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Good marriages gone bad: Health mismatches as a cause of later-life marital dissolution

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Abstract. This study explores the impact of health status on marital dissolution for couples in late mid-life. A key feature of the empirical framework is that it incorporates the interaction of health between the spouses. This specification allows not only a general test of whether health matters but also a specific test of an important implication of cost-benefit models of marriage dissolution. In particular, cost-benefit models imply that marriages exhibiting a "health mismatch" (where one partner has substantially better health than the other one) are more likely to get divorced than couples who have similar health (whether good or bad). Using a Cox proportional hazards model, we test this hypothesis by estimating the impact of different spousal health combinations on the probability of marital dissolution (as indicated by separation). Data are taken from four waves of the Health and Retirement Study (1992–1998) and consist of 4,241 couples where at least one spouse is between the ages of 51 and 61 in 1992. We do find evidence for the health mismatch hypothesis, but only among couples in which both couples report their marriages to be very satisfying. Among other couples, no effect is found. This suggests that health is of minor consequence for already unhappy couples, but health mismatches pose a significant risk of dissolution to happy couples within this age cohort, possibly because of the unexpected nature of poor health at a relatively young age.

Keywords: health, marital dissolution, rational models

Introduction

A robust empirical regularity in demographic research is the strong association between health and marital status. The consistent finding of studies addressing the topic has been that married people enjoy higher levels of well-being, including both physical and mental health (see Joung et al. 1998 for a recent review).[1] As an illustration, consider Table 1 below, which documents the correlation between health and marital status using the 1992 Health and Retirement Study (HRS). This table shows how the prevalence of "fair" or "poor" health varies across sample respondents for both men and women. Only the never married women have health similar to their married counterparts. Particularly striking are the high values for separated and widowed, with rates of poor health two to three times as high as their married counterparts.

Table 1. Health and marital status, 1992

	Men		Women	
Marital status	N	%	N	%
Married	3.710	16.9	3.519	17.1
Living with partner	610	23.6	88	26.3
Separated	117	32.6	191	41.6
Divorced	374	26.8	691	30.1
Widowed	75	38.2	542	29.8
Never married	166	25.5	192	19.4

All individuals are aged 51–61 in 1992.

The association between health and marital status is well documented and robust to all common measures of health status. However, causal mechanisms are still poorly understood. At least four distinct, but not mutually exclusive, explanations exist. First, some argue that healthy people are more likely to marry, though little evidence exists that health plays a causal role in marital selection. Second, marriage may improve health (Waite & Gallagher 2000).[2] For instance, some have found that the marital relationship protects partners from the negative effects of stress (Coyne & DeLongis 1986). Third, relatively strong evidence exists that marital dissolution may have a negative impact on health, especially for men. Because divorce is a highly stressful life change, it is strongly related with the onset of physical problems (Albrecht et al. 1983). Furthermore, some have found that a decrease in marital satisfaction, which often precedes divorce, is positively correlated with a decline in physical health (Wickrama et al. 1997).

The fourth possible explanation – the focus of this study – is that poor health leads to marital dissolution. This explanation addresses issues that are at the heart of what marriage (at least idealized marriage) is all about, as articulated in the traditional marriage vow to stay together "in sickness and in health". While it may be true that illness draws couples closer together, it is also plausible that poor health places stress on the marital relationship that raises the risk of dissolution. Poor health may lead to high medical costs and resulting financial strain; it may result in difficulty in performing regular activities of daily living, often placing additional burden on the spouse of the ill person; and it may, for a number of other reasons such as increased worry and anxiety or a loss of interest in activities previously shared by the couple, reduce marital satisfaction among some couples.

Our aims in this analysis are twofold. First, we want to determine whether or not evidence exists that health status contributes to the odds of divorce. As

illustrated in Table 1, as well as numerous other studies, divorced and separated individuals are in much poorer health than are married individuals. But such evidence is almost always cross-sectional in nature. In contrast, we follow a cohort across a six-year period to determine whether health at baseline is a predictor of marital dissolution (as measured by separation or divorce). Nested within this first aim is a second objective: to explore the conditions under which health may affect marital dissolution. In particular, we want to test whether the interaction of health status variables for the husband and wife is important. Using a rational choice framework, we provide theoretical reasons in the next section of this paper why a "health mismatch" should increase the odds of marital dissolution. Thus our analysis provides a test of the rational choice models of marital dissolution that have been proposed by social exchange theorists and by economists.

Poor health is just one of many factors that can put stress on a marriage. But health is different than many other stressors because it strikes spouses differentially. Many other marital stressors, such as loss of income, a death in the family, or problems with children, affect *both* partners (though not necessarily to the same extent), whereas poor health strikes individuals. This fact has important theoretical and empirical implications. In particular, the rational choice model of marriage dissolution implies that it is not the *aggregate* number of health problems within a marriage that affect dissolution but the *relative* health across spouses. This is a basic implication of the fact that individuals in the rational model weigh the expected utility they get from remaining married against the expected utility associated outside of marriage (either as a single person or in a new relationship). When both spouses are in poor health, marriage quality may fall for both spouses, but so do opportunities outside of marriage. Therefore, rational choice theory predicts that the couples with the highest odds of dissolution are not those where both spouses are sick, but those where a "health mismatch" occurs, namely that one partner's health status is considerably worse than the other's.

In overview, our empirical results are puzzling. For the sample as a whole, we find little impact of health status whatsoever. But when we restrict the analysis to couples where both spouses report a high degree of marital satisfaction, the health mismatch hypothesis finds relatively strong support. Couples where only one spouse is in poor health have over twice the odds of dissolution as couples where both partners are in good health, but couples where both are in poor health actually have a lower likelihood of dissolution than healthy couples. Why the health mismatch hypothesis is confirmed only among marriages that are satisfying to both partners remains an unsolved puzzle, though the determinants of dissolution among unsatisfying marriages are, in general, much different than those among satisfying marriages. Our

conjecture is that in a satisfying marriage, a mismatch is a highly salient marital stressor, whereas in a unsatisfying marriage, a multitude of problems may exist that undermine martial quality, thereby masking the effect of health issues.

