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Supplement Article

Revisiting the Role of Gender and Marital Status as Risk Factors for Nursing Home Entry

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Abstract

Objective: To study the role of gender and marital status as risk factors for nursing home entry in the United States.
Method: The paper uses data from the Health and Retirement Study, a nationally representative survey of the older population in the United States. Multivariate logit models of the risk of nursing home entry over a 2-year follow-up period were estimated for noninstitutionalized individuals over the age of 65. A multiple imputation procedure was used to explore the sensitivity of the results to alternative assumptions about the data-generating process of missing outcome values.
Results: In an analysis based on complete observations, women exhibited the same risk of nursing home entry as men (risk ratio [RR] = 1.01; CI: 0.90, 1.13). However, after expanding the sample to include information on nursing home use for individuals who died during the follow-up period, women were found to have a statistically lower risk of nursing home entry (RR = 0.85; CI: 0.79, 0.92). The latter result was robust to alternative assumptions about the nature of missing data. The type of sample used in the analysis did not affect the conclusions regarding the role of marital status. Divorced and widowed individuals were found to be at higher risk of nursing home admissions than married individuals in all specifications.
Discussion: The findings clarify the role of gender as a predictor of nursing home admissions and may provide useful prognostic information for clinicians and caregivers regarding nursing home entry risk. The study also sheds light on how conclusions about predictors of nursing home risk obtained from prospective studies with long follow-up periods can be affected by the treatment of missing outcomes due to death or attritions.

Keywords: Gender, Living arrangements, Long-term care, Nursing home entry

Background

With the long-term care needs of older adults expected to increase in the coming decades (Redfoot et al., 2013; Saucier et al., 2012), there is growing interest in understanding the predictors of nursing home entry among older adults. Identifying risk factors for nursing home admission can not only help forecast future private and public costs associated with long-term care provision but also guide the targeting of home- and community-based services that allow individuals to delay or forgo institutionalization.

Of the multiple demographic factors that might affect nursing home use, gender and marital status are likely to be among the most important. To the extent that there is some degree of substitutability between formal and informal care, the presence of a spouse is likely to protect individuals from institutionalization. Because women are typically younger than their husbands and have longer life expectancies, they are more likely to become widows. Because they are also more likely to never marry and less likely to remarry after a divorce, women are more likely to live without a spouse in old age. Gender may also affect

institutionalization independently of marital status if men and women have different preferences for different forms of long-term care provision, if one gender is more likely than the other to receive informal support from children, or if social norms make one gender more likely to become the primary carer of their spouse.

There is ample evidence that the presence of a spouse reduces the risk of nursing home use (Gaugler et al., 2007; Jette et al., 1995; Pearlman & Crown, 1992; Wachterman & Sommers, 2006). However, previous research has provided conflicting evidence on the role of gender. While the unadjusted risk of entering a nursing home is higher for women than men, the extent to which this gender disparity is mediated by other factors, including marital status, is unclear. Miller and Weissert's (2000) review of multivariate, prospective analyses of predictors of long-term care outcomes found two studies where being a female was associated with a higher risk of institutionalization, five studies where it was associated with a lower risk, and 40 studies where the association was not significant. Gaugler and colleagues' (2007) meta-analysis of predictors of nursing home admission found that being a female was not a significant predictor of nursing home entry—although it was associated with a longer time to nursing home admission.

To a large extent, heterogeneous estimates of the role of gender as a predictor of nursing home entry are likely explained by differences in study designs, the representativeness of the samples used in the analyses, or the period during which the data were collected. However, even longitudinal studies performed on nationally representative surveys of the older U.S. population have yielded contradictory results. For example, using data from the Assets and Health Dynamics of the Elderly data set, Kasper and colleagues (2010) find that women are at higher risk of institutionalization than men after adjusting for other factors, while Banaszak-Holl and colleagues (2004) find that they are at lower risk, and Himes and colleagues (2000) find that they are either at lower risk or that the risk is statistically the same, depending on how nursing home status is defined. In the National Long-Term Care Survey, Hanley and colleagues (1990) find that women are at a relatively lower risk of nursing home admission than men. In the Longitudinal Study of Aging, Kersting (2001) finds that women are less likely than men to utilize a nursing home after adjusting for other factors, while Steinbach (1992) and Coward and colleagues (1996) find that gender does not play a significant role in explaining institutionalization. One possible explanation for the conflicting findings regarding the role of gender as a risk factor for nursing home admission in studies of the same population using similar statistical models are differences in the way in which nursing home transitions are identified in the data.

