, it can be seen that there is a significant relationship of the unmet need for 'emotional support' of the husband to his PU, but not to his wife's RA. The relationships of the wife's 'unmet need' have been examined and found unrelated to her RA or to her husband's PU or to his RA.

In addition to the above findings the hypothesis was entertained that the wife's attacks on the husband might be associated with attempts to control him that would leave his need to avoid being controlled unmet and that this would in turn contribute to his ulcer. This hypothesis was not supported.

At this point it is possible to summarize the essential findings in Fig. 4. Here,



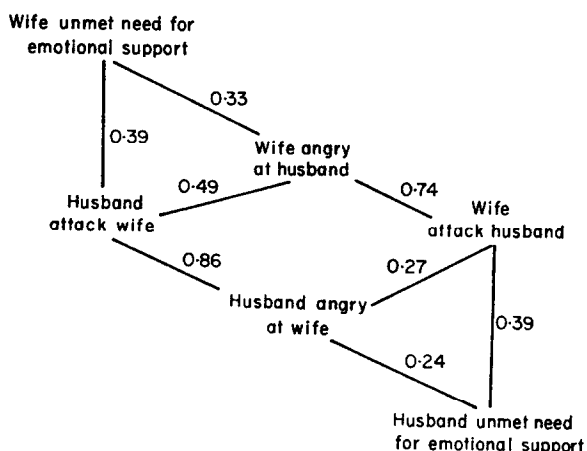


FIG. 3. Correlogram showing the relation of 'unmet need for emotional support' to the 'marital hostility' variables.

TABLE 7. THE RELATION OF THE HUSBAND'S UNMET NEED FOR EMOTIONAL SUPPORT TO HIS PU AND HIS WIFE'S RA

Husband	Wife		Overall
	RA	$\overline{RA}$	
PU	0.61	0.82	0.69
$\overline{PU}$	0.46	0.29	0.35
Overall	0.53	0.41	

$t=1.72; p<0.05; W^2=0.15.$

instead of correlation coefficients, the proportion of variance accounted for in each relationship is inserted. In this diagram, we believe that we have omitted no paths between the variables that account for more of the variance than the paths which are shown. It can be seen that a useful proportion of the total variance is accounted for in all segments of the diagram. In general, it would seem fair to conclude that the indicated psychological variables are among the more important ones describing the association of RA in the wife with PU in the husband.

DISCUSSION

A set of associations that are statistically significant have been demonstrated. We know from earlier work [11] that if the classification errors of our measures are independent of the variables to which they are being related, the associations demonstrated are as significant as if they had been demonstrated using perfect measures. The one variable which may not be independent of the classification of the diseases and be associated with some of the psychological variables is 'complaint level'. This has been examined and it has been shown that the contribution of 'complaint level' to misclassification of the diseases is trivial. It is conceivable that social desirability effects [12], which were not measured in this study, might have contributed to the strength of the association simply because those who are low on social desirability

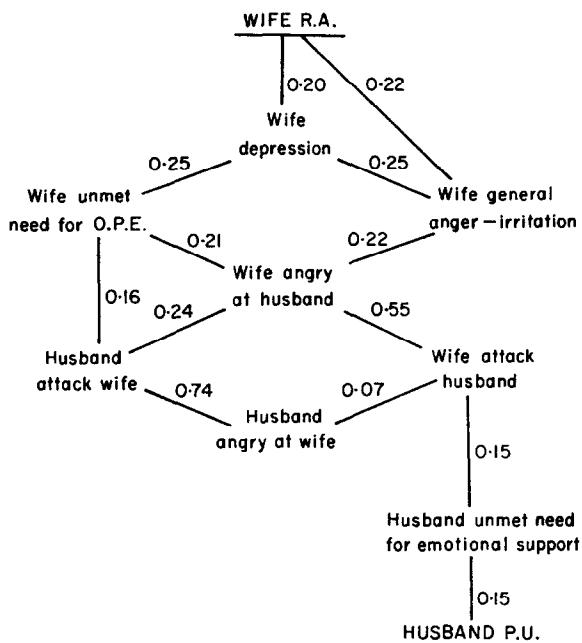


FIG. 4. The proportion of variance accounted for by various paths between the key variables.

effects might be more willing to report their diseases and their affects and behaviors. This could not have accounted for all of the association found for if it had, we should have come out with a much more agglomerated and non-specific mass of associations. Incidentally, we believe that the medical context of these interviews somewhat reduced the social desirability effects. This notion is supported by the fact that the interviewers found the information requested in this study much easier to get than the information requested in many of the studies on which they have worked.

