Effects of Marital Status and Transition on Hypertension in Chinese Women: A Longitudinal Study

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Abstract

Background Previous studies have indicated that married women are generally healthier than unmarried women. Most of those studies have examined the effect of marital status on mortality, self-rated health status, or psychological well-being however, only few studies investigated the relationship between marital transition and cardiovascular health, namely hypertension. With a prospective design, we attempt to analyze the temporal relationship between initial marital status and marital transition with measured levels of hypertension of Chinese women.

Methods Subjects consisted of women aged 20-59 in a longitudinal study in 9 provinces in China. Hypertension, marital status and covariates were enumerated at a baseline interview in 1991 and in a follow-up interview in 1997. A two-level logistic random effect model was carried out to estimate the effects of marital status and marital transition on hypertension.

Results After adjusting for individual's 1991 demographic and socioeconomic factors, health risk factors including baseline hypertension and community level socioeconomic factors, women both never married and divorced, widowed or separated have a higher risk for hypertension (OR= 2.98, 95% CI: 1.16-7.62 and OR=2.27, 95% CI: 1.10-4.69, respectively) relative to married women. Women with marital transitions between 1991 and 1997, after adjusting for the same covariates, were more likely to be at risk for hypertension (OR=1.99 for exit to marriage, 95% CI: 1.07-3.71 and OR=3.97 for entry to marriage, 95% CI: 1.58-9.93) relative to women staying in marriage.

Conclusions Married women are less likely to be at risk for hypertension. Women experiencing marital status changes are more likely to suffer short-term adverse effects.

Keywords Marital status, marital transition, hypertension, women's health, Chinese women

Introduction

A considerable number of studies have focused on health differentials in relation to marital status. Married women generally have lower morbidity (Burman and Margolin 1992; Hu and Goldman 1990) and mortality (Ross, Mirowsky and Goldsteen 1990; Wyke and Ford 1992; Hahn 1993), and are better in both physical and mental health than unmarried women (Verbrugge 1979; Khlat, Sermet and Le Pape 2000; Waite and Gallagher 2000). These marital status differentials in health appear to be due to three types of effects: marriage protection effect (Burman and Margolin 1992; Waldron et al. 1996), marriage selection effect (Goldman 1993; Lillard and Panis 1996; Waldron et al. 1996) and indirect selection effect (Fu and Goldman 1996). The marriage protection effect suggests that marital status has a causal impact on women's health. Marriage selection effect proposes that women with better health and health-related attributes have a higher probability being married and staying married. The indirect selection effect concerns the effects of some characteristics which influence both marital status and health, but are not controlled or measured in the relationship analysis of marital status and health. The commonly observed lower morbidity and mortality of the married women partly reflects a selection bias. Therefore, it is necessary to adjust for these selection effects to examine the effect of marital status on health.

Marital status can be defined as marital states at any given time point, which take several major forms such as married, never married, divorced, separated and windowed. Marital transitions can be conceptualized as marital trajectories (Barrett 2000) during any given

time period, which can take several major forms by remaining stable or by changing due to entry into marriage, dissolution of marriage, or death of a spouse. Most previous analyses have been based on cross-sectional data, evaluating current marital status (Hu and Goldman 1990; Trovato 1992; Joung et al. 1995; Khat 2000). Few studies have investigated the effect of marital transitions on health (King et al. 1998; Sobal et al. 2003; Lee et al. 2005)**.** Limited by a static data structure, these studies are not able to generate persuasive evidence of marital status' effect on women's health. Studies based on analyses of prospective data have mostly examined mortality, self-rated health status, or psychological well-being (e.g. Gove 1973; Hahn 1993). Very few studies considered the effects of marital relationship on cardiovascular risk and disease (Lee et al. 2005).

Cardiovascular disease has decreased dramatically in western countries over the past several decades and has also increased to become the leading cause of death in China (WHO 1996; Murray et al. 1997). Nearly 40% (37.0% in men and 41.8% in women) of all deaths in China are attributed to cardiovascular disease (WHO 1996). Even more troublesome, the morbidity and mortality of cardiovascular disease in China is projected to increase over the next 20 years (Murray et al. 1996).

