Chapter Four
Empirical Results on the Association Between Marital Status and Health Care Use Among the Seriously Ill

Until this point, our interest has been in the impact of marital status and marital status transitions on health. I have focused on mortality as a pleasingly unambiguous measure of health. I have found modest mortality differences associated with a change in marital status, but almost none associated with marital status per se. As discussed at the end of the last section, mortality is not the only outcome of interest. We may be interested in how the experience of illness varies as a function of marital status. One way to begin to examine this is to look at the impact of marital status on the forms of health care use.

There have been a number of scattered findings suggesting that marital status has a substantial impact on health care utilization. Thus we find that the married are more likely to have a primary care physician. (Sox et al. 1998) Married Hispanic elderly are more likely to get influenza and pneumococcal vaccines than the unmarried Hispanic elderly. (Mark and Paramore 1996). Married women present with earlier stage breast cancer, and may have better cancer screening behavior. (Goodwin et al. 1987; Lannin et al. 1998) The recently widowed may have more hospitalizations, and have greater use of mental health services. (Prigerson,

Maciejewski and Rosenheck 1999) When hospitalized, the married have been found to have shorter lengths of stay for a number of common conditions. (Chin and Goldman 1997; Kuykendall et al. 1995) At the end of life, the married experience better pain control at nursing homes. (Bernabei et al. 1998) In light of earlier discussion of the role of households as fundamental decision-making units, rather than atomic individuals, such findings are not surprising.

But, to date, there has a not been a unified effort to understand the role of marital status in health care utilization in general. This chapter begins an effort to correct this deficiency. In particular, I will use the experiences of inpatient and outpatient care as crucial model systems. I will first examine the degree to which marital status impacts of the choice of hospital at which the probands were diagnosed with their disease. I will be particularly interested in whether married individuals pick higher quality hospitals. Next, I ask, how good was the care that the proband received at the hospital that was chosen? Does this vary as a function of marital status?

In order to make valid comparisons, a number of precautions need to be taken. I will take into account differences in age, sex, race, income, and comorbidity burden, between the married and the widowed. But I also need to take into account geographic availability – and ideally, a host of other "availability" factors, most of which are unmeasured in ours or any dataset. In order to accomplish this control, I exploit hierarchical linear models (H.L.M.) to allow a varying random effect for each level of aggregation.

To be more concrete, consider the first question I will face: how does marital status alter the likelihood that a proband goes to a teaching hospital for the index admission? I need to take into account the nonrandom distribution of marital status across counties – with the consequent differences in proximity to a teaching hospital. I do this by estimating an HLM model with two levels. At the individual level (a.k.a. "level-1") I run a standard logistic regression, looking at the impact of our usual control variables on the outcome. But I take into account that the data have a natural level of aggregation – these probands are nested within counties. Then HLM allows us to fit a separate logistic regression for each county; I can constrain some coefficients to have the same effects across counties, but allow others to vary. Here, I allow each county to have a distinct intercept term, but require that the effects of the other coefficients are the same across counties. This lets each county vary in its average propensity to use a teaching hospital, without the need to specify the precise control variables that account for that variation.[1] It also corrects the standard errors of the individual level effects to take into account this implicit clustering. I then assume

[1] The following additional technical details are relevant. I use group-mean centered level-1 variables; this means that all coefficients at level-1 are interpretable as within-group effects. (In this example, they are the effect of variables within a county.) I could, in theory, allow all coefficients to vary across all level-2 units. This would amount to asking how much the impact of marriage varies across counties. This is a potentially interesting, but distinct question from those that have engaged us here; it may be future work, given the suggestion that measured social support is less important in rural communities than in urban communities. Moreover, these models with all variables having level-2 random effects are enormously computationally intensive, and, less stable in their estimates from the E.M. algorithm. Unless otherwise noted, the level-2 variance component on the intercept was highly significantly different from zero; its magnitude has no meaningful interpretation for categorical outcome regressions.

that within counties, the married and the widowed are approximately homogenously distributed with respect to distance and other variables not causally related to marital status. That is, I make the plausible but untested assumption that those who live close to a teaching hospital are not less likely to become widowed, and therefore that if the married are more likely to go to a teaching hospital, causality runs from marital status to choice, not via some confounding variable.