This paper revisits the role of gender and marital status as predictors of nursing home transitions using the Health and Retirement Study (HRS), a biennial, nationally representative survey of the U.S. population over age 50. The paper illustrates how conclusions about the role of gender, in particular, depend on the mechanism used to deal with observations for which nursing home status at the end of the follow-up period is missing due to death or attrition from the sample. Specifically, the paper highlights the importance of using data from exit interviews to capture the large fraction of nursing home stays that take place in the last weeks of life.

The goal of the paper was to determine whether marital status and gender have independent effects on the risk of nursing home entry so as to improve existing prediction models of institutionalization risk. The information obtained from such models can help clinicians target interventions intended to delay nursing home admissions, allowing individuals to "age in place" for as long as feasible. The paper also aims to shed light on how conclusions obtained from prospective studies can be affected by the treatment of missing outcome variables. In particular, given that surveys modeled on the HRS (the so-called International Sister Studies) are currently available in many countries, this study illustrates how analyses of end-of-life outcomes, based on those surveys, can deal with the ubiquitous problem of missing data.

Data and Methods

Source of Data

The HRS is a biennial, longitudinal household survey that was started in 1992 and became representative of the U.S. population aged 50 and older in 1998 (Barczyk & Kredler, 2019; HRS, 2020). The variables used in the empirical analysis are drawn from the RAND HRS Longitudinal File 1992–2016 v1 (Bugliari et al., 2019), when possible, and the RAND HRS Fat Files (RAND HRS, 2020). When a survey respondent is identified as deceased, an attempt is made to obtain an exit interview with next-of-kin to collect information on the respondent's last year of life. Variables from exit interviews are taken from the Harmonized HRS End of Life (Ailshire et al., 2019).

The empirical sample includes all noninstitutionalized respondents above age 65 from Waves 6 to 12, spanning the years 2002–2014. Wave 13 information is used to determine nursing home transitions for Wave 12 respondents. There are initially 69,675 person-wave observations (repeated observations for the same individual are included in the sample if they fulfill the eligibility criteria in multiple waves). Of those, 95 (0.14%) observations that were missing baseline demographic variables or information on functional limitations are excluded, yielding a sample of 69,580 person-wave observations. Of these, 57% are from females (39,899 person-wave observations from 9,819 individuals) and 43% from males (29,681 person-wave observations from 7,528 individuals).

Outcome Variable

Nursing home status at the end of the follow-up period is coded as 1 for individuals who entered a nursing home over a one wave (2-year) interval and as 0 for those who did not. In Model 1, an individual was determined to have transitioned into a nursing home between t and $t + 1$ if they reported living in "a nursing home or other health facility that provides all of the following services for its residents: dispensing of medication, 24-hour nursing assistance and supervision, personal assistance, and room & meals" at the time of the $t + 1$ interview. The estimation sample used in Model 1 consisted only of complete cases for which a $t + 1$ interview was available. Hence, it excluded individuals who died before the end of the follow-up period as well as those who were nonrespondents in wave $t + 1$.

Model 2 was estimated on a larger sample that also included observations from individuals who died during the follow-up period and whose exit interview provided information on whether they were living in a nursing home or other long-term health care facility (excluding hospices) at the time of death. This variable was preferred to an alternative one recording the individual's place of death to avoid misclassifying nursing home residents who transited to a hospital or hospice in the last days of life.

Of the 59,580 observations in the empirical sample, 3,113 (4.47%) were nonrespondents in wave $t + 1$. Moreover, nursing home status at the time of death could not be established for 219 individuals who died within waves, yielding a total of 3,332 observations for which the value of the outcome variable was missing. Models 3–5 were estimated using a sample that included those missing observations. For 706 of them, nursing home status in $t + 1$ was recovered from retrospective information provided in wave $t + 2$. For the remaining 2,626, the value of the outcome variable was imputed under different assumptions about the data-generating process for nursing home admission, discussed below.

To avoid capturing postacute hospitalizations in skilled facilities, nursing home stays that started and ended before the end of the 2-year follow-up period were not considered. However, all results were robust to coding nursing home status in $t + 1$ as 1 for individuals who spent more than 30 days in a nursing home during the follow-up period, as well as coding nursing home status as 0 for individuals who had been living in a nursing home for less than 30 days by the time of the $t + 1$ interview. Details on these robustness checks are provided in Supplementary Appendix 2.

Control Variables

All control variables were measured at baseline (i.e., wave t). Gender was assessed with a binary indicator equal to one if the individual self-reported being a female. Marital status was measured with four mutually exclusive binary indicators capturing whether the individual was married, separated or divorced, widowed, or never married.

