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SOCIOCULTURAL FACTORS IN PUERPERAL INFECTIOUS MORBIDITY AMONG NAVAJO WOMEN

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From 1980 to 1982, a sample of 968 pregnant Navajo women in New Mexico was enrolled in a prospective study of biologic and sociocultural factors in puerperal infectious morbidity. Past studies have independently implicated both genital infection and psychosocial stressors in perinatal complications, but, to the authors' knowledge, no previous work has concurrently investigated the interactive effects of genital pathogens and psychosocial processes. Endocervical cultures for *Mycoplasma hominis* and *Chlamydia trachomatis* were obtained during prenatal visits, and structured interviews were conducted assessing social support and the degree of cultural traditionality, in this context a proxy measure of acculturative stress. The incidences of postpartum fever, endometritis, and premature rupture of membranes were significantly associated with the concurrence of two factors: the presence of genital tract *M. hominis* and a highly traditional cultural orientation. When demographic and conventional obstetric risk factors were controlled for, women with both *M. hominis* and high traditionality experienced infectious complications at a rate twice that of women with either factor alone. Among the plausible explanations for this result is the possibility that acculturative stress undermines physiologic resistance to infectious genital tract disease.

acculturation; infection; pregnancy complications; stress, psychological

The role of genital organisms in abnormal pregnancy outcomes has been proposed and investigated for nearly two decades. Studies such as those by Jones (1) and

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others (2–9) have implicated genital colonization or infection with *Mycoplasma hominis* in a variety of puerperal complications, including premature rupture of membranes (5), spontaneous abortion (2, 3), low birth weight (4, 5, 9), endometritis (6, 7, 9), and postpartum fever (8). In addition, other genital pathogens, such as *Chlamydia trachomatis* and the group B *Streptococcus*, have been similarly proposed as etiologic agents in the infectious complications of pregnancy (10–14).

However, as summarized by Harrison for studies of mycoplasma infection, epidemiologic investigations have often yielded conflicting results, suggesting a "need for more information on . . . the roles of noninfectious factors . . . in determining abnormal (infectious) outcomes of pregnancy" (15, p. 311). Because psychosocial processes may alter host resistance to infections (16, 17), factors such as psychologic stress and the availability of social support may contribute to the observed variability in relations between genital infections and pregnancy complications.

Independent of biologic factors, a variety of psychosocial phenomena have been shown to influence the course and outcomes of pregnancy (18, 19). Early studies, such as those by Berle and Javert (20), Kapp et al. (21), and Drillien (22), noted disproportionate numbers of emotionally distressing events during the pregnancies of women sustaining spontaneous abortions, prolonged labors, or premature births. More recent work, employing both retrospective and prospective designs, has similarly documented a modest but significant association between various measures of stressful experience and complications of pregnancy (23–25).

However, as noted by Chalmers (26), variables describing psychologically stressful events have never accounted for a major proportion of the variance in pregnancy complications. Partially in response to such criticism, investigators have become increasingly interested in the supportive, as well as the stressful, aspects of social experience and have studied the capacity of social support to buffer or ameliorate the health consequences of stress (27, 28). Nuckolls et al. (29), for example, found that among pregnant women with high levels of stressful life change, those with strong social support developed complications at a rate only one third that of those with weak or nonexistent supports. Others (30, 31) have similarly reported beneficial effects of social support on the course and outcomes of pregnancy.

Finally, in a previous paper, Boyce et al. (32) reported that both adherence to traditional cultural practices and low levels of supportive personal interaction were independently associated with obstetric complications in a population of pregnant Navajo women. In that study, both traditionality and lack of social support were interpreted as markers for social isolation, and pregnancy complications were regarded as a set of potential health consequences stemming from the stress of marginality.

A broad range of previous work thus implicates both biologic factors (i.e., infectious agents) and psychosocial factors (i.e., stress, social support, and social marginality) in the occurrence of abnormal pregnancy outcomes. However, to our knowledge, no past studies have concurrently investigated the separate and interactive effects of biologic pathogens and psychosocial processes. Because of the known influences of such processes on the individual's susceptibility to infectious disease, this study was designed to examine the interaction of biologic and sociocultural risk factors in the course and outcomes of pregnancy. Navajo women were chosen as the subjects of study because of the known cultural heterogeneity among contemporary Navajo persons and the potential implications of such cultural differences for experiences of stress and social isolation. In addition, prior work (33) with a Navajo population has demonstrated a high prevalence of genital tract organisms known to be associated with complications of pregnancy.