4.1 Data

The data used in this section parallel those used in Chapter 2 for the whole COSI cohort comparisons. I compare those who are widowed at their time of diagnosis to those who are detectably married and coresiding. Basic descriptive statistics are shown in Table 4.1 There are 455,594 individuals overall; 33.6% are male. For analyses of readmission rates, only those who survived the initial hospitalization are analyzed; there are 136,154 such men and 273,839 such women. The total counts are somewhat lower than in earlier chapters, as I require the following additional information be valid and available in order for analysis: (1) the hospital identifier, including linkage to secondary data source files; and (2) the county identifier, valid as linked to the Area Resource File.

Individual outcomes are defined in their appropriate sections.

4.2 Initial Hospital Choice

Do the married go to better hospitals? There are at least 3 characteristics by which a "better" hospital could be defined. They are: (1) teaching hospitals; (2) hospitals ranked in the U.S. News & World Report Best Hospitals Survey in 1993; and, (3) hospitals with more high technology facilities. These are ranked in decreasing order of availability of information to the general public. That is, while most people would probably know that the University of Chicago Hospital is a teaching hospital and the Jackson Park Hospital is not, they are less likely to know if Jackson Park Hospital has a cardiac catheterization lab. Yet each of these characteristics has been associated with improved outcomes for patients.

In particular, the hospital-choice variables are defined as follows. Teaching hospitals are those that are members of the Council of Teaching Hospitals; this includes all hospitals who have residency programs. All hospitals which were presented as top performers in any of six specialties important to COSI patients in the 1993 U.S. News and World Report rankings were identified. (Hill and Rudolph 1993; Hill, Winfrey and Rudolph 1997) Every year, the American Hospital Association (AHA) surveys all of its members on the services that they provides; this information is generally considered the best census of hospitals that is available. (American Hospital Association 1994) From the AHA Survey data, we obtained information for a technology index. The technology index scores the presence of 27 items, with more rare items adding more points. Its performance and details of its construction are described elsewhere. (Baker and Spetz 1999) Finally, the total number of COSI

patients with the same diagnosis as the patient who also had their index hospitalization at this hospital was calculated.

There is reasonable evidence that three of these variables are associated with better outcomes for patients; it seems unlikely that these indicators represent fully orthogonal axes.

- Teaching Hospitals: Patients with the 20 common medical conditions were shown to have better outcomes at teaching hospitals, using claims data. (Yaun et al. 2000) Patients within the National Long-Term Care Survey who were hospitalized for hip fracture, stroke, coronary heart disease, and C.H.F. all had better outcomes at teaching hospitals, but only the hip fracture results were statistically significant. (Taylor Jr., Whellan and Sloan 1999) The belief in the superiority of care at teaching hospitals is the reason they are placed at the pinnacle of referral networks – they are believed to be particularly more effective at the treatment of more unusual conditions.
- US News and World Report Rankings: Heart attack patients who went to a top-rated hospital had lower 30-day mortality (OR 0.87) in the high-quality data from the Cooperative Cardiovascular Project for 1994 and 1995; this difference was partially accounted for by the use of more effective treatments (beta-blockers and aspirin) at these top hospitals. (Chen et al. 1999)
- Technology: The impact of newer technology on outcomes is less clear. Indeed, efforts to constrain "technological arms races" (which presumably provide no benefit to patients) undergird Certificate of Need programs.

However, there is a general perception that, all else equal, most people would rather be at a hospital with more capabilities than less. Since I am interested in choices, not outcomes, this may still be a variable of interest to us.