Background

Rational choice and the health mismatch hypothesis

Although there exists an extensive empirical literature on marital dissolution, theories of divorce are undeveloped and seldom drive empirical work in the area (White 1990). Of those theories that do exist, the dominant one is social exchange theory (Karney & Bradburry 1995).[3] With basic grounding in Thibaut and Kelley's (1959) theory of interdependence, social exchange theory looks at relationships as a set of bartering arrangements where participants weigh possible gains and losses when deciding a course of action (Huston & Burgess 1979). Levinger (1965, 1976) was among the pioneers in applying this theory to marital dissolution, arguing that marital success depends on participants weighing three criteria: (1) the attractions of the relationship, (2) the barriers to leaving the relationship, and (3) the presence of attractive alternatives outside the relationship. Social exchange theory predicts that marriages will end when the relationship offers little continuing attraction, there are weak constraints on partners keeping them in the relationship, and alternatives to the relationship are more appealing than continuing it.

Though arising from a different intellectual tradition, the economic theory of marriage and divorce formalizes many of the key ideas present in social exchange theory. The seminal papers using economic models are those by Becker (1973, 1974) and Becker et al. (1977). In Becker's model, individuals come together in a competitive marriage market, which sorts couples according to the characteristics they bring to each hypothetical marriage match. Individuals who bring valuable characteristics to a marriage or have many consumption (broadly defined) opportunities outside of marriage will be able to negotiate a high level of benefits from any marriage match they make. Significant events in life, such as unemployment or health problems, may cause individuals to re-evaluate their marriages, and divorce occurs when sufficient opportunities exist outside of marriage (or within another marriage) to induce one or both of the partners to dissolve the marriage.

Although differences exist between the social exchange model and Becker's economic model, there is sufficient overlap, for our purposes, to refer to them together as the rational choice theory of marital dissolution.

We argue that the rational choice framework is a general and flexible mode of analysis that can accommodate a wide variety of variables. Essentially, anything that might potentially affect the benefit of staying married relative to dissolving can be incorporated into the analysis. The rational theory can be applied ably to survey data that contain demographic and socioeconomic characteristics of couples. Psychological theories such as Wiseman (1975), Kessler (1975), and Guttman (1993) reveal important insights about the divorce process, but how these theories can be empirically implemented with large scale survey data is not as obvious. While not modeling the complete divorce process at the psychological or psychosocial level, the rational choice model points to the role played by demographic and socioeconomic variables in setting the preconditions for marital dissolution to occur.

Two important implications for how health and other potential marital stressors will affect the risk of marital dissolution can be derived from the Becker model. First, variables present at the time of marriage formation should have minimal impact on separation and divorce in later life. These differences are part of the process of the decision to form a marriage. Differences that are present and observable at the time of marriage will be "negotiated out", and should not affect the risk of dissolution. Likewise, differences that are not fully observed should resolve themselves relatively early in the marriage. As previously unobserved spousal characteristics become apparent, individuals will either accept the differences, renegotiate the terms of the marriage, or dissolve the marriage. A high hazard of divorce within the first few years following marriage is likely caused, in part, by features of individuals that were unobserved, or at least not fully appreciated, before the marriage. If this is true, then it is chiefly the unanticipated aspects of the marriage relationship that are likely to lead to dissolution in later life.

Because health usually starts to deteriorate long after the formation of marriage (though obviously exceptions exist), health is an ideal variable to test the implication that unanticipated events in marriage will raise the hazard of dissolution. Of course this implication needs refinement because all individuals expect their health to ultimately deteriorate, assuming they do not die from accidental injuries or from serious acute conditions such as heart attacks. Likely the best way to gauge whether the incidence of a health condition is anticipated by one's spouse is the age that it occurs. We argue that the age cohort examined in this study (age 51–61 in 1992) is generally characterized by good health and that a large share of the conditions prevalent among this group were surely not expected to occur so early in life, though we cannot test this assumption directly.

The second important implication of the rational model concerning how health should impact marital dissolution is that the importance of one's health

status relative to the health status of one's spouse. When an individual has a spouse whose health declines (and is subsequently able to contribute less to the marriage in terms of factors such as income, household tasks, or recreational activities), the net benefits of staying married, relative to being single or married to a different person, will fall. This will lead some marriages to dissolve. Empirically, those marriages where only one partner is in poor health – what we refer to as "health mismatch" – should have the highest hazard of divorce across possible health status groups, even higher than the case where both partners are in poor health. It is even theoretically possible that the joint occurrence of health problems will actually reduce the likelihood of marital dissolution relative to healthy couples.

The health mismatch hypothesis has significant empirical content because there are at least three credible alternative hypotheses. First, it could be that health status plays no significant role in marital dissolution. Second, perhaps the idealized marriage commitment is true: poor health actually brings couples together, thereby lowering the odds of dissolution. Third, the health of partners may have independent and cumulative negative impacts on health, implying that marriages where both couples are in poor health face the highest risk of dissolution because they have the highest cumulative stress from poor health.[4]

Empirical evidence to date

The empirical literature has identified both micro-level and macro-level variables associated with marital dissolution.[5] On the macro level, the legal shift from fault to no-fault divorce, economic cycles, lessening dependence on the family institution, sex ratios, changing gender roles, lower levels of social integration, and changing cultural norms are all contributors, to some extent, to changes in divorce rates. Among micro-level variables, several demographic and life course factors have been shown to influence marital stability. Second marriages or marriages where stepchildren are present are more likely to run into problems than first marriages. Parental divorce increases the probability that the children of these broken unions will eventually divorce. Cohabitation before marriage, premarital pregnancy and the bearing of children prior to marriage all lead to a higher risk of divorce. However, bearing children within a marriage can be a stabilizing influence, at least with the first child. Age is also a consideration. The younger partners are at marriage, the greater the likelihood that they will divorce. Race is a factor in marital stability, with several researchers pointing to the consistently higher divorce rates among blacks than whites, although no definitive explanation for the disparity has been forwarded. Finally, it has been well demonstrated that as people age they are less likely to divorce (Fergusson et al. 1984; Thornton & Rodgers

1987), but evidence is mixed on the effect of marital duration. Some authors (e.g., Booth et al. 1986) argue that power of divorce predictors diminishes with both age and marital duration. Others (e.g., Heaton et al. 1985; South & Spitze 1986) find no discernable difference in predictive power with increased marital duration.