MATERIALS AND METHODS

A sample of 968 pregnant Navajo women was enrolled during the first prenatal visit to the obstetrics clinics at two Indian Health Service hospitals in Gallup and Crownpoint, New Mexico. Enrollment was completed during the two-year period between October 1980 and October 1982. The study population was nonrandomly selected as a sample of convenience, comprising 40 per cent of the 2,421 women presenting for prenatal care during that period. Recruitment was conducted without prior knowledge of variables intrinsic to the study design. At the time of enrollment, basic demographic information was collected, and a structured interview was completed to assess the availability of social support and the woman's degree of cultural traditionality. Interviews were conducted by a Navajo research assistant in either the Navajo or the English language, according to the subject's preference. In addition, endocervical cultures for both *M. hominis* and *C. trachomatis* were obtained at the enrollment visit and again during a prenatal visit in the third trimester of pregnancy.

Within two months after delivery, a review of the medical record was completed without knowledge of prenatal interviews or the results of cervical cultures. Data were gathered on the occurrence of four specific obstetric complications: postpartum fever, endometritis, premature rupture of membranes, and preeclampsia. These outcomes were chosen to represent both a set of complications in which infection may play a role (postpartum fever, endometritis, and premature rupture of membranes) and a complication with no known or biologically plausible link with infection (preeclampsia). Additional information was obtained from the medical record on antibiotic treatment in the course of the pregnancy, as well as on subjects' past medical and obstetric histories. Although length of hospital stay was not assessed, standard Indian Health Service obstetric practice at the time of the study was hospitalization for three postpartum days. It is therefore unlikely that ascertainment of the targeted outcome variables was biased by a shortened observation period.

In accordance with standard definitions of febrile morbidity (34), postpartum fever was defined as a temperature equal to or greater than 38 C on two occasions more than 24 hours after delivery, and endometritis was defined as postpartum fever plus purulent cervical discharge and/or uterine tenderness. Because of the frequent difficulty in clinically distinguishing postpartum fever from endometritis, these two diagnoses were combined into a single outcome, designated postpartum fever/endometritis. Premature rupture of membranes was defined as that occurring one hour or more prior to the onset of labor. Again in accordance with standard criteria (35), preeclampsia was defined as the development of hypertension with proteinuria, edema, or both after the twentieth week of gestation.

At the time of the enrollment interview, subjects reported their age, education, and the income of the household in which they lived. The presence of medical conditions with possible effects on the course of pregnancy was ascertained, including anemia (hematocrit <28 per cent), diabetes, and preexisting hypertension. Social support was measured using a weighted index of interview items modified from the instrument of Schaefer et al. (36) for use in a Navajo population. The five-item index assessed marital status and the availability of both emotional support and instrumental support (or aid). For purposes of analysis, scores were collapsed into a dichotomous variable representing high or low availability of social support.

Subjects' degree of traditionality was evaluated using an abbreviated instrument derived in part from the work of Milligan et al. (37). As previously reported (32), factor analysis of interview responses revealed two factors, corresponding to the traditionality of cultural practices and the modernity of the home environment. Five items in

the first factor were retained as the measure of traditionality. These were 1) religious affiliation (Navajo Way or Native American Church versus Christian or none), 2) use of corn pollen in ritual observances, 3) use of a traditional healer, 4) having had a Kinaalda (Navajo puberty ceremony), and 5) planning a Blessing Way ceremony for the baby. In the subsequent analysis, traditionality scores were converted to a two-level variable, representing the most traditional (highest quartile) and the less traditional (lowest three quartiles). Three items from the second factor were used as measure of the modernity of the home. These items were the presence of 1) electricity, 2) running water, and 3) a telephone.

Endocervical cultures were collected with calcium alginate-tipped swabs immersed in sucrose-phosphate buffer for *C. trachomatis*, and in trypticase soy broth with added bovine serum albumin for *M. hominis*. All specimens were immediately frozen at −70 C until inoculation. Standard culture methods for the identification of *C. trachomatis* and *M. hominis* were followed and have been described in detail elsewhere (33). For both genital organisms, cervical cultures were counted as positive if the organism was isolated at the time of either enrollment or the final prenatal visit.