Cardiovascular disease is multifactorial in origin. Hypertension is one of the most important risk factors in western populations (He et al. 1999), as well as in Asian populations (ESCHDCRG 1998). According to previous national surveys conducted in China, the prevalence of hypertension has increased dramatically during the past several decades (Wu et al. 1995; He et al. 1996; Gu et al. 2002). Gu et al. (2002) find that

hypertension prevalence has increased from 19.1% to 25.8% in the last ten years among Chinese women.

Marital status and marital transitions have indirect influences on health outcomes including hypertension through health risk behaviors and stress, and direct influences on cardiovascular, endocrine, immune, neurosensory, and other physiological mechanisms (Kiecolt-Glaser and Newton 2001). Excessive alcohol use, high dietary of sodium, lack of exercise, and higher levels of stress contribute to the greater likelihood of developing hypertension. Marital status and marital transitions are related to differentials in health behaviors (Waite 1995). Marital and familial commitment may encourage married women to self-regulate their health risk behaviors. Women who are not in committed relationships have a higher likelihood of engaging in risky health behaviors (Umberson 1987, 1992). Specifically, married people are more likely to quit smoking (Waldron and Lye 1989), more likely to conform to dietary guidelines (Roos et al. 1998) and less likely to drink alcohol excessively (Power and Estaugh 1990). Behavioral changes that may accompany divorce and widowhood among women are a relapse in smoking, increased drinking, and poor diet (Lee et al. 2005). Exiting from the marital role is a stressful life event (Hobson et al., 1998) that leads to a decline in everyday social support and social control and is associated with depression. Social support from a husband may help a woman deal with stressful situations. Due to the absence of partner support, the transition from being married to being unmarried may be deleterious to health status (King et al. 1998). On the other hand, marital strain has deleterious effects on cardiovascular, endocrine, and immune functions as well (Theodore and Kiecolt-Glaser 2003). Marital strain can be viewed as a repeated or chronic social stressor.

In this study, which is based on longitudinal data from the China Health and Nutrition Survey, we examine the effects of earlier marital status and marital transitions on subsequent cardiovascular risk, namely hypertension, while partially adjusting for marriage selection and indirect selection effects. With a prospective design and repeated measures of variables, we attempt to analyze the temporal relationship between earlier marital statuses and marital transitions with subsequent levels of hypertension.

Materials and methods

China Health and Nutrition Survey

Study subjects were drawn from the China Health Nutrition Survey (CHNS), an ongoing longitudinal survey of households in nine provinces in China. CHNS debuted in 1989 with follow up surveys conducted in 1991, 1993, 1997 and 2000. The survey used a multistage, random cluster process to draw a sample of about 4,400 households with a total of 16,000 individuals in nine provinces that vary substantially in geography, economic development, public resources, and health indicators. CHNS was designed to see how the social and economic transformation of Chinese society is affecting the health and nutritional status of its population. Details about the survey design and sample structure can be found in related articles (Popkin et al. 1993; Stookey et al. 2000).

Study population

This study used the 1991 and 1997 waves of data from Shandong, Jiangsu, Henan, Hubei, Hunan, Guangxi and Guizhou provinces[1]. The 1991 survey included 2,882 women aged 20-59, and was the same group of women interviewed in the follow-up 1997 survey. Subject excluded were women who were pregnant at either survey stage (n=46). The physical examination questionnaires did not cover all sampled women, and therefore, those women who missed physical examination were also excluded (n=677). The main analysis involved 2,189 women. There were no significant differences on selected characteristics between observed and missed cases.

Marital status and marital transition

In both the 1991 and 1997 questionnaires, participants reported their current marital status. In this study, marital status was categorized as follows: never married, married, marital discontinuation including divorced, widowed or separated. Thus, marital transitions during 1991-1997 were identified as: staying married or unmarried, changing from married to unmarried (marital dissolution), changing from unmarried (those never married, divorced, widowed and separated) to married.

Hypertension

Hypertension is defined as systolic blood pressure≥140 mmHg or diastolic blood pressure ≥90 mmHg. We excluded those using anti-hypertension medication (*n=63*) because the association between marital status and hypertension is likely to be different between

[1]Due to unreliability of blood pressure measures, 1993 data were not included. Due to the non-continuous measurement, data from Heilongjiang and Liaoning Provinces were not included.

treated and untreated individuals. For example, those on medication may have modified their risk factor profile by engaging in healthier behaviors.