Over against the above mentioned tendencies to exaggerate the associations reported, there are certain tendencies to underestimate, which should be noted. The first is that the measuring techniques for the psychological and behavioral variables have only face validity and/or some construct validity [13]. As the reliability and validity of our measurement techniques improve, it is possible that the association will become stronger. Second, the sample studied includes an undue proportion of women with RA who are under continuous medical care. As pointed out above, these women under continuous medical care are lower on anger-irritation than those who are not. This effect is visible in the fact that the associations of wife RA and husband PU are significant in the National sample but not in the Clinic sample and in the fact that the association of 'marital hostility' with wife RA and husband PU is significant only in the National sample. Because the two samples are not significantly different on the vast majority of variables examined, the decision was made to combine the samples and analyze them as one. This, however, resulted in a dilution of the association of the diseases across the marriage and, in some reduction in the intercorrelation among variables related to 'marital hostility'.

These considerations lead immediately to the possibility that the results here reported may well not be replicable in Clinic samples. It seems likely that the best evaluation of the conclusions here presented would be via a sample of marriages stratified with respect to marital hostility then examined for the relevant diseases and other characteristics.

One thing missing in this study is an answer to the question, 'What brought these couples together and what holds them together?' Various complementarities have been suggested. First, there might be sado-masochistic relationships involved. On this point we have no information. Second, women with high needs for objective public esteem, including those with RA might tend to select supportive husbands and that it might be a significant proportion of these husbands turn out to behave supportively because they themselves need support, rather than because they are themselves strong. The data examined are in the right direction to support this notion but are not statistically significant. From the other side, it is possible that the dependent man who has an increased probability of an ulcer picks a wife who appears to him as strong and likely to be supportive, but who turns out to be hostile. The crude data available from this study neither support nor deny this hypothesis. This is a matter for further investigation.

So far, nothing has been said about the direction of causation. In Fig. 4 there are a couple of key lines that have only one really logical direction. First, it seems reasonable that the wife's attacks on her husband might cause his need for emotional support to be unmet and less reasonable that the reverse should be true. This suggests that the marital hostility might contribute to the husband's ulcer but that the husband's ulcer is perhaps less likely to contribute to the marital hostility. By the same token, the husband's attacks on his wife might plausibly cause her need for objective public esteem to be unmet but the reverse seems less likely. Since we have shown reason to believe that anger-irritation in women may contribute to their rheumatoid arthritis rather than the reverse (see the fifth and sixth papers in this series), it seems appropriate in future studies to start with the hypothesis that marital hostility contributes to the likelihood of peptic ulcer in the husband and rheumatoid arthritis in the wife.

In concluding, we are moved to note that these findings should give hope to those who have been discouraged by the lack of specificity of the findings in psychosomatic research, for they suggest several things. First, as our measurement techniques improve, we should be able to test more and more specific hypotheses. Second, when one looks at the interaction of personality with the social environment, as we have done in developing our measures of unmet needs, one sees larger effects than if one had looked at either one alone. Third, it is possible that this approach of studying the association of diseases across the marriage might have a broadening field of application. For example, one might speculate that hypertension might be unduly frequent in those marriages in which high values against aggression are common and shared but in which spouse specific anger is also high. If this proved to be the case, it might be enough to account for the association of hypertension in marital partners [14]. This speculation is intended merely as an encouragement to others to pursue this line of investigation.

## SUMMARY AND CONCLUSIONS

As predicted from pre-existing knowledge, a significant association between rheumatoid arthritis in the wife and peptic ulcer in the husband has been demonstrated. The data support the theory that marital hostility is the key variable, and suggest that this marital hostility contributes to rheumatoid arthritis in the wife via resentment and depression and to the peptic ulcer in the husband via unmet needs for emotional support. Rheumatoid arthritis in the husband appears to be associated with significantly less marital hostility. The meaning of this sex difference is not clear, but is possibly a cultural difference in the inhibition of and/or the reporting of anger.

The value of studying the interaction of personality and environment is demonstrated. This supports the notion that persons with certain personality characteristics when exposed to the relevant environmental circumstances will have physiologic responses that contribute to certain diseases but not to others.