Table 1 summarizes the independent and outcome variables assessed in the course of the study. Outcomes were treated as dichotomous (present/absent) variables in the analysis of data. Bivariate relations among pairs of independent variables and between independent and outcome variables were examined using Pearson correlations and chi-square analyses, according to the continuous or categorical nature of the variables. At the multivariate level, stepwise multiple logistic regression was used, following the approach of Kleinbaum et al. (38), to estimate the approximate relative risk associated with an individual predictor variable, while controlling for the potentially confounding effects of other independent variables. Hypothesized interaction effects were tested by including product terms (e.g., *M. hominis* × traditionality) in the regression equations after all main effects had been added.

RESULTS

A total of 12 per cent of the sample developed postpartum fever or endometritis. Premature rupture of membranes and preeclampsia were found in 8 and 21 per cent, respectively. The prevalence of the genital organisms were 22 per cent for *C. trachomatis* and 50 per cent for *M. hominis*. As described in another report (9), the presence of genital organisms was significantly related to abnormal pregnancy outcomes in certain subgroups of the entire population, such as women delivered by cesarean section or those with a past history of spontaneous abortion. However, as shown in table 2, no significant bivariate relations were found between outcome variables and culture results in the study population as a whole.

Other independent variables, however, were significantly associated with abnormal outcomes at the bivariate level. As displayed in table 3, postpartum fever/endometritis was significantly related to nul-

TABLE 1

Independent and outcome variables for Navajo women, New Mexico, October 1980 to October 1982

Independent variables
Age
Education
Income
Parity
Past pregnancy complications
Present medical problems
Gestational age at first prenatal visit
Antibiotic treatment during pregnancy
Cesarean section
Modernity of home
Social support
Traditionality
Chlamydia trachomatis
Mycoplasma hominis
Outcome variables
Postpartum fever/endometritis
Premature rupture of membranes
Preeclampsia

TABLE 2

*Percentages of Navajo women with specified abnormal pregnancy outcomes and results of cultures for Chlamydia trachomatis and Mycoplasma hominis, New Mexico, October 1980 to October 1982**

Culture results (%)	Postpartum fever/endometritis (%)	Premature rupture of membranes (%)	Preeclampsia (%)
C. trachomatis			
Positive (22)	13.6	9.4	21.4
Negative (78)	11.3	7.8	20.6
M. hominis			
Positive (50)	12.4	8.9	22.0
Negative (50)	11.6	7.1	19.8

* No differences significant at $p < 0.05$ by chi-square with 1 df.

liparity, presentation for prenatal care early in pregnancy, delivery by cesarean section, and low social support. In the case of premature rupture of membranes, associations were found for parity alone, with nulliparous women again having higher rates. Finally, preeclampsia was significantly related to parity, the presence of chronic medical problems, delivery by cesarean section, low social support, and high cultural traditionality. Many of the variables, however, were significantly associated with each other, raising the possibility that bivariate associations were confounded by interrelations among independent variables. Parity, for example, was highly correlated with age ($r = 0.47$, $p < 0.001$), suggesting that the relation of nulliparity to preeclampsia could be due in part to the confounding effect of age.

Because of the potential for confounding, stepwise multiple logistic regression analyses were used to examine the relations of the predictor variables to the three selected outcomes of interest. In addition, since a major focus of the study was the potential interaction between biologic and psychosocial variables, logistic regression analyses were also used to test for significant effects of interaction (cross-product) terms. Multivariate analyses therefore employed the following strategy for each of the three outcome variables. First, a limited model was constructed in which the list of potential independent variables included only *C. trachomatis*, *M. hominis*, traditionality, social support, and their interaction terms. Forward stepping was used with the interaction terms admitted to the model only after all main effects had been added. Any interaction terms with probability values of less than 0.20 were then included in a second equation, which tested the main effects of *all* the potential independent variables (table 1) in addition to the interactive effects of the surviving product terms. Forward stepping and backwards elimination were used to arrive at the subset of terms that represented the best compromise in achieving both validity and precision. All terms of theoretical importance or with probability values of 0.20 or less were retained in the final models. Results of both the limited model (step 1) and the final regression model (step 2) are presented in tables 4–6, for the outcomes of postpartum fever/endometritis, premature rupture of membranes, and preeclampsia, respectively.