4.2.1 Results

Results for the two categorical indicators of quality are shown in Table 4.2. They present a quite consistent picture. Let's look first at the demographic outcomes. Older individuals and poorer individuals are less likely to go to a higher quality hospital – this is net of the availability of these hospitals in a given county. Unexpectedly, whites are also less likely to go to a higher quality hospital. There is no gender difference in likelihood of going to a high-quality hospital. Those who are widowed at baseline have a 10% lower odds of going to a high-quality hospital; this effect does not vary by gender. The magnitudes are such that a married man on Medicaid and a widowed man who does not quality for Medicaid are about equally likely to go to a teaching hospital. These results were replicated within the subset of patients suffering from cancer to confirm that variation in the urgency of the primary diagnosis was not being masked; similar results were found.

A similar picture emerges from looking at Table 4.3. Again, older, poorer, sicker (more comorbidities) and (in this case) female probands go to hospitals with less technology. Again whites go to lower "quality" hospitals than nonwhites. More urgent diagnoses tend to go to lower technology hospitals. Probands who are widowed at baseline go to hospitals with less technology; this effect is substantially

more pronounced in men than in woman. However, the overall effect is substantially smaller than the Medicaid effect – in contrast to the results for the categorical indicator. This *suggests* that the effects of marital status are less pronounced here, although comparison of the magnitudes across regressions can be no more than impressionistic.

In sum, then, the married appear to consistently choose higher quality hospitals. Relative to otherwise similar individuals within the same county, the married are more likely to use teaching hospitals, U.S. News & World Report "Best" hospitals, and higher technology hospitals. This is consistent with a perspective in which an important role for the spouse is in providing better information, Moreover, recall that these effects occur *before* the probands have a diagnosis – that is, they represent where people who are feeling seriously ill go for help, rather than where people are referred after diagnosis. This suggests that the married may have a better overall "algorithm" for how to seek care.

4.3 Care at Index Hospital

Once a hospital has been chosen, does marital status influence the experience of care at that hospital? This could occur in two distinct ways. First of all, the widowed may be more complicated to care for in some way – that is, marital status may function as a risk for increased difficulty, as demographics or comorbidity burden are assumed to be. Second, the married and the widowed might receive different kinds of care as a result of their status differences. As recently as the middle

of this century, the medical community explicitly considered the married to be more deserving of cutting-edge treatments than the unmarried; this was shown most starkly in the criteria for organ transplantation.(Fox and Swazey 1978) Substantial differences in treatment patterns are known to persist in a scattered collection of practices. (Bernabei et al. 1998; Christakis and Iwashyna 1998; Freedman 1996; Freedman et al. 1994; Goodwin et al. 1987; Kang and Bloom 1993; Kuykendall et al. 1995; Lannin et al. 1998; Mark and Paramore 1996; Suarez et al. 1994) Moreover, similar patterns of nonequivalent treatment, apparently inexplicable in strictly clinical terms, have been documented for a number of other important social characteristics. (for just a sample, see (Canto et al. 2000; Epstein et al. 2000; Escarce et al. 1993; Gatsonis et al. 1995; McWhorter and Mayer 1987; Michalski and Nattinger 1997; Morrison et al. 2000; Samet et al. 1987; Schulman et al. 1999).)

In order to examine these possibilities, I will look at three attributes of the initial hospitalization. First, I will look at length of stay. As all hospital stays were purchased on a per-visit basis by HCFA during the period under study, hospitals have strong incentives to discharge patients as rapidly as possible – costs increase with length of stay, but reimbursement does not. Thus if marital status is associated with increased complexity of care, it should be associated with greater lengths of stay. However, if the widowed, as a lower status group, received lower quality care, their lengths of stay might be inappropriately shortened. I therefore also check two indicators of quality of care. The first asks whether or not the patient is documented to have a complication of care. (I will return to this in more detail below.) The

second looks at whether the patient was readmitted to any hospital within 14 days. Early readmission has been used extensively, particularly in the heart failure literature, as an indicator of inappropriately rapid discharge or substandard care.