Data analysis

Descriptive statistics on marital status, marital transition, etc., are presented to facilitate interpretation of subsequent regression analysis. With a two-level logistic random intercept model, the main analysis estimates the effects of marital status and marital transition on hypertension[2]. Each set of analyses was adjusted for initial (1991) hypertension, age, work status, parental status, education, income, smoking, alcohol use, medical insurance coverage, family size, cooking fuel, drinking water source, and a set of community level socioeconomic factors which were collected in the 1991 survey. The inclusion of initial hypertension serves to minimize the confounding due to the effects of hypertension on marital status. By performing a multilevel analysis, the clustered data structure was taken into account and relatively accurate standard errors of coefficients can be estimated (Diez-Roux 2000). Moreover, the effects of omitted or unmeasured factors such as health behavior norms are captured by random effect terms. In each analytic model, a two-level structure is considered: women and community levels. For analyses of marital status, the reference group is women who were married at the beginning of interval. For analyses of marital transition, the reference group is women who stayed married for both time points.

[2] Interaction terms between marital status, work status and parental status have been included in the original models, but no significant effects were found. We also tested the same model with being overweight (BMI ≥25) as a dependent variable. No significant effects were found from either marital status or marital transition on being overweight. The results were not shown here.

Results

In Table 1, we present the definitions, means and frequency distributions of hypertension, marital status and marital transition and covariates which were used to estimate the independent relationship of hypertension with marital status and marital transition. In 1991, 6% of women aged 20-59 were assessed as having high blood pressure and in 1997, this proportion increased to 13%. Among sampled women, 92% were married, while 5% were never married and 3% were divorced, widowed or separated. Compared to their status at the beginning, 85% of women remained married, 4% had dissolved their marriage, 3% entered marriage (either as a newly married or remarried person), and 5% remained unmarried. Table 2 presents the 7 percentage point change in hypertension levels over the interval for this cohort.

Table 3 presents the observed relationships of hypertension in 1991 and 1997 to 1991 marital status and 1991-1997 marital transition. Compared to married and never married women, divorced, widowed or separated women showed a higher prevalence of hypertension. In 1991, 7% of the latter were hypertensive, while 3% of never married and 6% of married were. In 1997, 31% of those divorced, widowed or separated were measured to be hypertensive, while only 13% of married and 12% of never married women were. Among those experiencing marital transitions in the interval, a lower proportion of hypertension was observed for women staying married, a lower level of hypertension in 1997 is observed for women staying married (12%) compared to women who exited marriage (28%). Women entering marriage have a hypertension prevalence

level of 19% and those remaining unmarried a level of 18%. Both bivariate relationships are statistically significant (*P<0.01)*.

Results from two-level logistic random intercept analysis of hypertension determinants are shown in Table 4. Relative to married women, both women never married and divorced, widowed or separated in 1991 have a higher risk for hypertension in 1997 (OR= 2.98, 95% CI: 1.16-7.62 and OR=2.27, 95% CI: 1.10-4.69, respectively). Compared to women who remained married in the six-year interval, women who exited marriage were about 1.99 times more likely to be at risk for hypertension (95% CI: 1.07-3.71). While marriage itself apparently has beneficial effects, the transition from unmarried to married status showed adverse effects on blood pressure (OR=3.97 95% CI: 1.58-9.93), relative to women whose marriage status remained unchanged in the interval. Women who remained unmarried also showed a higher risk of subsequent hypertension, but the magnitude was less, compared to women who stayed married (OR=1.96, 95% CI: 0.97-3.95).

The two-level logistic random intercept model was adopted to take in account the nested data structure. Expressed as an intraclass correlation the contextual variation was relatively strong at the community level (ICC=0.18-0.19). The variance of community level random effect was statistically significant (95% CI: 0.26-1.23). This finding suggests the relationship between marriage and health is mediated by social context. Some pathways may be through shared health behavior norms and responses to shared stresses in the environment.