Variables that have been shown to predict nursing home transitions in previous studies—namely demographic characteristics, measures of socioeconomic status, functional dependence, and measures of caregiver availability—were used as additional controls. Specifically, binary indicators were created to control for age (whether the individual was aged 66–70, 71–75, 76–80, 81–85, 86–90, or >90); race/ethnicity (whether the individual was non-Hispanic White, Black, Hispanic, or other); education (whether the individual's highest qualification was below high school, high school, some college, or a college degree); functional limitations (six indicators for whether the individual had from no activities of daily living [ADL] to five ADL limitations from a list including bathing, dressing, eating, getting out of bed, and getting across a room; and six indicators capturing whether the individual had from no instrumental activities of daily living [IADL] to five IADL limitations from a list including using the phone, managing money, taking medications, shopping for groceries, and preparing hot meals); financial resources (whether the individual belonged to each of the five quintiles of the household wealth distribution for individuals aged 66 and over and whether the individual owned a home); and availability of potential caregivers (proxied by whether the individual had none, one, two, or three or more living children. An additional indicator was created to record instances where the number of living children was missing).

Statistical Methods

The analysis was performed using Stata v. 14.2. Descriptive statistics portray characteristics measured on wave t for different subsamples defined according to nursing home, death, and interview response status on wave $t + 1$. Comparisons between subsamples were performed with Bonferroni multiple comparison tests (Miller, 1981) obtained using Stata's "oneway" command.

Multivariate logistic regressions were estimated for the outcome variable. Because some of the individuals in the sample are married to each other, standard errors were clustered at the household level. All regressions included a full set of HRS-wave indicators as controls.

Three sets of risk ratios are reported for each model. First, unadjusted risk ratios were obtained for female versus male—from a logit regression that controlled only for gender—and for the different marital status categories relative to married—from a logit regression that used only the marital status indicators as controls. Second, gender- and marital status-adjusted risk ratios were obtained from regressions that controlled jointly for the two demographic factors. Finally, fully adjusted risk ratios were computed using the full set of controls. Adjusted risk ratios

were obtained with Stata's user-written "adjrr" command (Norton et al., 2013).

Three sensitivity analyses were conducted to evaluate the extent to which results are sensitive to assumptions about the demographic characteristics of nursing home entrants in the sample of nonrespondents. In Models 3 and 4, missing outcomes were replaced using a multiple imputation procedure using Stata's "MI" suite (StataCorp, L.P., 2013). A total of 250 imputed data sets were created, in which the missing outcomes were replaced with random values from statistical models based on different assumptions on the nature of the missing data (discussed in the Supplementary Appendix). In Model 5, missing outcomes were replaced randomly in 1,000 bootstrapped samples assuming that all nursing home entrants in the sample of nonrespondents were women. Bootstrapped confidence intervals are reported for the adjusted risk ratios in this analysis. Details about the sensitivity analyses performed in Models 3–5 are provided in Supplementary Appendix.

Results

Descriptive Analysis

Table 1 shows baseline (i.e., wave t) summary statistics for $t + 1$ respondents not living in a nursing home at the time of the $t + 1$ interview (column (1)), $t + 1$ respondents living in a nursing home at the time of the $t + 1$ interview (column (2)), respondents who die before the $t + 1$ interview (column (3)), and $t + 1$ nonrespondents (column (4)). Bonferroni multiple comparison tests were used to test for differences in means relative to column (1).

Two years after the baseline interview, 84.7% of individuals not institutionalized in wave t were not living in a nursing home; 2.2% were living in a nursing home; 8.7% had died, and the remaining 4.5% were nonrespondents.

Individuals living in a nursing home were more likely to be female (diff. = 11.23 percentage points [p.p.], p-value = .000) than those not in a nursing home, whereas individuals who died between waves were less likely to be female (diff. = −7.19 p.p., p-value = .000). Both groups were less likely to be married (diff. = −28.20 p.p., p-value = .000 and −13.21 p.p., p-value = .000, respectively) and more likely to be widowed (27.42 p.p., p-value = .000 and 13.56 p.p., p-value = .000, respectively). There were no statistically significant differences in gender or marital status between $t + 1$ nonrespondents and individuals not in a nursing home.

In terms of other controls that have been found to be predictors of nursing home status, individuals living in a nursing home in $t + 1$ and those who died between waves were older than those not in a nursing home. They also had a higher number of functional limitations, both in terms of the number of ADLs and IADLs, a lower socioeconomic status, indicated by lower educational attainment, household wealth, and likelihood of owning a home, and fewer children. Both groups were more likely to be non-Hispanic White and less likely to be Hispanic, although the difference was only statistically significant for individuals who died within waves.