It is commonly believed that hospitals vary substantially in the quality of care that they provide to their patients. Moreover, existing institutional measures do not fully capture this quality variation. Again, an HLM model seems appropriate; in this case, I allow the intercept of each hospital to vary randomly. Thus I can look at the effect of marital status on quality of care within a given hospital, without confounding by the impact of marital status on the choice of a hospital. (Practically, this means that the level-2 units for the purposes of this analysis are hospitals. Again, all individual, level-1 variables are entered as group-mean-centered. Only the intercept was treated as random at level-2 for the same reasons as in the case of the analyses on hospital choice. Unit-specific coefficients are reported for categorical outcomes. Unless otherwise noted, the level-2 variance component on the intercept was highly significantly different from zero; its magnitude has no meaningful interpretation for categorical outcome regressions.)

In summary, then, if the married possess a privileged status, they should appear to get better care at a hospital, with reduced complications and readmission rates. If, instead, the married are simply making better choices – rather than the unmarried being discriminated against in some sense – than married should *not* have lower readmission or complication rates, as those rates are largely not influenced by

patient behavior. If the married are healthier than the widowed, they should have shorter lengths of stay but similar readmission and complications rates.

4.3.1 Results

The results for length of stay are presented in Table 4.4. Because of the highly skewed distribution of length of stay, I have modeled the natural logarithm of length of stay. This means that coefficients represent proportional increases in the length of stay.[2] Thus older, female, non-white and poor individuals have longer lengths of stay. Patients with myocardial infarction and urinary tract cancers have the shortest lengths of stay. Women who are widowed at diagnosis have longer lengths of stay – equivalent to being three years older. Men who are widowed at diagnosis have substantially longer lengths of stay – their increase is three times greater than widowed women (0.009 + 0.018 = 0.027 vs. 0.009). For men who have lost a spouse, they have the same increase in their length of stay that is associated with having a Charlson score of about 2 – that is, equivalent to moderate to severe diabetes. These findings suggest that the married are healthier than the widowed; they do not have

[2] I am not substantively interested in the absolute magnitudes of the effects here. However, the reader may recall that a coefficient of 1 in a linear regression predicting a ln-transformed variable is associated with an increase of the length of stay by a factor of e (approximately 2.7). It may be easier to think of coefficients in terms of their impact on doubling the length of stay – this is done by dividing the coefficient by the natural logarithm of 2. Thus a coefficient of 0.69 in Table 4.4 is associated with a doubling of the length of stay. Retransformation to units of absolute numbers of days is fraught with methodological difficulties. See Manning, Willard G. 1998. "The Logged Dependent Variable, Heteroscedasticity, and the Retransformation Problem." *Journal of Health Economics* 17:283-295.

direct implications for whether the married or the unmarried are receiving preferentially better care.

Although there has been an enormous amount of attention to the study of adverse events, their measurement remains elusive. (Kohn, Corrigan and Donaldson 2000) Adverse events are generally defined as some negative outcome of care – usually with a focus on an *avoidable* negative outcome of care. The hope is that the study of adverse events will lead to indicators of poor quality care. Chart-review is often considered the gold-standard data source, but rates obtained can vary substantially. (Brennan et al. 1991; Leape et al. 1991) Similarly, ethnographic observers have been placed *in situ* to record what the medical staff treat as an adverse event. (Andrews et al. 1997) A number of efforts based on the medical claims have been published. Of the two most sophisticated such efforts – which attempted to use the diagnostic context to differentiate complications from preexisting conditions (Brailer et al. 1996; Iezzoni et al. 1994; Iezzoni et al. 1992) – one failed to withstand a detailed chart review-based validation, and the other appears to be proprietary. (Geraci 2000; Lawthers et al. 2000; McCarthy et al. 2000; Weingart et al. 2000) Where does this leave the investigator who wants to examine the quality of care received in the claims? Two options remain: looking at explicitly coded complications of care, and looking at readmission rates. I examine each in turn.