For postpartum fever/endometritis (table 4), a significant effect was found for the interaction of *M. hominis* with traditionality in the limited regression model ($p = 0.05$). Women with both a positive genital culture for *M. hominis* and a highly traditional orientation bore a risk of postpartum fever or endometritis approximately 2.7 times that of women with either risk factor alone. In the expanded model, in which other significant independent variables are included, the approximate relative risk associated with the *M. hominis* × traditionality product term fell slightly to 2.4 ($p = 0.10$). This decrement in relative risk indicates that the effect of the interaction may be accounted for in part, but not completely, by the confounding influence of other significantly associated variables, such as parity, delivery by cesarean section, and gestational age at the first prenatal visit.

In the case of premature rupture of membranes (table 5), a borderline significant

TABLE 3

Percentages of Navajo women with specified abnormal pregnancy outcomes by independent variables, New Mexico, October 1980 to October 1982

Independent variables	Postpartum fever/ endometritis (%)	Premature rupture of membranes (%)	Preeclampsia (%)
Age (years)			
13–18	16.6	12.1	25.0
19–35	11.4	7.4	19.4
36–45	13.0	6.5	24.4
Education (years)			
0–8	11.1	10.3	25.4
9–11	12.4	8.5	17.5
12	12.8	6.8	24.0
13–18	8.3	9.4	11.5
Income (dollars/year)			
0–2,999	12.5	8.5	10.4
3,000–4,999	16.7	7.8	20.4
5,000–6,999	10.7	5.8	17.1
7,000–9,999	6.7	7.6	24.3
≥10,000	10.7	9.6	25.6
Parity			
0	19.3***	12.7**	25.9**
1–3	8.2	6.1	17.2
4–19	10.8	5.9	22.2
Past pregnancy complications			
No	8.3	5.2	18.1
Yes	9.3	7.8	17.6
Present medical problems			
No	12.2	8.1	19.2
Yes	14.6	7.3	53.7***
Gestational age at first prenatal visit (trimester)			
1	14.3*	7.5	20.7
2	11.2	9.2	21.0
3	3.6	9.1	20.4
Antibiotic treatment during pregnancy			
No	11.5	8.5	21.0
Yes	0	0	8.3
Caesarean section			
No	8.3	8.3	18.2
Yes	33.3***	8.1	34.0***
Modernity of home (no. of conveniences)			
0	12.7	7.5	19.6
1	11.6	7.8	23.4
2	11.7	8.9	19.2
3	12.6	8.6	19.3
Social support			
Low	17.4**	8.3	26.8**
High	10.3	8.0	18.6
Traditionality			
Low	11.2	7.6	18.8
High	15.5	9.2	25.5*

* $p \leq 0.05$.
** $p \leq 0.01$.
*** $p \leq 0.001$.

TABLE 4

*Risk of postpartum fever/endometritis among Navajo women by genital infection with Chlamydia trachomatis or Mycoplasma hominis and other selected risk factors, New Mexico, October 1980 to October 1982**

Variables	Limited model†		Full model‡	
	Odds ratio§	95% CI‖	Odds ratio	95% CI
Chlamydia trachomatis (present/absent)	1.0	0.52–1.96	1.0	0.49–2.04
Mycoplasma hominis (present/absent)	0.7	0.40–1.18	0.8	0.43–1.36
Social support (low/high)	1.5	0.87–2.60	1.3	0.69–2.32
Traditionality (high/low)	0.9	0.44–1.78	0.9	0.45–1.97
Caesarean section			6.0	3.70–9.89
Parity (1–3 vs.:)				
0			2.9	1.76–4.82
≥4			1.2	0.54–2.79
Gestational age at first prenatal visit (trimester)			0.6	0.40–0.92
C. trachomatis × social support	2.0	0.73–5.57	1.8	−0.50–5.59
M. hominis × traditionality	2.7	1.04–6.75	2.4	0.89–6.58

* Adjusted for the effects of other variables in the model.

† Includes only *C. trachomatis*, *M. hominis*, traditionality, social support, and their interaction terms.

‡ Includes all independent variables and interactions terms of theoretical importance or with probability values of 0.20 or less.

§ Approximate relative risk.

‖ 95% CI, 95% confidence intervals.