Surprisingly, little empirical work has been done that identifies the effect of health on marital dissolution, though there are some inconsistent findings concerning the effect of health on marital quality.[6] Interestingly, some scholars find that the spouse of an unhealthy individual is more likely to report this degradation of the marital relationship than is the afflicted individual (Ahern et al. 1985; Romano et al. 1989), which is consistent with the health mismatch hypothesis. A recent study among residents of Eidhoven, Holland (Joung et al. 1998) examines the influence of existing health conditions on the probability of marital transitions in general (getting married, getting divorced, or bereavement). The authors find that poor health did increase the probability of divorce, but not of marriage or bereavement. It is safe to say that, in general, little is known about the impact of health status on marital dissolution.

Health mismatches can be viewed as a type of heterogamy, but one that has not been studied before. Some have argued that heterogamous marriages are more likely to experience marital disruption because they have less consensus than homogamous marriages. The empirical literature on heterogamous marriages, however, finds very mixed results, and almost all of it is based on cross-sectional data. In a longitudinal study using the National Longitudinal Survey of Youth, Tzeng (1992) finds evidence that couples who differ in education, age at marriage and labor force status face higher odds of divorce. She did not test for the impact of health mismatches, though they would likely not be important in this young cohort.

Methods

Heaton et al. (1985) point out the necessity of using a model that takes into account the timing of events important to the marriage survival when evaluating marital stability.[7] Thus, when investigating the impact of health on the probability of marital dissolution, it is import to account not only for the presence of health problems in a marital relationship, but for the timing of their occurrence as well. Karney and Bradbury (1995) note that the majority of marriage literature is based on cross-sectional data that is useful in many respects, yet lacks the power to explain how marriages become more or less stable over time. As Heaton states, "analysis underscores the importance of concepts and statistical methodology that take notions of time, process, and change seriously" (1991: 294).

Researchers are increasingly emphasizing the importance of longitudinal analysis of marital processes. The model presented here is a modest attempt at understanding how marriage relationships change over the life course by analyzing four waves (1992–1998) of HRS data on married couples in late middle age. We do not attempt at this point to model all the dynamics of marriage, but we do try to identify those characteristics, measured during the baseline interview, which predict marital dissolution in the following periods. Since marital dissolution is frequently modeled using techniques of survival analysis, we employ here the Cox (1972) proportional hazards model, which is reviewed briefly in the next section.

Our discussion of the rational choice model discussed above suggests an additional theme that the empirical work should address: in short, the importance of interacting the characteristics of spouses, particularly health status. To the extent possible, we employ spousal interaction effects of dependent variables in our estimation.

An empirical framework

The Cox proportional hazards model

Survival analysis typically starts with the specification of the hazard function, which is the instantaneous probability of failure in period t, conditioned on the probability of surviving to period t. If we let λ be the hazard rate, and T be a random variable with possible values $t = 1, 2, 3, \ldots T$, indicating time until failure, then the hazard rate measured in discrete time units is the following conditional probability:

$$\lambda(t) = P(T = t | T\beta t).$$

Numerous specifications of $\lambda(t)$ are possible. The assumption employed by Cox, which now is ubiquitous in survival analysis, incorporates covariates in the following fashion:

$$\lambda(t) = \lambda_0(t)e^{X\beta}$$

where X is a vector of covariates, βa vector of coefficients, and $\lambda_0(t)$ the baseline hazard function. The role of covariates is to shift the baseline hazard function according to the estimated coefficients. Coefficients can be converted easily into odds ratios, which will be reported in this analysis.

The baseline hazard function can take any form and need not be estimated, as opposed to parametric hazard functions that proscribe a particular functional form for the hazard function. The key assumption of the Cox model, however, is that covariates shift the hazard function by the same percentage for all values of t, hence the name *proportional* hazard.

Censoring and competing risks

A salient feature of longitudinal survey data is that respondents often fail to appear in subsequent waves of the data collection. This is usually due either to death or to a failure of survey investigators to locate the respondent. In the current analysis of marital dissolution, couples face three distinct types of "failure" during any survey period: (1) marital dissolution (our principal concern), (2) death, and (3) non-response. In the Cox terminology, we say that the couple faces "competing risks".

Under the standard assumption that these competing risks are independent, the hazard for the jth risk, $\lambda^j(t)$, can each be estimated separately (Cox & Oakes 1984). Incorporation of failures of other types is equivalent to a single-risk model with right-censoring of the data. In practice, this is accomplished by treating missing observations of the data as censored at the point where the observation drops out of the sample. For example, if a particular marriage ends through death, we have no additional information on whether or not that marriage would have dissolved in the future. Furthermore, all observations that do not experience a failure prior to the end of the survey are effectively censored at the last period.

The Cox model, therefore, allows a simple and natural way to incorporate both changes in the probability of failure over the course of the period under study and a loss of observations due to death or failure to locate the respondents. Discrete dependent variable models such as logit or probit (which would model the probability that a marital dissolution occurred within the 6-year period), on the other hand, typically necessitate the deletion of observations that do not last until the end of the survey period. Selection on completion of the survey period can introduce significant bias. This problem is avoided in the Cox framework.

Issues in estimation

Several features of both the HRS data and the question at hand impose difficulties and limitations on the estimation process. First, because we do not observe marriages over the complete life course, we can only estimate the hazard function that is conditional on the marriage surviving to the baseline. Hence, we have to be careful in making inferences about general risks of marital dissolution when our estimates are made on a very narrow set of marriages.

Heterogeneity in marriage duration at baseline is also a critical problem. Most of the marriages in the data have existed for some time, but some are recent marriages. The proportional hazards model assumes a common baseline hazard function, but we know that the hazard of dissolution is much higher during the first part of a marriage than after the marriage matures. Possible

solutions to this problem would be to include a dummy variable for recent marriages or a variable that identifies the number of years the marriage has existed. These approaches, however still force the same hazard on the recent marriages as on longer marriages, and the hazard rates are assumed to differ only by a constant of proportionality. Instead, we take the more conservative approach of limiting our analysis to only those marriages that have existed for at least ten years.

Another concern in applying the Cox model to the HRS data is the frequency of observation. Hazard models typically work best when data is collected frequently. In the HRS, however, a "period" is two-full years. Thus there are only four points in time, $t = 0, 1, 2, 3$ in the data, and only 3 points at which failure can occur. Furthermore, we do not know when in the period the marital dissolution occurred – failures one week after the initial survey are treated the same as failures that occur almost two years later (but before the subsequent survey).