There are two commonly accepted lists of explicitly coded complications in the Medicare claims; those of DesHairnes *et al*., and those used by the CDC.[3] (DesHarnais et al. 1990) For the purposes of the analyses here, I combine them for a maximally sensitive list. These represent well-described, severe complications of procedures. As such, a patient who does not have a procedure performed cannot suffer the complications. Since I cannot reliably observe procedure rates in the Medicare claims, I am left with an aggregate measure of the effect of a characteristic on the tendency to receive a procedure multiplied by their rate of complication given the procedure. Prior studies do not exist to allow us to say whether variation in observed complication rates are typically dominated by one or the other part of that equation. Moreover, these complications must be self-reported by the attending physicians in the claims; if marital status is associated with differences in perceived litiginousness, this might lead to purely artifactual differences in rates. Given all of these warnings, in Table 4.5, I present the HLM regression looking at the impact of marital status on suffering from a coded complication as defined by either Des Hairnes or the CDC. I see that the married at diagnosis are modestly more likely to suffer from any complication. Similar results are obtained when looking either the Des Hairnes or the CDC list of complications separately. That is, there is no evidence that the married are receiving preferential or "better" care *net of their choice of what hospital to go to*.

[3] The CDC method relies on the "E codes": E870-E879, E930.0-E949.9.

Rather than looking at rates of complications self-reported on the claims by physicians, one other commonly accepted measure of quality is available. Early readmission rates have a certain straightforward appeal as an indicator of appropriateness of care. If a patient is given good care, he or she should not need to return to the hospital within 2 weeks of discharge. (Chin and Goldman 1997; Krumholz et al. 1997; Wray et al. 1997) It is generally argued that early readmission rates are primarily an indicator of the quality of care received at the hospital, rather than an indicator of the quality of the immediate post-hospitalization care. That is, they are argued to be, in general, *not* sensitive to the quality of home care. This measure has been used repeatedly in the literature, particularly with respect to congestive heart failure admissions. If the married receive better care than the widowed, we would expect the married to have lower rates of early readmission.

As shown in Table 4.1, the overall rate of 14 day readmission among these quite sick patients is 20.4%. This is somewhat lower than the 22% 30-day readmission rate reported at the Brigham and Women's Hospital for C.H.F. patients at the same time period, but of the same general magnitude. As shown in Table 4.6, men are more likely to be readmitted, as are individuals with more comorbidity. However, the estimated effects of marital status at diagnosis on readmission rates are trivial and statistically insignificant. It was possible that the processes leading to longer stays for the widowed might be masking a tendency to have increased readmission at any given length of stay; analyses that stratified on length of stay showed similar null results. Likewise, analyses within those patients who had C.H.F.

failed to find a substantial marital status effect. (With the exception that there is a modest, and barely statistically significant, increased rates of readmission among widowed men with C.H.F.) Again, there is no evidence that the married are receiving preferentially better care *net of their hospital choice*.

4.4 Limitations

The results presented in this chapter are subject to a number of limitations that bear explicit discussion. First relates to the possible confounding of wealth and marital status. In the Chapter 2, I argued the unmeasured wealth differences would tend to exaggerate any mortality differences between the married and the widowed; as the differences found were quite small, the bias from inadequate measurement of wealth was unlikely to be substantively important. In the current case, I find large and substantively interesting differences in the choices made between the married and the widowed. May it be that the married are simply wealthier than the widowed, and that drives these apparent effects? In order to begin to assess this, I looked at the effect of marital status on choosing a teaching hospital without controlling for Medicaid status or ZIP-code median income. I find that the marital status coefficient changes from -0.102 to -0.108, or 6%. This suggests that either the effects of marital status and the effects of wealth are largely independent (as the coefficient is insensitive to intentionally magnified misspecification), or that Medicaid-receipt and ZIP-code median income are quite poor proxies for the truly relevant financial status variable. While I can bring no novel data to bear, I favor the former interpretation.

Second, it is worth noting that the outcome variables presented here are not independent. While the similarity of findings across outcomes is reassuring, it does not provide us with the protection of fully independent measures – for example, nearly all of the top hospitals as recorded in the U.S. News & World Report study are teaching hospitals. Shared biases may be present throughout.