Discussion

Our analysis indicates that, in general, married women in China are less likely to be at risk for developing hypertension. In comparison to never married and divorced, widowed or separated women, women married at the beginning of the six-year follow-up interval were less likely to have high blood pressure. This finding supports from previous prospective studies which highlighted the beneficial effects of marriage on individual health (Burman and Margolin 1992; Waldron et al. 1996, 1997). Married women have more access to financial resources and social support, less psychological stress and are more likely to incorporate positive behaviors for a healthier lifestyle. Spousal income support reduces the potential stress resulting from potential financial ups and downs within a household. In addition, social support from both husband and family may help women to work through various life stresses. Commitment to marriage also encourages women to stay healthy and hence, women may feel inclined to engage in more positive health related activities. All of these contribute to the hypothesized set of beneficial effects of marriage on hypertension.

An impact from marital transitions on hypertension has also been found in the present study. Change of marital status in the short-term shows a higher risk for hypertension, relative to women continuously married. The finding of the effects from marital dissolution confirms previous studies which concluded that exit from marriage has negative effects on health behaviors and health outcomes (Umberson 1987, 1992; Lee et al. 2005). There may be several explanations. Women who leave a marriage may lose their only financial resource and social support previously provided through the marriage,

and therefore, they may suffer from various levels of depression. Women who are not in committed marital relationships have a higher likelihood of engaging in risky health behaviors (Umberson 1987, 1992) such as taking up or having a relapse in smoking, increased drinking, and poor diet (Lee et al. 2005), all of which are common cardiovascular risk factors.

On the other hand, a negative effect of a transition from unmarried to married is also observed in this study. A possible explanation is that the transition from unmarried to married status involves a huge change in lifestyle. A newly married couple needs to adapt to each other's lifestyles and habits. For example, women may quit smoking after marriage, but may also experience a change in diet, which leads to weight gain (Sobal et al. 2003; Lee et al. 2005). Further studies need to be done to fully understand the health effects of this type of marital transition.

The impact of marital status on individual health has been a focus of earlier studies. However, stability or duration in a marital state may be another variable with a significant influence on women's health. Moreover, quality of a marriage can be important. Indicators such as marital happiness or satisfaction may provide other avenues to explore and deconstruct the relationship between marriage and health.

Finally, further exploration on how social context mediates the marriage and health relationship is needed. For example, one would be interested in the extent to which marriage protect women from hypertension and other cardiovascular risks when their level of marital satisfaction is high or they reside in household and community settings with strong social support systems.

Our data do not include information on the duration of each marital status, exact timing of the marital transition and quality of life-related variables, which limits the range of our analysis of the effects of marital dynamics on women's health. Collected at the beginning and at the end of a six-year period, these data may also do not capture information on events occurring during the six-year interval. Potentially shorter of near-term effects of marital transitions can not be assessed with these data.

In conclusion, being single has an adverse effect on physical health such as the likelihood of having high blood pressure. Marital transition, including from unmarried to married, at least in the short term, may also have a negative effect on women's health. In China today, there is an increase in the divorce and remarriage rates, as well as an increase in the proportion of singles versus married couples. It will be interesting to carry out more detailed studies in the future on the effects of marital dynamics on physical health including chronic diseases within China.

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Table 1 Means and frequency distribution of measures of health status and individual and community status factors