The relatively short time span of the data also limits the type of dynamic analysis needed to fully understand the marital processes. As discussed above, unanticipated aspects of the marital relationship should play a key role in marital dissolution. Ideally, we would, therefore, like to incorporate period-by-period variation in the independent variables and see how the timing of "shocks" to the marriage played out in terms of marital dissolution. We feel, however, that the data here provide too narrow of a window on the life course to adequately investigate the role of shocks to health or other variables upon marital dissolution rates. Furthermore, there is no way to investigate these dynamics without imposing significant structure, such as a naïve application of time-varying covariates, upon the dynamics of marital status.

Finally, among the age cohort studied in the HRS, marital dissolution is a relatively rare event. Of the 4,241 marriages under analysis, only 139 dissolve in the six-year follow-up period. A severe limitation inherent in analyzing marital dissolution among this age cohort is that low probability events typically cannot be used as predictors of low probability outcomes without extremely large data sets. Attempting to do so leads to spurious results and, oftentimes, a failure of the estimation procedure. For example, a dummy variable that equals unity only infrequently will be perfectly correlated with the explanatory variable if, for the few occurrences of the variable, there are no occurrences of failure in the dependent variable, which is highly likely since failures are rare. The consequence of this happening is that the likelihood function is maximized by driving the coefficient on the regressor to negative infinity.

The practical implication of trying to predict low probability events is that categorical variables must be defined very broadly. Detailed categorical vari-

ables, and particularly interactions of categories, are not possible. Although the HRS is relatively large compared to other data sets of its kind, it is still too small to provide a detailed investigation of low probability events.

Data and measurement issues

The health and retirement study

The recent decade has brought an abundance of new health and demographic data for researchers to exploit. Among the most important data sets to become widely available is the Health and Retirement Study (HRS). The first wave of the HRS was collected in 1992 on a representative national sample of men and women aged 51–61, and follow-up waves were taken in 1994, 1996 and 1998. The initial wave was completed in face-to-face interviews, where extensive information was taken from both age-eligible respondents and their spouses, and subsequent waves were performed over the telephone. The total sample size of the 1992 HRS is 12,762 persons. From this group, we identified 4,746 married couples living together at time of interview. Of this group, 4,241 have been married 10 years or longer; and of these, 2,757 (65%) report a high level of satisfaction from both partners. Of the couples married at least ten years, 78% of women and 78% of men report their marriages as very satisfying out of the possible choices of "very satisfied", "somewhat satisfied", "even", "somewhat dissatisfied", and "very dissatisfied".

Many of the relationships estimated here may apply as well to unmarried heterosexual and homosexual couples. However, since the dynamic processes involved in marital formulation and dissolution are still poorly understood, we defer analysis of other couple types to a later date. Understanding if and how married couples differ from unmarried couples of different types is an important topic for future research

Variables under analysis

The HRS contains a rich source of information on numerous demographic, socioeconomic and health variables. Below we briefly summarize the variables we use in the subsequent analysis. The sample means and frequencies for the variables discussed below are given in Table 2. All variables reflect values at baseline, which is 1992.

Table 2. Sample characteristics at baseline, 1992

Variable	Mean or %
Wife's age: 45 and under	4.2%
Wife's age: 46–50	15.0%
Wife's age: 51–55	35.3%
Wife's age: 56–60	35.2%
Wife's age: 61 and up	9.3%
Husband's age: 50 and under	4.0%
Husband's age: 51–55	31.1%
Husband's age: 56–60	31.6%
Husband's age: 61–65	24.5%
Husband's age: 66 and up	8.9%
Husband 5–9 years older than wife	26.0%
Husband 10 + years older than wife	11.1%
Wife 5+ years older than husband	39.2%
Wife's education (years)	12.2
Husband's education (years)	11.5
Husband's education 2–3 years more than wife	11.9%
Husband's education 4+ years more than wife	6.1%
Wife's education 2–3 years more than husband	17.7%
Wife's education 4+ years more than husband	16.0%
Race: Both white	78.9%
Race: One spouse white/one non-white	11.8%
Race: Both non-white	9.3%
Religion: Both active	36.1%
Religion: Wife active/husband inactive	18.0%
Religion: Husband active/wife inactive	4.7%
Religion: Both inactive	41.2%
Children at home (1992)	41.4%
Care for grandchildren 100+ hours	37.2%
Care for parents 100+ hours	5.8%
Relatives in neighborhood	38.4%
Previous divorce: Husband = no/wife = no	70.9%
Previous divorce: Husband = yes/wife = no	9.1%
Previous divorce: Wife = yes/husband = no	7.7%
Previous divorce: Wife = yes/husband = yes	12.4%

Table 2. Continued

Variable	Mean or %
Net household wealth in 1991	$27,443
Labor force part.: Wife = no/husband = no	14.9%
Labor force part.: Wife = no/husband = yes	22.7%
Labor force part.: Husband = yes/wife = no	14.2%
Labor force part.: Husband = no/wife = yes	48.2%
Health: Husband = good/wife = good	64.8%
Health: Husband = poor/wife = good	16.6%
Health: Wife = poor/husband = good	11.6%
Health: Wife = poor/husband = poor	7.0%
N = 4,241	

Marriage and family variables

The dependent variable of the empirical model described in the next section is marital dissolution. Of course, identifying when marriages dissolve is a challenging question from both a theoretical and empirical standpoint. Some divorces happen quickly, others occur after lengthy separation. Still others effectively end before any change in living arrangements occurs. Additional difficulties exist because respondents are interviewed only at two-year intervals. Furthermore, the relatively short time horizon of this study makes it difficult to track many of the marital dissolutions through the process of separation and eventual divorce, not to mention possible reconciliations.

Given the data limitations discussed above, we use separation as the indicator of marital dissolution. In the proportional hazard model estimated in the next section, once dissolution occurs, it is assumed to be permanent, and we do not model transitions from separation to marital cohabitation. Using divorce, rather than separation, as the indicator of dissolution would risk eliminating many cases of marital failure that occur towards the end of the time period, but do not actually result in divorce until a later date. As subsequent waves of data become available, it will be possible to examine transitions between cohabitation, separation and divorce.

Previous studies have estimated the impact of previous divorce on marital dissolution rates. We classify each couple with four binary variables: neither has been previously divorced; only the husband has a previous divorce; only the wife has a previous divorce; and neither has a previous divorce. Other variables like number of marriages were not used, since they are highly collinear with divorce.