Finally, there are the usual sorts of limitations of any empirical work. I have had to make a methodological approximation in order to define the choice set each patient faces. I lack a number of sociodemographic variables of considerable interest, such as education and kin availability. Only interactions of substantive interest for the current project were checked; others might exist.

4.5 Discussion

This chapter builds on the preceding chapters in two distinct ways. First of all, it allows a test of one of the hypotheses that still had support – that spouses act by providing information. Second, it explores a different set of intermediate and outcome variables that may be of interest.

From a theoretical perspective, I have found evidence quite consistent with a role for spouses in the provision of higher quality information to their sick partners. Throughout, I found that there were effects on the quality of care chosen, whenever a choice could be made. At the same time, for those dimensions not amenable to choice – e.g. complication rates and readmission rates – there seemed to be much less of an effect of marital status. Interpreting this relationship between marital status and

the postulated intervening variable is subject to all the limitations discussed previously, but it is intriguing nonetheless.

This finding warrants two additional comments. First, if the associations with marital status were confounded by some other variable, then we *might* not find that things aligned as well with our sense of where choice could be occurring. This provides encouragement – but not proof – that our results are not confounded. Second, I find no evidence to suggest that marital status was associated with differences in quality of care. Indeed, to the degree that marital status may be associated with unmeasured health status, this suggests that the deficits of widows may be being compensated for by the health care system. This stands in contrast to the evidence of a half-century ago that suggested that widowed may have been less valued. In a health care system fraught with persistent racial differentials, this finding is encouraging.

More generally this chapter allows us to bring some data to bear on a perspective otherwise unrepresented within this dissertation. It has been argued by others that marital status is an important status variable – this undergirded the earlier discussion of the possibility of discrimination against the unmarried. The argument would run something like as follows. The married have a higher status in society, for whatever reasons. (Functionalist and/or patriarchy-based arguments can be made.) As such, one of the reasons the married may experience better outcomes is the result

of pervasive, low-level better treatment.[4] Whether this acts through reduced stress, improved material conditions, or some combination, the married are subtly advantaged. While I cannot address whether or not this is true relative to the never married, among the widowed (who, granted, may be the highest prestige of the unmarried), I was unable to find any evidence of discriminatory treatment.

From a health services research perspective, I found that there are substantial impacts of marital status on hospital choice. While the normative implications of this – particularly given the quality-of-care findings – are unclear at best, it may have certain implications for the those interested in the health of academic medical centers. Consider two facts. First, academic medical centers have excess capacity – nearly none are queuing customers. Second, the fraction of the elderly that are married is falling and will continue to fall for the foreseeable future. Currently, it appears that academic medical centers and other higher quality institutions are failing to market themselves as adequately to the less informed consumer. If this interpretation is correct, this means that the demand for AMCs may fall even beyond the fall induced by managed care penetration and increasing cost pressures. This chapter has not presented modeling of the appropriate form to allow predictions as to how large this decrement in demand could be absent compensating activities by AMCs. However, the apparent magnitude suggests that additional modeling may be valuable.

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[4] For those so-inclined, this can be thought of as the married facing lower shadow costs to the inputs for health capital production.

The impact of marital status on length of stay is also of some interest. The effects were reasonably large – of the same magnitude as the effects of comorbidities that are routinely adjusted for, and more than half as large as the effects of race and sex for which comparisons and compensation are always adjusted. Given the central role of prospective payment in the funding of hospitals – and increasingly other modes of health care – it is worth considering whether marital status should qualify for consideration as a risk adjuster. There are many possible criteria for assessing the appropriateness of variables on which to risk adjust, (Iezzoni 1997) but the following seem minimal:

1. EXOGENEITY: the proposed variable must be independent of the actions of the hospital, and not readily changed by the hospital;
2. COLLECTIBILTY: the proposed information must be easily assessed, so as not to increase the costs of care;
3. VERIFIABILITY: the proposed information must be readily verifiable by outside auditors, to limit the possibility of fraud; and,
4. EMPIRICAL IMPORT: the proposed variable must explain "administratively significant" amounts of variation in cost and outcomes.