## REFERENCES

1. COBB, S.: Paper read before the Mental Health Nursing Group at Annual Meeting of A.P.H.A. November, 1961.
2. COBB, S., MILLER, M. and WIELAND, M.: On the relationship between divorce and rheumatoid arthritis. *Arthritis Rheum.* 2, 414, 1959.
3. COBB, S.: Contained hostility in rheumatoid arthritis. *Arthritis Rheum.* 2, 419, 1959.
4. DUNN, J. P.: Duodenal Ulcer in Executives with Consideration of Methodological Problems of Formulation of an Association Index. Thesis, Graduate School of Public Health, The University of Pittsburgh, 1959.
5. DUNN, J. P. and COBB, S.: Frequency of peptic ulcer among executives, craftsmen and foremen. *J. occ. Med.* 5, 10, 1863.
6. MOTT, P. E., MANN, F. C., McLAUGHLIN, Q. and WARWICK, D. P.: *Shift Work, The Social, Psychological and Physical Consequences.* Ann Arbor, Univ. of Mich. Press, 1965.
7. COBB, S., BROOKS, G. W., KASL, S. V. and CONNELLY, W. E.: The health of people changing jobs. *Am. J. Publ. Hlth* 56, 1476, 1966.
8. GOODMAN, L. A. and KRUSKAL, W. H.: Measures of association for cross-classifications. *J. Am. Stat. Ass.* 49, 732, 1954.
9. HAYS, W. L.: *Statistics for Psychologists.* Holt, Rinehart & Winston, New York, 1963.
10. COBB, S. and HALL, W.: Newly identified cluster of diseases: rheumatoid arthritis, peptic ulcer and tuberculosis. *J. Am. med. Ass.* 193, 1077, 1965.
11. RUBIN, T., ROSENBAUM, J. and COBB, S.: The use of interview data for the detection of associations in field studies. *J. chron. Dis.* 4, 253, 1956.
12. CROWNE, D. P. and MARLOWE, D.: *The Approval Motive.* Wiley, New York, 1964.
13. CRONBACH, L. J. and MEEHL, P. E.: Construct validity in psychological tests. *Psychol. Bull.* 52, 281, 1955.
14. WINKELSTEIN, W., KANTOR, S., IBRAHIM, M. and SACKETT, D. L.: Familial aggregation of blood pressure. *J. Am. med. Ass.* 195, 884, 1966.

## APPENDIX

*The principal psychological measures*

The 'frequency of general anger-irritation of husband (wife)' Seven items dealing with anger, irritation and annoyance, e.g. How often do you feel irritated or annoyed? [30, 31]\*.

'Husband (wife) angry at wife (husband)'; 2 items; (1) How often do you feel like being a little rude to your wife (husband)? (2) How often do you feel like losing your temper at your wife (husband)? [32, 33] In an earlier paper [13] this was called 'impulse to overt aggression (spouse specific)'.

'Husband (wife) attack wife (husband)'; 2 items; (1) How often are you rude to your wife (husband)? (2) How often do you lose your temper at your wife (husband)? [34, 35] In an earlier paper [13] this was called 'frequency of overt aggression (spouse specific)'.

'Husband (wife) denigrates wife (husband)' as reported by the person denigrated; 3 semantic differential items; (1) Seldom criticizes—often criticizes. (2) Often finds fault—seldom finds fault. (3) Often praises—seldom praises [47, 48].

'Husband (wife) unmet need for objective public esteem'. This is the difference between the need reported by the husband (wife) and the wife's (husband's) report of how well he does [14, 15].

'Need for objective public esteem'; 5 semantic differential type items dealing with stability of self esteem, need for praise and response to criticism, e.g. Often doubts self—seldom doubts self.

'Objective public esteem of husband'; wife report on 7 items of the Dick and Jane type dealing with performance in various male roles, e.g. Ed has been successful at his job—Frank hasn't been too successful at his job—.

'Objective public esteem of wife'; husband report on 6 items of the Dick and Jane type having to do with performance in various female roles, e.g. Jane has done a good job with her house—Betty has not been too successful at running the house —.

'Husband (wife) unmet need for emotional support from spouse'. This is the difference between the self report of need for emotional support from spouse and the spouse report of supportive behavior [20, 21].

'Need for emotional support from spouse'; 4 items dealing with the tendency to seek help from, lean on, and complain to spouse, e.g. I usually tell my wife (husband) about my difficulties and misfortunes.

'Supportive behavior'; 2 items of the Dick and Jane type; (1) Tom (Jane) is a very sympathetic husband (wife)—(2) Frank (Helen) is a husband (wife) you can lean on—

'Husband (wife) depression'; 8 items dealing with sadness, low spirits, low self evaluation and dissatisfaction, e.g. How often do you feel low in spirits? [36, 37].

'Husband (wife) self esteem'; self report on 8 items for husband and 7 items for wife dealing with performance in various roles, e.g. John—has helped his wife out. Helen—has been able to help her husband.

\*Variable numbers used in Table B of this appendix.

TABLE A. THE DISTRIBUTION OF RA IN HUSBANDS AND WIVES AND PU IN HUSBANDS FOR THE 49 FAMILY CLUSTERS UNDERSTUDY. (H=HUSBAND, W=WIFE, THE NUMBERS REFER TO THE GRADE OF THE CLASSIFICATION,—= NO INFORMATION)

Cluster no.	Key person's spouse	Key person	Key person's sibling	spouse
3	W	H PU 1	H PU 1	W RA 3
4	H	W RA 2	H	W
6	H PU 2	W RA 2	H	W
11	W	H	H	W
14	H PU 2	W RA 2	H	W
25	H PU 2 RA 3	W RA 3	H	W
26	H	W RA 2	W	H
38	H	W RA 2	H	W RA 3
43	H PU 2	W RA 2	W	H PU 1
50	W	H PU 1 RA 2	W	H
66	H PU 2	W RA 2	W RA 2	H
75	H PU 1	W RA 2	W	H

Table A (cont.)