We are particularly interested in family variables that may put stress on a marriage. Therefore we include variables that control for whether or not the couple has children at home, whether they provide over 100 hours per year caring for an elderly parent, and whether they provide over 100 hours per year caring for grandchildren. Because social support may affect marital stability, we also include a variable that identifies whether the couple has relatives in the neighborhood.

In the design of the HRS, investigators operated under the assumption that the female partner was best able to answer accurately the questions related to the marriage and family variables unless the couple preferred to have the male partner answer these questions. The survey question regarding marital satisfaction, however, was asked of both male and female partners separately.

Health measurement

In this study we measure health using self-assessed general health status. Respondents are asked whether, in general, their health is "excellent, very good, good, fair or poor". This measure of health exists in most surveys related to health and is ubiquitous in the scholarly literature. While often criticized for being excessively subjective and non-specific, this measure has been shown to be highly correlated with more objective measures of health (Maddox & Douglas 1973; Booth & Johnson 1994). For reasons given below, this health status variable is dichotomized into two categories of health, with those falling into the "excellent","very good" and"good" categories designated as "Good" and those with "fair" or "poor" responses designated as "Poor".

Demographic and socioeconomic variables

Because the rate of divorce declines with age, appropriate age controls are essential in estimating the determinants of marital dissolution. We let age enter the model nonlinearly with a set of dummy variables representing five-year age groups for both husbands and wives. Additionally, we try to control for dissimilarities in age between the partners. Hence we include binary variables which indicate whether the husband is more than five years older than the wife, whether he is more than ten years older, or whether the wife is five years older than the husband (there are insufficient numbers of couples with the wife more than ten years older than the husband to justify a separate category).

As noted earlier, the primary respondents in the HRS are sampled from a cohort aged 51–61 in 1992. This does not allow us to say much about the effect of life course transitions on the rate of marital dissolution. Moreover, those in the sample who are younger or older than this cohort are not a rep-

resentative sample of people from their age group. For example, wives in the sample who are under age 45 are *all* married to men who are aged 51–61. Thus the impact of this variable cannot be construed to reflect a pure age effect, even given our controls for age difference between the spouses.

An advantage of the narrow age distribution is that confounding effects of pooling people from different birth cohorts is mitigated. In cross-section studies and longitudinal studies over a short time period, it is usually impossible to separate age and cohort effects. A cohort study such as this one, however, does not have this problem, though there may be slight cohort differences between younger and older individuals in the sample.

A cohort study also aids in the analysis of education effects, since there have been rapid increases in educational attainment in successive cohorts over the mid part of the last century. In this study we use years of formal schooling as our measure of education for both the husband and the wife. We also include binary variables that capture the potentially important interaction of the partners' education. There are four interaction variables indicating whether the husband has either two or four more years of education than the wife, and similarly defined variables for cases where the wife's education exceeds that of the husband.

Additional demographic controls include race and religious activity. As with many of the other variables in this study, we construct a set of binary variables characterizing the couple that can be used to capture both the individual effects and the interaction effects. Three types of racial classifications are made: both husband and wife are white; both are non-white; and mixed, where one is white and one is non-white. Because of insufficient sample size and the fact that most couples marry along self-identified racial lines, the data do not allow more detailed racial or ethnic classification classifications such as identifying black, Asian and Hispanic couples, or, in particular, interactions between these additional racial and ethnic groups. A weakness of this definition is that it treats mixed-race couples where neither partner is white the same as non-mixed minority couples. Again, this constraint is imposed by the limitation of the data, not by any theoretical reason.

The stress caused by differences in religious observances may affect the odds of marital dissolution. This stress may be caused either by differences in religious belief, affiliation or activity. We incorporate only the dimension of religious activity, where "active" indicates attendance at church or church functions at least once per month. Couples are identified as one of four types: both partners active; only husband active; only wife active; neither active.

Finally, the economic status of couples may play a significant role in marital stability. We incorporate two economic variables. The first is net household wealth. This is calculated by HRS researchers as the sum of the net

assets of couples based on extensive questions related to real estate wealth, pension wealth, savings and security holdings and a variety of other assets. The units of the wealth variable are given in thousands of dollars.

The second economic variable is labor force participation. Labor force participation is defined here with the standard definition of economics, namely that a person is a participant in the labor force if she is either employed or unemployed but looking for work. Further delineation of non-participants into categories such as retired or homemaker is not made here due to the relatively small number of observations in these groups. Categorizing the employed by hours worked is also not undertaken for the same reason. As is done with other variables, we create four binary variables indicating: both the husband and wife participate in the labor force; only the wife participates; only the husband participates; and neither participates.

Finally, the effect of binary variables is always analyzed in relation to the "reference group". Because there are several exclusive sets of binary variables, it is important to keep in mind the characteristics of the reference couple. For purposes of this analysis the reference couple are both employed, both religiously active, have no relatives in their immediate neighborhood, have no children at home, provide no care of either parents or grandchildren, have an education attainment within 2 years of their spouse, are both 51–55 years old, and have not been previously divorced.

Results

Marital dissolution is a complex process that may take several years to occur and will almost always be preceded by a period of dissatisfaction with the quality of the marriage. However, many unsatisfying marriages are very stable, and some marriages reported as satisfying can dissolve quite quickly. In order to account for the possibility that satisfying marriages are qualitatively different from unsatisfying marriages, we want to explore the effects of health in both types of marriages. For purposes of analysis, we classify marriages as "satisfying" if both partners report that they are "very satisfied" with their marriage. If either or both partners are unsatisfied then the marriage is classified as "unsatisfying".

We estimate the effects of health on the hazard of marital dissolution with five different models. The first three models use the entire sample of 4,241 couples. Model I is estimated without controls for marital satisfaction, while Model II includes controls for both spouses' satisfaction with the marriage. Model III, on the other hand, includes an interaction of the health and marital status variables. Models IV and V divide the sample into two parts based on whether the marriage is satisfying. As noted above, couples where at least

one partner fails to report that they are "very satisfied" are classified as "not satisfied"; others are "satisfied".

Table 3 below summarizes the results of the Cox proportional hazard model for Models I-III. Results are presented in terms of odds ratios. A value of 1.5, for instance, means the covariate in question raises the hazard of marital dissolution by a factor of 1.5. Statistical significance is indicated by t-statistics, which are calculated using robust standard errors in STATA 7.0.