The three canonical demographic features of age, race, and gender meet all four criteria. The baseline health of the patient, generally conceptualized as the patient's comorbidity, also meets the criteria; however, the somewhat decreased verifiability of this information may account for the substantially greater debate as to how comorbidity information ought to be used. (Green et al. 1990; Greenfield et al. 1993;

Hsia et al. 1992; Pope et al. 1998) Marital status clearly meets the first three criteria: hospitals cannot easily affect or misrepresent the marital status of their patients, and the data is trivially easy to collect. Many hospitals already collect this information for internal use. What is needed is an examination of (1) whether hospitals vary substantially in the marital status composition of their patient-base; (2) whether the effects of marriage persist in less serious hospitalization; (3) whether the rankings of hospitals for some outcomes of interest (including compensation) might change if marital status were included in the risk adjustment program.

Thus, the married use "better" health care than the unmarried. This appears to be the result of better choices by the married, as opposed to differential treatment by institutions. This is quite consistent with the work in the previous chapter arguing that an important benefit of marriage is the extra information that a spouse is able to acquire. Moreover, it suggests an important role for the spouse in the upper-level management and direction of an individuals care. By revisiting some results from the beginning of the dissertation, my final chapter will elaborate an argument that making better choices about service providers is an almost paradigmatic example of what it is that spouses may do for each other.

Table 4.1: Characteristics of Cohort for Hospital Choice Analyses

n	455,594
Age	80.3
Male	33.6%
White	89.9%
Medicaid Recipient	13.6%
ZIP-code Median Income ($1000)	29.9
Primary Diagnosis:	
Heart Attack	17.4%
C.H.F.	21.4%
Hip Fracture	19.3%
Colon Cancer	6.3%
Lung Cancer	5.6%
Stroke	20.4%
Urinary Tract Cancer	2.8%
Bad Cancer	7.0%
Charlson Score (3-year Mean)	1.00
Widowed at Diagnosis	65.7%
Initial Hospital Characteristics:	
Teaching Hospital	11.2%
U.S. News & World Report Ranked	6.5%
Technology Index	7.17
Length of Stay (days)	7.4
Died During Initial Hospitalization	10.2%
Early Readmission (if survived initial admission)	20.4%
Complications: DesHairnes Definition	7.7%
Complications: CDC Definition	1.9%

Table 4.2: Impact of Marital Status on Likelihood of Choosing A Teaching Hospital or a U.S. News-Ranked Hospital

	Teaching Hospital			US News & World Report		
	Coefficient	Odds Ratio	p-value	Coefficient	Odds Ratio	p-value
Intercept	-3.572		0.000	-4.080		0.000
Age	-0.017	0.983	0.000	-0.020	0.980	0.000
Male	0.028	1.029	0.141	0.050	1.051	0.033
White	-0.413	0.662	0.000	-0.384	0.681	0.000
Medicaid	-0.119	0.887	0.000	-0.244	0.784	0.000
Median Income of ZIP ($1K)	-0.001	0.999	0.230	0.008	1.008	0.000
Widowed at Diagnosis	-0.102	0.903	0.000	-0.150	0.860	0.000
Widowed at Diagnosis * Male	0.011	1.011	0.675	0.012	1.012	0.701
M.I.		1.000	<ref.>		1.000	<ref.>
C.H.F.	-0.020	0.980	0.256	0.017	1.017	0.459
Hip Fracture	-0.033	0.968	0.082	0.006	1.006	0.814
Stroke	-0.168	0.845	0.000	-0.143	0.867	0.000
Bad Cancer	0.552	1.736	0.000	0.809	2.246	0.000
Colon Cancer	0.144	1.155	0.000	0.300	1.350	0.000
Lung Cancer	0.253	1.287	0.000	0.405	1.500	0.000
Urinary Tract Cancer	0.319	1.376	0.000	0.542	1.719	0.000
Charlson Score	-0.007	0.993	0.041	0.000	1.000	0.952

Unit-specific models with all variables group-mean centered and only intercept with level-2 random effect