TABLE 5

*Risk of premature rupture of membranes among Navajo women by genital infection with Chlamydia trachomatis or Mycoplasma hominis and other selected risk factors, New Mexico, October 1980 to October 1982**

Variables	Limited model†		Full model‡	
	Odds ratio§	95% CI‖	Odds ratio	95% CI
Chlamydia trachomatis (present/absent)	1.3	0.63–2.58	1.2	0.59–2.46
Mycoplasma hominis (present/absent)	0.9	0.49–1.69	0.9	0.47–1.65
Social support (low/high)	1.2	0.62–2.37	1.0	0.48–1.90
Traditionality (high/low)	0.7	0.26–1.68	0.6	0.25–1.60
Parity (1–3 vs.:)				
0			2.5	1.41–4.28
≥4			1.3	0.50–3.16
Gestational age at first prenatal visit (trimester)			1.3	0.86–1.99
Chlamydia trachomatis × social support	0.8	0.23–3.00	0.8	0.23–3.06
Mycoplasma hominis × traditionality	2.9	0.91–9.34	3.3	1.00–10.59

* Adjusted for the effects of other variables in the model.

† Includes only *C. trachomatis*, *M. hominis*, traditionality, social support, and their interaction terms.

‡ Includes all independent variables and interaction terms of theoretical importance or with probability values of 0.20 or less.

§ Approximate relative risk.

‖ 95% CI, 95% confidence intervals.

effect of the same interaction term was found in both the limited ($p = 0.08$) and the full ($p = 0.06$) regression models. The final model indicates that subjects with both genital tract *M. hominis* and a highly traditional life-style were 3.3 times more likely to experience premature rupture of membranes than their counterparts with only one of the two risk factors. As shown in table 5, a significant effect of parity was

TABLE 6

*Risk of preeclampsia among Navajo women by genital infection with Chlamydia trachomatis or Mycoplasma hominis and other selected risk factors, New Mexico, October 1980 to October 1982**

Variables	Limited model†		Full model‡	
	Odds ratio§	95% CI‖	Approximate ratio†	95% CI
Chlamydia trachomatis (present/absent)	0.9	0.51–1.44	0.9	0.49–1.48
Mycoplasma hominis (present/absent)	1.1	0.72–1.65	1.1	0.74–1.76
Social support (low/high)	1.7	1.13–2.62	1.6	0.99–2.43
Traditionality (high/low)	1.3	0.79–2.26	1.3	0.72–2.17
Parity (1–3 vs.:)				
0			1.6	1.12–2.42
≥4			1.4	0.79–2.56
Present medical problems (yes/no)			5.5	2.72–11.00
Modernity of home (no. of conveniences)			0.9	0.77–1.07
Education (years) (0–8 years vs.:)				
9–11			0.6	0.35–1.05
12			0.8	0.48–1.43
>12			0.4	0.16–0.86
C. trachomatis × social support	1.3	0.54–2.93	1.2	0.51–2.95
M. hominis × traditionality	1.1	0.53–2.29	1.1	0.50–2.33

* Adjusted for the effects of other variables in the model.

† Includes only *C. trachomatis*, *M. hominis*, traditionality, social support, and their interaction terms.

‡ Includes all independent variables and interaction terms of theoretical importance or with probability values of 0.20 or less.

§ Approximate relative risk.

‖ 95% CI, 95% confidence intervals.

also found, such that nulliparous women had a risk of premature rupture of membranes 2.5 times that of other subjects.

Table 6 shows that for preeclampsia, an abnormal outcome unrelated to infection, no significant main or interactive effects were found for the genital organisms. In the limited model, a significant effect of low social support was seen, but this was no longer significant in the final model controlling for the effects of other predictors. Significant associations with preeclampsia were found only for nulliparity, present medical problems, and maternal education. In particular, the interaction of *M. hominis* and traditionality was, in this instance, unrelated to the outcome.

Figure 1 provides a more graphic picture of the synergistic effects of *M. hominis* and traditionality on the incidence of postpartum fever/endometritis and premature rupture of membranes. Using women with neither *M. hominis* colonization nor a highly traditional life-style as a point of reference, figure 1 shows the adjusted relative risks of the two complications for the three other categories of subjects: those with *M. hominis* alone, those with a highly traditional orientation but no *M. hominis*, and those with both. No significant differences in risk were associated with either risk factor in isolation. On the other hand, women with both factors bore a risk of postpartum fever endometritis and premature rupture of membranes two to three times that of women with only one or neither factor.