Given the very low probability of dissolution present in this cohort of marriages that have survived at least 10 years, it is not surprising that few of the explanatory variables are statistically significant. Looking first at Model I, there do appear to be some important effects of age. Interpreting the coefficients is somewhat tricky, however, because it must be remembered that at least one partner must be in the target age range of 51–61. However, it seems that mismatches in age are important predictors of dissolution, particularly for the cases where the wife is older than the husband. Mismatches in the other direction may also be important, except for the case where the husband is 66 years or older.

Education, race, wealth and labor force participation have little if any effect on the hazard of dissolution (though the marginal effect of the husband's non- participation is higher than the wife's). Interestingly, religious inactivity has a positive effect on dissolution both for cases where the wife alone is active and where both partners are inactive. Couples where the husband is active but the wife is not have the same dissolution rate as couples where both are active (the reference category). Not surprisingly, couples where both partners are previously divorced have significantly higher chances of dissolution than couples without a previous divorce.

The variables of interest for this study are the health status variables. In short, in Model I we find no statistically significant effects of health status upon the hazard of marital dissolution, though poor health in either or both spouse does raise the estimated hazard. We also do not find evidence for the health mismatch hypothesis outlined in Model I.

In Model II we include marital satisfaction indicators as predictors of dissolution. Not surprisingly, the effects of the satisfaction variables are strong and statistically significant, especially in the case where both parties report some level of dissatisfaction with the marriage relationship. It is, however, difficult to determine how these variables should be interpreted. In a sense, all that we know is that marriages that are unsatisfying dissolve more quickly than satisfying marriages – hardly a surprising result. An important question in identifying determinants of marital dissolution is whether or not the marital satisfaction variables enter the analysis independently or whether they are co-linear with the other variables, thereby significantly changing the impacts

Table 3. Proportional hazards model results – full sample

Characteristics at baseline	Model I		Model II		Model III	
	Odds ratio	*t*-stat.	Odds ratio	*t*-stat.	Odds ratio	*t*-stat.
Wife's age: 45 and under	1.565	1.08	1.565	1.06	1.549	1.04
Wife's age: 46–50	0.916	−0.32	0.938	−0.23	0.909	−0.34
Wife's age: 51–55	–		–		–	
Wife's age: 56–60	1.194	0.64	1.155	0.52	1.199	0.66
Wife's age: 61 and up	1.126	0.25	1.037	0.07	1.071	0.14
Husband's age: 50 and under	2.786	2.80***	2.564	2.61***	2.800	2.83***
Husband's age: 51–55	–		–		–	
Husband's age: 56–60	1.044	0.16	1.113	0.37	1.042	0.15
Husband's age: 61–65	0.539	−1.49	0.591	−1.26	0.547	−1.45
Husband's age: 66 and up	0.406	−1.33	0.425	−1.26	0.376	−1.44
|Husband's age − wife's age| < 5 years	–		–		–	
Husband 5–9 years older than wife	1.212	0.68	1.156	0.51	1.178	0.57
Husband 10+ years older than wife	1.735	1.32	1.804	1.44	1.970	1.62
Wife 5+ years older than husband	1.390	0.79	1.403	0.82	1.380	0.78
Wife's education (years)	0.992	−0.11	0.992	−0.10	1.011	0.15
Husband's education (years)	0.993	−0.09	0.985	−0.20	0.974	−0.37
|Husband's educ. − wife's educ.| < 2 years	–		–		–	
Husband's education 2–3 years more than wife	1.281	0.86	1.268	0.81	1.257	0.79
Husband's education 4+ years more than wife	1.251	0.49	1.279	0.51	1.371	0.66
Wife's education 2–3 years more than husband	1.171	0.50	1.145	0.43	1.084	0.26
Wife's education 4+ years more than husband	1.652	1.05	1.647	1.04	1.474	0.81

Table 3. Continued

Characteristics at baseline	Model I		Model II		Model III	
	Odds ratio	*t*-stat.	Odds ratio	*t*-stat.	Odds ratio	*t*-stat.
Race: Both spouses white	–		–		–	
Race: One spouse white/one non-white	1.273	0.55	1.116	0.24	1.168	0.34
Race: Both spouses non-white	1.222	0.43	1.139	0.28	1.134	0.26
Religion: Wife active/husband active	–		–		–	
Religion: Wife active/husband inactive	1.636	2.16**	1.317	1.21	1.440	1.62
Religion: Wife inactive/husband active	1.003	0.01	0.896	−0.24	0.948	−0.12
Religion: Both spouses inactive	1.402	1.61	1.222	0.95	1.312	1.29
Children at home (1992)	1.286	1.40	1.201	1.01	1.221	1.10
Care for grandchildren 100+ hours	0.916	−0.47	0.895	−0.60	0.922	−0.44
Care for parents 100+ hours	1.411	1.18	1.318	0.95	1.297	0.88
Relatives in neighborhood	0.935	−0.37	0.959	−0.23	0.936	−0.36
Previous divorce: Wife = no/husband = no	–		–		–	
Previous divorce: Wife = no/husband = yes	1.277	0.94	1.313	1.07	1.336	1.12
Previous divorce: Wife = yes/husband = no	0.790	−0.66	0.787	−0.67	0.836	−0.51
Previous divorce: Wife = yes/husband = yes	1.745	2.219**	1.669	2.01**	1.799	2.36**
Wealth	1.000	0.27	1.000	0.11	1.000	0.06
Labor force part.: Wife = yes/husband = yes	–		–		–	
Labor force part.: Wife = no/husband = no	0.581	−1.69*	0.633	−1.42	0.641	−1.38
Labor force part.: Wife = no/husband = yes	0.837	−0.81	0.847	−0.74	0.867	−0.64
Labor force part.: Wife = yes/husband = no	1.226	0.75	1.166	0.58	1.245	0.80
Health: Wife = good/husband = good	–		–		–	
Health: Wife = good/husband = poor	1.168	0.64	1.055	0.21		