Table 4.3: Impact of Marital Status on Technology-Level of Hospital Chosen

	Technology Index	
	Coefficient	p-value
Intercept	5.971	0.000
Age	-0.027	0.000
Male	0.104	0.000
White	-0.204	0.001
Medicaid	-0.410	0.000
Median Income of ZIP ($1K)	0.010	0.001
Widowed at Diagnosis	-0.062	0.002
Widowed at Diagnosis * Male	-0.097	0.000
Heart Attack	1.000	<ref>
C.H.F.	-0.159	0.000
Hip Fracture	0.253	0.000
Stroke	-0.225	0.000
Bad Cancer	0.716	0.000
Colon Cancer	0.242	0.000
Lung Cancer	0.504	0.000
Urinary Tract Cancer	0.615	0.000
Charlson Score	-0.012	0.001

Note that this outcome variable is continuous
Level-1 Variance component: 11.78
Level-2 Variance component: 4.56

Table 4.4: Impact of Marital Status on Length of Stay

	Length of Stay (**natural log**)	
	Coefficient	p-value
Intercept	1.997	0.000
Age	0.003	0.000
Male	-0.036	0.000
White	-0.037	0.000
Medicaid	0.045	0.000
Median Income of ZIP ($1K)	-0.001	0.000
Widowed at Diagnosis	0.009	0.003
Widowed at Diagnosis * Male	0.018	0.000
Heart Attack	0.000	<ref.>
C.H.F.	0.125	0.000
Hip Fracture	0.291	0.000
Stroke	0.099	0.000
Bad Cancer	0.188	0.000
Colon Cancer	0.472	0.000
Lung Cancer	0.197	0.000
Urinary Tract Cancer	-0.078	0.000
Charlson Score	0.014	0.000

Note that this outcome variable is continuous.
Level-1 Variance component: 0.393
Level-2 Variance component: 0.050

Table 4.5: Impact of Marital Status on Suffering a Complication

	Any Complications		
	Coefficient	Odds Ratio	p-value
Intercept	-2.575		0.000
Age	-0.005	0.995	0.000
Male	0.124	1.132	0.000
White	0.113	1.120	0.000
Medicaid	0.050	1.051	0.004
Median Income of ZIP ($1K)	0.001	1.001	0.367
Widowed at Diagnosis	-0.092	0.912	0.000
Widowed at Diagnosis * Male	0.034	1.034	0.178
Heart Attack		1.000	<ref>
C.H.F.	0.322	1.380	0.000
Hip Fracture	0.869	2.385	0.000
Stroke	1.344	3.835	0.000
Bad Cancer	0.728	2.072	0.000
Colon Cancer	-0.278	0.757	0.000
Lung Cancer	0.768	2.155	0.000
Urinary Tract Cancer	0.480	1.615	0.000
Charlson Score	-0.025	0.976	0.000

Unit-specific models with all variables group-mean centered
and only intercept with level-2 random effect

Table 4.6: Impact of Marital Status on Early Readmission Rates

	Early Readmission Rate		
	Coefficient	Odds Ratio	p-value
Intercept	-1.281		0.000
Age	-0.027	0.974	0.000
Male	0.112	1.118	0.000
White	0.024	1.025	0.108
Medicaid	-0.167	0.846	0.000
Median Income of ZIP ($1K)	-0.002	0.998	0.001
Widowed at Diagnosis	0.001	1.001	0.968
Widowed at Diagnosis * Male	0.002	1.002	0.938
Heart Attack		1.000	<ref.>
C.H.F.	-0.781	0.458	0.000
Hip Fracture	-0.219	0.803	0.000
Stroke	-0.315	0.729	0.000
Bad Cancer	-0.662	0.516	0.000
Colon Cancer	-1.110	0.330	0.000
Lung Cancer	-0.770	0.463	0.000
Urinary Tract Cancer	-1.192	0.304	0.000
Charlson Score	0.009	1.010	0.000

Unit-specific models with all variables group-mean centered
and only intercept with level-2 random effect