Finally, it is important to note that, in the case of each outcome, tests for the size of the interaction effect have been made while controlling for the potentially confounding influences of other, significantly related independent variables. The effect size of the *M. hominis* × traditionality product term, for example, has been estimated, in the case of postpartum fever/endometritis, controlling for the effect of cesarean delivery. Similarly, the logistic coefficient for the interaction term in pre-

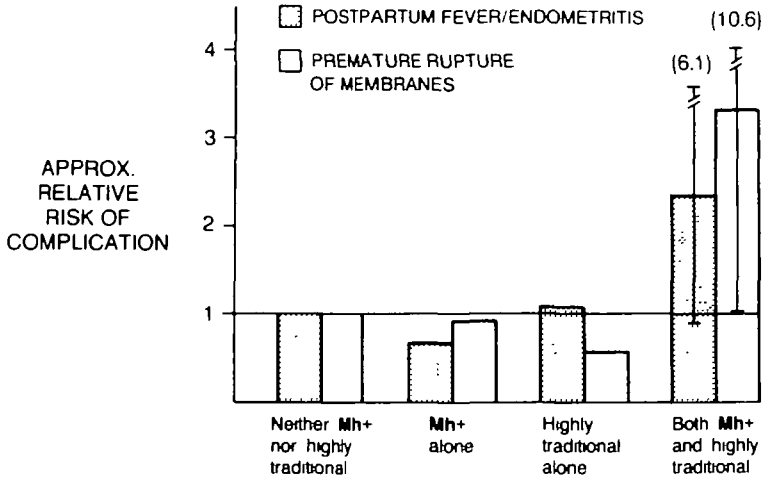

FIGURE 1. Synergistic effects of *Mycoplasma hominis* and traditionality on the incidence of postpartum fever/endometritis and premature rupture of membranes. Mh+, *Mycoplasma hominis*-positive culture.

mature rupture of membranes was derived from a logistic equation that controls for the confounding influence of parity. Other independent variables not included in the final regression models were either found not to confound the interaction effects or were not associated with the outcome in question.

DISCUSSION

The results indicate that in this sample of pregnant Navajo women the development of infectious perinatal complications was related to the concurrence of two risk factors: the presence of *M. hominis* in the woman's genital tract and a highly traditional cultural orientation. Women with both factors experienced postpartum fever/endometritis or premature rupture of membranes at a rate two to three times that of women with only one such factor. The term representing the interaction of *M. trachomatis* and traditionality attained only a borderline level of significance in the fully developed logistic regression models. However, the magnitude of the relative risks associated with the interaction suggests an effect of substantial proportion. It should be noted that the method used in testing for interaction effects is an inherently conservative procedure. The independent variables *M. hominis* and traditionality are necessarily intercorrelated with the product term *M. hominis* × traditionality, and the regression procedure assigns to the main effects of *M. hominis* and traditionality all the predictive contribution that cannot be unequivocally attributed to the product term. The regression model thus exerts stringent criteria on the estimation of interaction effects. Finally, the absence of even a borderline significant *M. hominis* × traditionality interaction in the case of the noninfectious outcome, preeclampsia, lends further strength to the validity of the interaction found for infectious complications.

In an earlier report (32), we argued that since it is unlikely that traditionality per se influences complications of pregnancy, traditionality should be regarded as a marker for some other variable or condition with more direct and biologically plausible influences on the course of pregnancy. In the case of the interactive effects of *M. hominis* and traditionality on the infectious morbidity assessed in this study, several possible explanations can be examined. First, the physical home environment of highly traditional Navajo women is likely to be primitive, with little or no access to running water and other modern conveniences. In such a setting, hygiene may well be com-

promised, and susceptibility to infectious disease may be augmented by the relative lack of sanitary facilities and conditions. This account of the observed interaction effect is weakened, however, by the absence of an association between infectious complications and the modernity of the home environment. For both postpartum fever/endometritis and premature rupture of membranes, the variable describing the modernity of the home was not significantly related to the outcome and failed to gain entrance into the regression model. The presence of running water (one component of the modernity scale) was separately analyzed and was also not significantly associated with either infectious outcome. It is therefore unlikely that the interaction of *M. hominis* and traditionality reflects simply an underlying effect of hygiene on the relative incidence of infection.