Cluster No.	Key person's spouse	Key person	Key person's sibling	Sibling's spouse
77	H	W RA 2	H	W
91	H	W RA 2	H	W
94	W	H	W	H
104	H	W	H	W
111	H PU 2	W RA 2	H	W
116	H PU 1	W RA 2	W	H
124	H	W	W	H
126	H PU 2	W RA 3	H	W
129	H	W RA 3	W	H PU 2
136	H PU 1	W RA 3	W	H PU 1
143	W	H RA 2 PU 1	W	H PU 1
146	H PU 2	W RA 3	H	W RA 2
147	H PU 1	W RA 3	H—	W
150	H	W RA 2	W	H
177	W RA 3	H RA 2 PU 1	H	W
178	H	W	W	H PU 1
179	H PU 2	W RA 3	H	W
180	H RA 3 PU 1	W RA 3	H	W RA 3
181	H	W RA 3	H PU 1	W
182	W	H RA 3	W	H
183	H PU 1	W RA 3	H PU 1	W
184	H	W RA 3	W	H
187	W	H RA 3 PU 2	W	H
188	H	W RA 3	H	W
189	H	W RA 3	W	H
191	W	H RA 3 PU 2	W RA 3	H
193	H	W RA 3	H PU 1	W
194	H	W RA 3	H RA 2 PU 1	W RA 3
195	W	H RA 3	W	H
196	W	H RA 3	W	H
197	H PU 1	W RA 3	W	H
198	W	H RA 3 PU 2	H PU 2	W
199	W	H RA 3 PU 1	H	W
200	W	H RA 3	H	W
203	H PU 1	W RA 3	W	H
204	W	H RA 3	W	H
205	H	W RA 2	H	W RA 2

*Note:* National sample clusters have numbers less than 179. Clinic sample clusters have numbers 179 and greater.

TABLE B. CORRELATION MATRIX FOR THE PRINCIPAL PSYCHOLOGICAL VARIABLES.

	Var. No.	30	31	32	33	34	35	47	48	14	15	20	21	36	37	44	45
Anger-irritation	H																
	W	0.04															
Feel angry at spouse	H	0.36*	0.27*	...													
	W	0.21	0.47*	0.42*													
Attack spouse	H	0.40*	0.38*	0.86*	0.49*												
	W	0.08	0.40*	0.27*	0.74*	0.41*											
Denigration of spouse	H	0.17	0.19	0.26*	0.46*	0.33*	0.40*										
	W	0.08	0.25*	0.44*	0.30*	0.39*	0.27*	0.30*									
Unmet need for OPE	H	0.26*	0.20	0.19	0.24*	0.17	0.21	0.39*	0.25*								
	W	0.18	0.49*	0.34*	0.46*	0.40*	0.44*	0.37*	0.47*	0.31*							
Unmet need for emotional support	H	0.06	0.23	0.24*	0.28*	0.22*	0.39*	0.12	0.31*	0.10	0.24*	0.06					
	W	0.03	0.36*	0.31*	0.33*	0.39*	0.38*	0.43*	0.32*	0.28*	0.39*	0.22*	0.13				
Depression	H	0.44*	0.13	0.21*	0.24	0.23*	0.32*	0.20	0.20	0.43*	0.15	0.22*	0.36*	0.20			
	W	0.13	0.50*	0.23	0.45*	0.32*	0.39*	0.26	0.32*	0.29*	0.50*	0.08	0.36*	0.20			
Low self esteem	H	0.28*	0.16	0.23*	0.17	0.19	0.07	0.11	0.19	0.46*	0.35	0.12	0.03	0.44*	0.15		
	W	0.00	0.23*	0.24	0.23*	0.28*	0.20	0.38	0.31	0.54*	0.45*	0.09	0.40*	0.14	0.35*		
Age†	54 or 57	-0.16	-0.19	-0.10	-0.02	-0.06	-0.05	-0.10	-0.21	-0.06	-0.29*	-0.02	-0.24*	-0.03	-0.18	-0.16	-0.24*
Education †	56 or 27	0.13	0.11	-0.04	-0.04	-0.03	-0.11	-0.12	0.08	0.01	0.09	-0.01	0.12	0.03	-0.04	0.19	0.12
Complaints†	26 or 27	0.29*	0.33*	0.09	0.30*	0.08	0.17	0.02	0.21	0.04	0.23*	0.17	0.22*	0.21*	0.47*	0.22*	0.31*

\*Significant at 0.01 level or beyond. *N* ranges from 96 to 211 depending on the variable pair.

†of husband or wife as relevant.