Nonrespondents in wave $t + 1$ were older than those not in a nursing home, less likely to be non-Hispanic White, and more likely to be Hispanic or from other race. They had lower educational attainment, more functional limitations, were less likely to own a home, and had fewer children. Although the differences in terms of these observable characteristics were statistically significant, the magnitude was lower than for the other two groups, indicating that nonrespondents were more similar to those not in a nursing home than either nursing home residents of those who died within waves.

Table 2 summarizes baseline (i.e., wave t) characteristics of individuals who died between waves by nursing home status at the time of death. The risk of nursing home entry was substantially higher in this sample (24.18%) than among individuals who did not die within waves (shown in Table 1). Information about living location at the time of death was missing for the 3.61% of individuals for whom an exit interview was not available. Compared to individuals not living in a nursing home at the time of death, those living in a nursing home were more likely to be female (diff. = 4.20 p.p., p-value = .042), less likely to be married (diff. = −8.13 p.p., p-value = .000) and more likely to be widowed (diff. = 7.16 p.p., p-value = .000). These differences have the same sign as those obtained when comparing columns (1) and (2) in Table 1, but their magnitude is smaller. That is, men and married individuals are relatively over-represented among nursing home entrants in the sample of deceased respondents. This is consistent with Kelly and colleagues' (2010) finding that the length of the final nursing home stay before death tends to be shorter, and therefore more likely to end in death before the end of the follow-up period, for men (median 3 months) than for women (median 8 months) and for married than for unmarried individuals (median difference of 4 months).

Table 3 shows baseline characteristics of individuals who do not respond to the survey in wave $t + 1$. For 733 (24%) nonrespondents, nursing home status by the time of the wave $t + 1$ interview was recovered from retrospective information provided in wave $t + 2$. Of those, 27 (3.68%) were living in a nursing home in $t + 1$, while the remaining 706 (96.32%) were not in a nursing home. Compared to individuals not in a nursing home, those in a nursing home were more likely to be female (diff. = 20.89 p.p., p-value = .094), less likely to be married (diff. = −37.76 p.p., p-value = .000), and more likely to be widowed (diff. = 44.41 p.p., p-value = .000). In this case, the magnitude of the differences was higher than those obtained comparing columns (1) and (2) of

Table 1. Descriptive Statistics by Status in Period $t + 1$ for All Baseline Observations

	Not in NH	Living in NH	Died			Unknown	
	(1)	(2)	(2)–(1)	(3)	(3)–(1)	(4)	(4)–(1)
Female (%)	0.58	0.69	***	0.51	***	0.57	
Marital status (%)							
Married	0.61	0.32	***	0.47	***	0.60	
Divorced	0.09	0.09		0.08		0.09	
Widowed	0.28	0.55	***	0.41	***	0.28	
Never married	0.02	0.03		0.03		0.03	
Age (%)							
66–75	0.59	0.19	***	0.30	***	0.55	***
76–85	0.33	0.42	***	0.40	***	0.35	
86+	0.08	0.39	***	0.30	***	0.10	***
Race							
Non-Hispanic White	0.76	0.83	***	0.77		0.73	***
Black	0.13	0.11		0.14		0.14	
Hispanic	0.08	0.04	***	0.07	*	0.10	**
Other	0.02	0.01		0.02		0.03	***
Education							
Below HS	0.24	0.31	***	0.34	***	0.26	**
High school	0.37	0.38		0.35	***	0.38	
Some college	0.20	0.16	***	0.17	***	0.19	
College	0.19	0.15	***	0.14	***	0.18	
Number of ADLs							
Zero	0.84	0.52	***	0.53	***	0.81	***
One to three	0.15	0.37	***	0.33	***	0.17	***
Four or five	0.02	0.11	***	0.14	***	0.02	
Number of IADLs							
Zero	0.85	0.45	***	0.53	***	0.81	***
One to three	0.13	0.38	***	0.32	***	0.16	***
Four or five	0.02	0.17	***	0.16	***	0.03	***
HH wealth							
Below median	0.46	0.66	***	0.59	***	0.48	
Above median	0.54	0.34	***	0.41	***	0.52	
Owns a home	0.81	0.53	***	0.68	***	0.78	***
Living with children[a]							
None	0.06	0.10	***	0.08	***	0.06	
One or two	0.33	0.39	***	0.34	**	0.35	**
Three or more	0.60	0.50	***	0.56	***	0.57	**
N	58,906	1,499		6,062		3,113	

Notes: ADL = activities of daily living; HS = high school; HH = household wealth; IADL = instrumental activities of daily living; NH = nursing home. *p*-Values shown for Bonferroni multiple comparison tests of equality of means between each outcome and Not in NH. Some variables have been collapsed into a smaller number of categories than that included in the empirical analysis.