Table 3. Continued

Characteristics at baseline	Model I		Model II		Model III	
	Odds ratio	*t*-stat.	Odds ratio	*t*-stat.	Odds ratio	*t*-stat.
Health: Wife = poor/husband = good	1.328	1.13	1.168	0.59		
Health: Wife = poor/husband = poor	1.322	0.85	1.058	0.18		
Marital satisfaction: Wife = yes/husband = yes	–		–		–	
Marital satisfaction: Wife = yes/husband = no			1.951	2.52**		
Marital satisfaction: Wife = no/husband = yes			1.861	2.33**		
Marital satisfaction: Wife = no/husband = no			4.847	7.40***		
Health/satisfaction interaction terms						
Both satisfied &:						
Health: Wife = good/husband = good					–	
Health: Wife = good/husband = poor					1.871	1.75*
Health: Wife = poor/husband = good					2.496	2.55**
Health: Wife = poor/husband = poor					0.841	−0.23
At least one spouse not satisfied &:						
Health: Wife = good/husband = good					3.734	5.83***
Health: Wife = good/husband = poor					2.624	2.87***
Health: Wife = poor/husband = good					2.463	2.39***
Health: Wife = poor/husband = poor					4.200	3.79***
Sample size:	4.241			4.241		4.241
Number of dissolutions:	139	(3.3%)	139	(3.3%)	139	(3.3%)
Log likelihood:	−1111.5		−1087.1		−1090.9	

Data: HRS couples married at least ten years. All *t*-statistics calculated using robust (heteroskedasticity-consistent) standard errors.
Significance levels: * = 0.1; ** = 0.05; *** = 0.01.

of other variables. For the great majority of variables, the inclusion of the satisfaction variables reduces (in absolute value) the estimated impacts of the other variables in the model, but only very slightly. Interestingly, it is the health variables that change the most.[8] The modest impacts of health present in Model I are essentially eliminated with the inclusion of the marital satisfaction variables. It cannot be concluded, however, that poor health causes dissolution *because* it leads to marital dissatisfaction, although regression results (not shown) show a statistically significant correlation between marital satisfaction and health status at their baseline values.

Models III–V address the question of whether or not a differentiation by marriage type ("satisfied" v. "unsatisfied") affects the estimated impact of health. We find clear evidence that the interaction of marriage type and health have strong impacts on marital dissolution. Model III in Table 3 interacts health and marriage type to create a set of eight dummy variables, where the category representing satisfied couples with both partners in good health is the omitted category. In general, the coefficients of Model III are very close to those estimated in Models I–II. The health effects, however, are sharply different in Model III.

For satisfied couples, health mismatches significantly raise the probability of dissolution, particularly if it is the wife that is sick (the other type of mismatch, where the husband is in poor health is significant only at the 0.1 signficance level). Couples where the wife alone is in poor health face a hazard of dissolution 2.5 times as high as those where both partners are in good health. Couples where the husband is in poor health have a slight lower odds-ratio of 1.9. On the other hand, couples where both partners are in poor health actually have a *lower* hazard of dissolution than healthy couples. For these satisfied couples, therefore, the health mismatch hypothesis finds some support.

However, couples that are not satisfied have a directly opposite pattern. All these couples face a considerably higher risk of dissolution than the satisfied couples, but those with health mismatches are actually less at risk of dissolution than those without mismatches. Furthermore, those where both are in poor health face the highest risk of dissolution. Thus for these couples, no evidence is found for the health mismatch hypothesis. The alternative hypothesis that health affects dissolution in an additive fashion across spouses finds mixed support among this group since those couples where both spouses are in poor health have the highest dissolution rate. However, if the additive stress hypothesis is true, couples with mismatches should have higher rates of dissolution than healthy couples, which is also not born out by the results.

A less restrictive way of testing for differences between satisfied and unsatisfied couples is by estimating the models separately for these two groups.

This is done in Models IV and V of Table 4. The first thing that one notices is that for many variables, the estimates differ substantially across the two groups. This fact belies the notion suggested in the previous estimation that marital satisfaction has only a modest effect on how the covariates in the analysis affect dissolution. Indeed, a comparison of Models IV and V suggest quite the opposite: the risk factors for dissolution seem to be quite different for happy couples than they are for those where some level of dissatisfaction is present.

One of the most noticeable aspects of Model IV is the large effect of age. Although, the patterns present here are not inconsistent with those found in the estimation of the full model, they are much more pronounced. These results suggest strong evidence that mismatches in age significantly increase the odds of dissolution among satisfying marriages. Notice that we do not see a decline in dissolution probability with the age of the wife. But this is mostly likely an artifact of the HRS sampling methodology. Women over age 61 all have spouses between the age of 51–61, so these are all women with younger husbands, which increases the odds of dissolution. Thus the coefficient of 2.076 on the 61 and up group will capture part of the effect of the age mismatch, indicating that estimated effect of the wife being 5+ years older than the husband is underestimated. Dissolution does decline, though, with the age of the husband, but husbands who are significantly older than their wives face a higher likelihood of dissolution. Among unsatisfying marriages in Model IV, the effects of age are sharply different. Indeed it is only those couples where the husband is 50 or under that the effect is significant at the 10% significance level.

The effects of education, race, religion and the economic variables of household wealth and labor force participation are not estimated precisely enough to make confident comparisons across the two groups, nor can we say with confidence that the variables have any effect on the probability of dissolution. The sign and magnitude of the effects is quite different, however, across the two groups. Larger samples sizes are needed to better identify the effects of these variables, if indeed they have an effect. Similarly, the potential stressors of children or grandchildren at home or the absence of relatives in the neighborhood have no statistically significant effect in either model. However, in Model V, caring for an elderly parent increases the hazard of dissolution by 83%.

The effect of previous marital experience differs markedly between Models IV and V. Among those with satisfying marriages, previous divorce has little impact. However, among the dissatisfied group, a somewhat strange pattern emerges. If the husband has been divorced before, the risk of dissolution rises by 89% and if both have been divorced, it rises by 136%. However,