Second, it is possible that the level of traditionality is a correlate of some health behavior or set of health behaviors that alters the likelihood of infection. It is conceivable, for example, that traditional Navajo women would be less likely to present early in pregnancy for prenatal care. Such women may also be less likely to comply with antibiotic therapy prescribed during the course of pregnancy. Although this study included no direct assessments of health care utilization or compliance behavior, two study variables offer at least approximate measures of related health behaviors and antibiotic exposure. Gestational age at the first prenatal visit was included in the final regression model for both postpartum fever/endometritis and premature rupture of membranes and was thus controlled for in the estimation of the interaction effects. Antibiotic treatment during pregnancy, on the other hand, was not sufficiently associated with any outcome to merit inclusion in the regression models. Neither variable was therefore a likely confounder of the interaction between *M. hominis* and traditionality.

A final and, we believe, equally plausible account of the observed interaction is the possibility that extreme traditionality, in the setting of this study, is associated with psychologic processes that undermine or diminish the person's physiologic capacity to resist disease. Our results suggest that genital colonization with *M. hominis* achieved maximum pathogenicity in a specific sociocultural context, one characterized by the retention of highly traditional practices and beliefs within a society undergoing rapid acculturative change. Within such a context, it is reasonable to propose that highly traditional women would be most likely to experience the biologic effects of stress and alienation, as their families and friends move, both culturally and geographically, toward an alternative way of life.

A growing body of work suggests that stressful experiences may have important influences on a person's immunologic competence and susceptibility to pathogenic agents (16, 17, 39–45). As summarized by Palmblad (17), Kiecolt-Glaser and Glaser (41), and others (43, 44), psychologic stress has now been associated with a variety of immunologic and reticuloendothelial changes, ranging from involution of the thymus and spleen to suppression of interferon production and impairment of lymphocyte cytotoxicity. In one example of the infectious sequelae that may accompany such immunologic impairment, Kasl et al. (46) examined the psychosocial correlates of clinical infectious mononucleosis in a cohort of West Point cadets, all of whom had serologic evidence of exposure to the etiologic agent, the Epstein-Barr virus. Among seroconvertors, the risk of clinically evident mononucleosis was significantly related to the stress-producing combination of high motivation and relatively poor academic achievement. As in our study, the development of clinical disease was best predicted by the concurrent presence of a pathogenic organism and circumstances characterized by chronic psychosocial stress.

There is evidence as well that local and systemic immunity to genital organisms

plays an important role in preventing the transition from genital tract colonization to clinical infectious disease. Holmes (47) for example, in a review of mycoplasma-related morbidity, noted that lack of bacteriocidal antibody to *M. hominis* correlates with susceptibility to postpartum fever and that the presence of antibody with complement appears to protect against invasive mycoplasma infection. Osser and Persson (48) found that among patients with positive genital tract cultures for *C. trachomatis*, those who developed salpingitis had lower mean *C. trachomatis*-specific antibody titers than those who did not. Thus, psychologic processes that impair immune competence may play significant roles in the conversion of asymptomatic carrier states into invasive disease.

This study provides evidence that psychologic and sociocultural factors play significant roles in mediating susceptibility to puerperal infection among women colonized with genital organisms. As suggested by Syme (49) and Depue et al. (50), sociocultural processes may create a general physiologic vulnerability to the agents of disease, with the specific category of illness then determined largely by the pathogens harbored or encountered by persons at risk. In 1965, Rene Dubos wrote that "... the prevalence and severity of microbial diseases are conditioned more by the ways of life of the persons afflicted than by the virulence and other properties of the etiological agents" (51, p. xxi). A view that has become increasingly accepted within the field of behavioral medicine is that biologic factors, while necessary for the occurrence of most diseases, are insufficient to account for the usual observed range in individual vulnerability. Until recently, what has *not* been widely held, at least as reflected in the design of psychosomatic investigations, is the reciprocal view: that psychosocial factors are similarly necessary, but not sufficient, to account for the occurrence of disease. A fuller, more elegant understanding of illness susceptibility awaits substantial and truly interdisciplinary collaboration by researchers representing both biologic and social science perspectives. Psychologic and sociocultural processes do not operate in isolation from the biologic origins of disease. By providing further evidence of significant interactions between biologic and psychosocial risk factors, we hope that this study will foster even greater interest in the rich and complex interplay among determinants of human infectious disease.

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