[a]Categories for living children do not sum to one because the variable is missing for 1.81% of the sample. A binary indicator for missing # of living children (not shown here) was created to keep those observations in the analysis.

*$p < .01$. **$p < .05$. ***$p < .001$.

Table 1, indicating that women and widows were relatively overrepresented among nursing home entrants in the sample of nonrespondents.

Multivariate Analysis

The first panel of Table 4 (Model 1) shows estimates of relative risk ratios obtained from the sample of complete cases. This sample includes the 60,405 observations for which summary statistics are shown in columns (1) and (2) of Table 1. About 2.95% of females and 1.83% of males in this sample had entered a nursing home by the end of the 2-year follow-up period. Accordingly, the unadjusted relative risk ratio for females, shown in the first column, was 1.61 (CI: 1.44, 1.79). The likelihood of nursing home admission was higher for those without a spouse than married individuals, with relative risk ratios of 1.87 (CI: 1.55, 2.25) for divorced individuals, 3.59 (CI: 3.22, 4.00) for

Table 2. Descriptive Statistics by NH Status at Time of Death for Individuals Who Died Within Waves

	Not in NH	Living in NH		Unknown	
	(1)	(2)	(2)–(1)	(3)	(3)–(1)
Female (%)	0.50	0.54	**	0.44	
Marital status (%)					
Married	0.49	0.41	***	0.47	
Divorced	0.08	0.08		0.08	
Widowed	0.40	0.47	***	0.40	
Never married	0.03	0.04		0.05	
Age (%)					
66–75	0.33	0.20	***	0.37	
76–85	0.41	0.38	*	0.40	
86+	0.26	0.43	***	0.23	
Race					
Non-Hispanic White	0.75	0.82	***	0.74	
Black	0.15	0.13		0.15	
Hispanic	0.08	0.04	***	0.10	
Other	0.02	0.01		0.01	
Education					
Below HS	0.34	0.33		0.30	
High school	0.34	0.36		0.41	
Some college	0.17	0.18		0.17	
College	0.14	0.13		0.11	
Number of ADLs					
Zero	0.55	0.48	***	0.60	
One to three	0.32	0.37	***	0.31	
Four or five	0.14	0.15		0.09	
Number of IADLs					
Zero	0.55	0.44	***	0.65	**
One to three	0.30	0.37	***	0.29	
Four or five	0.15	0.19	***	0.06	***
HH wealth					
Below median	0.59	0.62		0.65	
Above median	0.41	0.38		0.35	
Owns a home	0.70	0.60	***	0.71	
Living children[a]					
None	0.07	0.11	***	0.09	
One or two	0.33	0.38	**	0.35	
Three or more	0.58	0.50	***	0.54	
N	4,430	1,413		219	

Notes: ADL = activities of daily living; HS = high school; HH = household wealth; IADL = instrumental activities of daily living; NH = nursing home. *p*-Values shown for Bonferroni multiple comparison tests of equality of means between each outcome and Not in NH. Some variables have been collapsed into a smaller number of categories than that included in the empirical analysis.

[a]Categories for living children do not sum to one because of missing values. A binary indicator for missing number of living children (not shown here) was created to keep those observations in the analysis.

*$p < .01$. **$p < .05$. ***$p < .001$.

widowed individuals, and 2.32 (CI: 1.70, 3.16) for those never married.

Because gender and marital status are highly correlated—females were less likely than men to be married (diff. = 32 p.p., *p*-value = .000) and more likely to be divorced (diff. = 9 p.p., *p*-value = .000), widowed (diff. = –28 p.p., *p*-value = .000), or never married (diff. = 0.3 p.p., *p*-value = .007) in the baseline sample—risk ratios adjusted jointly for gender and marital status are shown in the middle columns of Table 4. Compared to the previous specification, the relative risk ratios for marital status categories were barely changed. Instead, the relative risk ratio for females decreased significantly in magnitude and was no longer statistically significant (risk ratio [RR] = 1.04, CI: 0.93, 1.17), indicating that marital status mediated most of the gender disparity evident from the unadjusted relative risk ratios.