Variables	Definitions	N=2189	Mean	S.D.
Hypertension 1997	If has hypertension in 1997	2189	0.13	0.34
Hypertension 1991	If has hypertension in 1991	1966	0.06	0.24
Women's level				
Marital status	Marital status in 1991	2189		
Currently married		2008	0.92	0.27
Never married		114	0.05	0.22
Divorced, widowed or separated		67	0.03	0.17
Marital transition	Change of marital status from 1991 to 1997	2189		
Married to married		1853	0.85	0.36
Married to unmarried		91	0.04	0.20
Unmarried to married		70	0.03	0.17
Unmarried to unmarried		104	0.05	0.22
Missing		71	0.03	0.17
Work status	If engaged in wage work activities 1991	2189	0.77	0.42
Parental status	If has children under age 6 in 1991	2189	0.33	0.47
Age	Age in years 1991	2189		
20-29		582	0.27	0.44
30-39		706	0.32	0.47
40-49		541	0.25	0.43
50-59		360	0.16	0.37
Education	Educational achievement in 1991	2189		
Illiterate or semi-illiterate		1219	0.56	0.50
Elementary school		379	0.17	0.37
Junior middle school and above		591	0.27	0.44
Per capita income (ln)	Per capita annual income in household 1991	2189	6.73[a]	1.00
Smoking	If current or ever smoker in 1991	2030	0.03	0.17
Alcohol use	If drunk more than once per week 1991	2028	0.05	0.21
Medical insurance	If covered by formal medical insurance 1991	2179	0.19	0.39
Water source	Method that household uses to obtain drinking water (tapwater=1) in 1991	2189	0.52	0.50
Common cooking fuel	If use gas or electricity in 1991	2188	0.09	0.29
Family size	How many persons in family in 1991	2110	4.65	1.49
Community level				
People who engaged in agriculture	Percentage in 1991	2136	56.4	36.6
Distance to the commonly used health facility	Distance in km in 1991	2139	0.84	1.91
Average household income (ln)	Mean of household income in a community in 1991	2189	8.38[b]	0.49
Mean of education	mean of years of education completed in a community in 1991	2189	5.36	1.37
Urban/rural	If a rural location in 1991	2189	0.74	0.44
Region	Region located in 1991	2189		

East	Jiangsu and Shandong	521	0.24	0.43
Central	Henan, Hubei and Hunan	994	0.45	0.50
West	Guangxi and Guizhou	674	0.31	0.46

[a] unlogged value is 837.15.
[b] unlogged value is 4359.

Table 2 Hypertension in 1991 and 1997

	1991		1997	
	n	%	n	%
Hypertension				
No	1850	94	1894	87
Yes	116	6	285	13

Table 3 Relationship of initial marital status and marital transition to hypertension in 1991 and 1997

	Hypertension 1991		
	n	column %	% with hypertension
Marital status in 1991			
Married	1816	92	6
Never married	90	5	3
Divorced, widowed or separated	58	3	7
P		<0.001	
Marital transition 1991-1997			
Married to married	1679	88	6
Married to unmarried	82	4	12
Unmarried to married	53	3	6
Unmarried to unmarried	91	5	4
P		<0.001	
	Hypertension 1997		
	n	column %	% with hypertension
Marital status in 1991			
Married	2008	92	13
Never married	114	5	12
Divorced, widowed or separated	64	3	31
P		<0.001	
Marital transition 1991-1997			
Married to married	1853	87	12
Married to unmarried	91	4	28
Unmarried to married	70	3	19
Unmarried to unmarried	104	6	18
P		<0.001	

Table 4 A two-level logistic random effects model relating 1997 hypertension to 1991 marital status and 1991-1997 marital transition, adjusted for a set of confounders[a]

A. Relationships of hypertension to initial marital status[b]			
	Parameter Estimate	Odds Ratio	95% Confidence Interval
Never married	1.09	2.98	1.16-7.62
Divorced, widowed or separated	0.82	2.27	1.10-4.69
Variance of community level random effect	0.76		0.29-1.23
Intraclass correlation	0.19		0.10-0.28
B. Relationships of hypertension to marital transition, assessed in 1991 and 1997[c]			
	Parameter Estimate	Odds Ratio	95% Confidence Interval
Married to unmarried	0.69	1.99	1.07-3.71
Unmarried to married	1.38	3.97	1.58-9.93
Unmarried to unmarried	0.67	1.96	0.97-3.95
Variance of community level random effect	0.73		0.26-1.20
Intraclass correlation	0.18		0.08-0.27

[a] In each model, the relationship of 1997 hypertension to marital status or marital transition pattern is estimated while adjusting for 1991 measures of hypertension, work status, parental status, age, income, education, smoking, alcohol use, medical insurance coverage, drinking water source, cooking fuels and a set of community level factors including percentage of residents who engage in agriculture, distance to health facility, average income and education, rural/urban location and region.

[b] Panel A gives unstandardized regression coefficients for the specific marital status category variables, relative to women who were married at the beginning of follow-up interval.

[c] Panel B gives unstandardized regression coefficients for the specified marital status pattern variables, relative to women who were married at the beginning and end of follow-up interval.