Table 4. Proportional hazards model results - by satisfaction level

Characteristics at baseline	Model IV: Satisfied		Model V: Not satisfied	
	Odds ratio	*t*-stat.	Odds ratio	*t*-stat.
Wife's age: 45 and under	4.132	2.23**	0.915	−0.15
Wife's age: 46–50	1.994	1.46	0.620	−1.35
Wife's age: 51–55	–		–	
Wife's age: 56–60	1.700	1.07	1.087	0.25
Wife's age: 61 and up	2.076	1.03	0.646	−0.63
Husband's age: 50 and under	4.224	2.44**	2.125	1.65*
Husband's age: 51–55	–		–	
Husband's age: 56–60	1.479	0.89	0.839	−0.51
Husband's age: 61–65	0.577	−0.81	0.512	−1.3
Husband's age: 66 and up	0.714	−0.31	0.251	−1.61
|Husband's age − wife's age| < 5 years	–		–	
Husband 5-9 years older than wife	1.973	1.42	0.902	−0.28
Husband 10+ years older than wife	2.959	1.8*	1.657	0.87
Wife 5+ years older than husband	4.116	2.52**	0.548	−0.86
Wife's education (years)	0.863	−1.32	1.129	1.24
Husband's education (years)	1.105	0.91	0.899	−1.22
|Husband's educ. − wife's educ.| < 2 years	–		–	
Husband's education 2–3 years more than wife	1.384	0.78	1.259	0.56
Husband's education 4+ years more than wife	0.574	−0.78	2.728	1.61
Wife's education 2-3 years more than husband	1.886	1.27	0.822	−0.47
Wife's education 4+ years more than husband	1.611	0.57	1.275	0.4
Race: Both spouses white	–		–	
Race: One spouse white/one non-white	1.984	1.06	1.020	0.03
Race: Both spouses non-white	0.751	−0.41	1.079	0.12
Religion: Wife active/husband active	–		–	
Religion: Wife active/husband inactive	1.015	0.04	1.781	2.05**
Religion: Wife inactive/husband active	1.440	0.65	0.532	−0.82
Religion: Both spouses inactive	1.119	0.36	1.562	1.54
Children at home (1992)	1.031	0.1	1.298	1.15
Care for grandchildren 100+ hours	0.868	−0.45	1.080	0.33
Care for parents 100+ hours	0.880	−0.21	1.827	1.74*
Relatives in neighborhood	0.894	−0.38	1.001	0
Previous divorce: Wife = no/husband = no	–		–	
Previous divorce: Wife = no/husband = yes	0.733	−0.69	1.887	2.00*
Previous divorce: Wife = no/husband = no	0.861	−0.34	0.591	−0.94
Previous divorce: Wife = yes/husband = yes	1.071	0.15	2.361	2.82***

Table 4. Continued

Characteristics at baseline	Model IV: Satisfied		Model V: Not satisfied	
	Odds ratio	*t*-stat.	Odds ratio	*t*-stat.
Wealth	1.002	0.92	0.999	−0.48
Labor force part.: Wife = yes/husband = yes	–		–	
Labor force part.: Wife = no/husband = no	0.448	−1.37	0.769	−0.66
Labor force part.: Wife = no/husband = yes	1.021	0.06	0.731	−1.01
Labor force part.: Wife = yes/husband = no	0.762	−0.49	1.641	1.53
Health: Wife = good/husband = good	–		–	
Health: Wife = good/husband = poor	2.391	2.37**	0.598	−1.52
Health: Wife = poor/husband = good	2.192	2.13**	0.682	−1.11
Health: Wife = poor/husband = good	2.192	−0.15	1.107	0.28
Sample size:	2.757		1.484	
Number of dissolutions:	55	(2.0%)	84	(5.7%)
Log likelihood:	−398.8		−577.7	

Data: HRS couples married at least ten years. "Not satisfied" refers to those couples where at least one partner does not report being "very satisfied" with his/her marriage. All *t*-statistics calculated using robust (heteroskedasticity-consistent) standard errors.
Significance levels: * = 0.1; ** = 0.05; *** = 0.01.

marriages where the wife has been divorced before, but the husband has not actually have a lower (though statistically insignificant) effect on dissolution.

Though these demographic and socioeconomic controls are of interest, our primary concern for the purpose of this analysis is the effect of health and the health mismatch hypothesis. Here we find the same patterns as were evident in Model III. Clearly, the effect of poor health is much different across the two types of marriages. Among the satisfying marriages, the health mismatch hypothesis is strongly confirmed. If either spouse is in poor health, the hazard of dissolution is more than twice what it is for couples with no health problems, and both types of mismatches are statistically significant. Over the complete six-year period, the cumulative rate of dissolution for the satisfied and healthy couples is 1.62% over the six-year period in this study. The rate of dissolution for the couples with health mismatches is 3.7% where the wife is unhealthy and 3.1% where the husband is unhealthy.

When both are sick, there is no statistically significant effect of health mismatches; in fact, a mismatch effect actually lowers the probability of dissolution. Again, this pattern is not found among the unsatisfied couples in Model IV. Indeed, such couples with mismatches have 30–40% lower hazard rates than do couples in good health, though the estimates are not statistically significant.

From the evidence presented here, it appears that unsatisfying marriages face very different risks of dissolution than do satisfying marriages in the HRS cohort. This is certainly the case with health status. It is possible that once marriages become troubled, the factors such as poor health that may have led to a decline in marital quality, no longer are of much importance, since they are dominated by an overall feeling of unhappiness with the marriage. It is reasonable to argue that couples that are disconnected from each other aren't bothered by the poor health of a spouse, nor with a variety of other factors as suggested by the lack of significant effects in Model V. It may also be the case that the segment of the population that stays in unsatisfying marriages for long periods of time are disproportionately more likely to abide by the "in sickness or in health" portion of their marriage vows than is the average couple in a satisfying marriage, though we have no direct evidence for this conjecture.

Conclusions

As the baby boom generation ages, divorce among those in middle and late ages will become an increasing social concern. Even though the annual rate of dissolution is low in this age cohort, when added up over several decades, the dissolution risk is substantial. Similarly, odds ratios on the order of 2 may not seem profound when talking about a low rate of dissolution, but small differences can compound over the decades to produce substantial differences when viewed from a complete life course perspective.

Up to this point, most of our knowledge of the factors leading to divorce is derived from cross-sectional data, and we know relatively little about the marriage dissolution process. The longitudinal investigation undertaken here is a modest step in understanding how and why long-standing marriages dissolve, even though the window we examine is relatively short, only six years. Although the age cohort used in this analysis is likely not the most critical in terms of marital dissolution, it was chosen because it is the time when health starts to deteriorate for many individuals.

We have relied on the rational choice model of marriage to draw implications concerning marital dissolution. Two general implications were discussed earlier. First, variables that are observable at time of marriage (age, education, race, etc.), should not have substantial effects on dissolution because the impact of these variables on marital quality will have been negotiated out in the marriage market. In general, our results do not refute this prediction of the model, though the absence of significant coefficients is certainly not proof of the prediction's validity. However, there do seem to be important effects of age, which infirms the theoretical prediction. A

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