The last two columns show relative risk ratios adjusted for the full set of control variables. The risk ratio for females

Table 3. Descriptive Statistics by NH Status in $t + 1$ for Wave $t + 1$ Nonrespondents

	Not in NH	Living in NH		Unknown	
	(1)	(2)	(2)–(1)	(3)	(3)–(1)
Female (%)	0.57	0.78	*	0.57	
Marital status (%)					
Married	0.64	0.26	***	0.59	
Divorced	0.08	0.04		0.10	
Widowed	0.26	0.70	***	0.28	
Never married	0.02	0.00		0.03	
Age (%)					
66–75	0.61	0.19	***	0.53	***
76–85	0.31	0.44		0.36	**
86+	0.08	0.37	***	0.11	**
Race					
Non-Hispanic White	0.67	0.89	**	0.74	***
Black	0.18	0.04		0.13	***
Hispanic	0.12	0.04		0.09	**
Other	0.03	0.04		0.03	
Education					
Below HS	0.34	0.37		0.24	***
High school	0.33	0.52		0.39	**
Some college	0.18	0.07		0.19	
College	0.15	0.04		0.19	*
Number of ADLs					
Zero	0.83	0.70		0.80	
One to three	0.15	0.30		0.17	
Four or five	0.02	0.00		0.02	
Number of IADLs					
Zero	0.84	0.56	***	0.81	
One to three	0.14	0.33	**	0.16	
Four or five	0.02	0.11	**	0.03	
HH wealth					
Below median	0.52	0.67		0.46	**
Above median	0.48	0.33		0.54	**
Owns a home	0.76	0.59		0.79	
Living children[a]					
None	0.06	0.19	**	0.06	
One or two	0.32	0.33		0.36	*
Three or more	0.61	0.48		0.57	*
N	705	27		2,381	

Notes: ADL = activities of daily living; HS = high school; HH = household wealth; IADL = instrumental activities of daily living; NH = nursing home. *p*-Values shown for Bonferroni multiple comparison tests of equality of means between each outcome and Not in NH. Some variables have been collapsed into a smaller number of categories than that included in the empirical analysis.

[a]Categories for living children do not sum to one because of missing values. A binary indicator for missing number of living children (not shown here) was created to keep those observations in the analysis.

*$p < .01$. **$p < .05$. ***$p < .001$.

remained statistically insignificant. Those for nonmarried individuals were substantially lowered, but divorced and widowed individuals remained at an elevated risk of nursing home entry within 2 years, relative to their married counterparts (RR = 1.25; CI: 1.04, 1.52 and RR = 1.24; CI: 1.08, 1.41, respectively). The relative risk ratio for never-married individuals was no longer significant in this specification.

The second panel of Table 4 (Model 2) shows results of the analysis performed on the sample that includes both complete cases and individuals who died during the follow-up period. In this sample of 66,248 observations, the overall likelihood of nursing home entry was 4.40%, with 4.73% of women and 3.93% of men entering a nursing home within 2 years. The first two columns show that, as was the case in Model 1, females and nonmarried individuals were at a higher relative risk of nursing home entry during the follow-up period. However, because males and married individuals were relatively overrepresented among nursing

Table 4. Adjusted Relative Risk Ratios of Nursing Home Admission From Logistic Regressions

	Unadjusted		Gender and marital status adjusted		Adjusted for full set of controls	
	RR	(95% CI)	ARR	(95% CI)	ARR	(95% CI)
Model 1: Wave *t* + 1 respondents (*N* = 60,405)						
Male	Ref.		Ref.		Ref.	
Female	1.61	(1.44, 1.79)	1.04	(0.93, 1.17)	1.01	(0.90, 1.13)
Married	Ref.		Ref.		Ref.	
Divorced	1.87	(1.55, 2.25)	1.85	(1.53, 2.23)	1.25	(1.04, 1.52)
Widowed	3.59	(3.22, 4.00)	3.53	(3.14, 3.97)	1.24	(1.08, 1.41)
Never married	2.32	(1.70, 3.16)	2.30	(1.69, 3.14)	1.16	(0.82, 1.65)
Model 2: Wave *t* + 1 respondents and exit interviews (*N* = 66,248)						
Male	Ref.		Ref.		Ref.	
Female	1.20	(1.11, 1.29)	0.83	(0.77, 0.89)	0.85	(0.79, 0.92)
Married	Ref.		Ref.		Ref.	
Divorced	1.55	(1.36, 1.77)	1.62	(1.42, 1.86)	1.20	(1.05, 1.37)
Widowed	2.77	(2.57, 2.99)	2.98	(2.75, 3.23)	1.13	(1.03, 1.23)
Never married	2.11	(1.72, 2.59)	2.18	(1.78, 2.68)	1.14	(0.90, 1.44)

Note: ARR = adjusted risk ratio; RR = (unadjusted) risk ratio. Ninety-five percent confidence intervals (CIs) obtained using delta method in Models 1–4. Bootstrapped CIs (from 1,000 replications) reported for Model 5. See Supplementary Appendix for details on Models 3–5.

home entrants in exit interviews, the unadjusted relative risk ratios for females and all marital status categories were lower than those obtained in Model 1. Jointly controlling for gender and marital status decreased the estimated relative risk ratio for females, which were found to be at a significantly lower risk of nursing home entry in this sample (RR = 0.83; CI: 0.77, 0.89). Divorced, widowed, and never-married individuals were at higher risk than married individuals. Adjusting for the full set of controls in the last two columns barely changed the relative risk ratio for females versus males (RR = 0.85; CI: 0.79, 0.92) and decreased the relative risk ratios for the nonmarried categories relative to married individuals. Divorced and widowed individuals remained at higher risk of nursing home entry within periods (RR = 1.20; CI: 1.05, 1.37 and RR = 1.13, CI: 1.03, 1.23, respectively). The relative risk ratio for never-married individuals was not statistically significant.

The next part of the analysis tested the sensitivity of the results to alternative assumptions about the factors resulting in missing values of nursing home status in *t* + 1 for a subset of observations. Three models were estimated using multiple imputation procedures based on different hypotheses about the data-generating process for missing values, namely that predictors of nursing home entry for nonrespondents were comparable to those in the subsample of individuals who died within waves (Model 3); that the predictors of nursing home entry for nonrespondents were comparable to those in the subsample of returning nonrespondents (Model 4); and that all nursing home entrants among the sample of nonrespondents were females. Details about the three models and estimation results are provided in Supplementary Appendix 1. The estimates obtained in Model 2 were found to be robust to the three imputation methods, with divorced and widowed individuals remaining at an elevated risk of nursing home admission relative to married individuals, and women remaining at a lower risk of nursing home admission relative to men, in the three specifications considered.

Discussion

This study estimated models of nursing home admissions in different samples to evaluate the role of gender and marital status as predictors of nursing home transitions. In all samples, the raw percentage of women entering a nursing home was higher than that of men. The raw percentage of divorced, widowed, and never-married individuals transiting into nursing homes was higher than that of married individuals. In all specifications, marital status was found to mediate some of the gender disparity suggested by differences in raw percentages. Different models yielded different answers to the question of whether gender was an independent predictor for nursing home risk after controlling for marital status.

In the sample of individuals who survived up to the end of the follow-up period (Model 1), gender was not a significant predictor of nursing home admission, while being divorced or widowed increased the likelihood of entering a nursing home. Care needs to be taken when interpreting these results because, as discussed in Diehr and Patrick (2003), conclusions regarding late-life outcomes obtained from samples that omit baseline observations that die during the follow-up period may not generalize to the overall population. This concern likely applies in the context of this study for two reasons. First, a significant share of nursing home stays takes place in the last year of life. According to Hurd and colleagues (2017), ignoring information from exit interviews in the HRS reduces the

estimate of lifetime risk of nursing home admission from 56% to 36%. Second, men and nonmarried individuals tend to have shorter nursing home stays before death (Kelly et al., 2010) and are hence likely to be underrepresented among nursing home entrants in a sample of complete cases.

Repeating the statistical analysis on a sample that added information on nursing home status at the time of death changed the conclusion regarding the role of gender. In this case, women were found to be at a statistically lower risk of nursing home admission than men. The estimated reduction in risk was meaningful. In particular, reversing the adjusted risk ratio (ARR) estimated in the third specification of Model 2 implies that being a male increases the risk of nursing home admission by 18%. This is approximately half the increase in risk associated with going from no ADL to one ADL and more than twice as high as the risk increase associated with any subsequent ADLs. It is also approximately one-fifth of the risk increase associated with the first IADL, about two-thirds as large as the risk increases associated with the second and third IADLs, and larger than the risk increase associated with the fourth and fifth IADLs (estimates of ADL and IADL ARRs available on request). The role of marital status did not change, with divorced and widowed individuals still found to be at higher risk of nursing home admission than those who had a spouse.

Another potential challenge to the generalizability of the results is the presence of missing data. In the HRS, nursing home status at the end of the follow-up period was not observed for baseline observations that became nonrespondents in the following wave. Missing data can lead to biased estimates of relative risks if the reason why an individual drops out of the sample is related to the outcome of interest (Biering et al., 2015). The possibility that women may be more likely to become nonrespondents upon transfer to a nursing home than men would be of particular concern for the current study. Three models were estimated to evaluate the extent to which alternative assumptions about the nature of missing values may affect the results obtained for Model 2. The main conclusion that both gender and marital status are independent risk factors for nursing home entry was not qualitatively changed in any of the three models. The number of missing values in the HRS sample was small (less than 5% of the sample), so even extreme assumptions about the gender distribution of nursing home entrants in those data did not alter the conclusion that women were at lower risk of nursing home entry than men.

The results in this paper suggest that, through the presence of a spouse, married individuals have access to more informal caregiving than unmarried people. Indeed, married individuals remained at a lower relative risk of nursing home entry even after controlling for the number of children, suggesting that those do not fully compensate for the absence of a spouse. This is consistent with Wachterman and Sommers' (2006) finding that children do not appear to help widowed or divorced parents at a higher rate than married parents.

The protective effect of female gender against nursing home admission may be explained by a stronger negative preference for nursing home care among women or by children providing more informal care to females than to males. For example, Silverstein and colleagues (2006) show that children (of any gender) provide greater support to mothers than to fathers, and Noël-Miller (2010) argues that they are more likely to reduce the risk of nursing home admission for elderly mothers than elderly fathers. Furthermore, Lee and colleagues (1993) find that children are more likely to provide care to a parent of their same gender, a trend that would benefit elderly women, given that daughters are more likely than sons to become care providers. The possibility that social norms make women more likely than men to become their spouse's primary carer (Van Houtven, 2015) cannot be ruled out, but this effect would not offer enough protection against nursing home entry to reverse the female gender advantage.

The study sheds light on how conclusions obtained from prospective studies with long follow-up periods can be affected by the treatment of missing outcome variables. The results point to the importance of using exit interviews to recover nursing home transitions that happen in the last months of life. End-of-life transitions constitute a relatively larger share of nursing home transitions for men than for women, and hence omitting them from the empirical sample leads to misleading conclusions about the role of gender as a risk factor for nursing home entry.

There are a number of limitations to this study. First, like any observational study, the analysis can only identify associations, but not necessarily causal effects of gender and marital status on nursing home admissions. The comprehensive list of controls used in the analysis is intended to ensure that the main drivers of nursing home entry identified in previous literature are accounted for. However, the possibility that an important confounder has not been accounted for cannot be excluded. Second, because of substantial differences in methods and data, it is not possible to exclude that previous conflicting findings regarding the role of gender as a risk factor for nursing home transitions may also be driven by other factors other than the treatment of exit interviews and missing values. Third, nursing home stays that started and ended during the follow-up period were not considered in the analysis. The results are robust to coding nursing home transitions taking place within waves that lasted a month or more as permanent nursing home transitions. Instead, the finding that women are at a lower relative risk of nursing home entry is not robust to coding nursing home stays of any length as permanent nursing home transitions. Because most nursing home stays of less than a month are likely to represent short, postacute hospitalizations in skilled facilities, it was

deemed appropriate to omit those from the current analysis, but results from a model including those transitions are discussed in Supplementary Appendix 1. Fourth, individuals living in hospice facilities at the end of life were not coded as living in a nursing home. However, it is possible to receive hospice care in some nursing homes, in which case those observations would have been coded as living in a nursing home. Fifth, while the current study focused on how conclusions regarding the role of gender and marital status as predictors of nursing home admissions are affected by omitting observations who die or drop out from the sample within waves, it did not consider the role of initial nonresponse (i.e., individuals that were invited to participate on the HRS sample but declined to do so). The initial nonresponse rate in the HRS is 18.4% (Michaud et al., 2011).

Conclusions

Significant gender and marital status differences exist in the risk of nursing home admission within a 2-year period. Women and nonmarried individuals are more likely than men to enter a nursing home. Marital status is also strongly correlated with gender, with older women being significantly more likely than men to be divorced, widowed, or never married. Multivariate analyses jointly controlling for gender and marital status showed the latter to be a strong mediator of gender differences in nursing home risk.

Sample selection influenced whether gender was deemed to be an independent predictor for nursing home risk after controlling for marital status. Once in a nursing home, males and married individuals tend to have shorter stays before death and are therefore more likely to be missed from studies that exclude individuals who die during the follow-up period. As a result, studies based on a sample of complete cases will tend to overstate the relative risk of nursing home entry for females and nonmarried individuals. In the study, the analysis of complete cases suggested that women were at the same risk of nursing home admission as men. However, after adding information on nursing home status at the time of death from exit interviews, being female had a protective effect in terms of risk of nursing home admission. Individuals without a spouse were at a higher relative risk of nursing home admission in all specifications considered.

The results may provide useful prognostic information for clinicians and caregivers regarding nursing home entry risk. In particular, this study clarifies the role of gender as a predictor of nursing home admissions, for which different studies had previously provided conflicting reports.

The study also sheds light on how conclusions obtained from prospective studies with long follow-up periods can be affected by the treatment of missing outcome variables. Given that surveys modeled on the HRS (the so-called International Sister Studies) are currently available in many countries, the results from this paper illustrate how studies of end-of-life outcomes based on those surveys can deal with the ubiquitous problem of missing data due to either attrition or death during follow-up.

Supplementary Material

Supplementary data are available at *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences* online.

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Conflict of Interest

None declared.

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