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A comparative assessment of emergency medicine between the widowers and widows among the elderly in Taiwan

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Abstract

This paper explored the utilization of emergency medicine between the widowers and widows among the elderly in Taiwan. Subject data were obtained from the National Health Interview Survey in Taiwan, a study conducted in 2009 that encompassed observations 65 years of age and older. Chi-square test and logistic regressions were used to determine the utilization of emergency medicine between the widowers and widows. Main empirical results confirmed that the life satisfaction, economic status, self-reported health, functional limitation, and stroke significantly associated with utilization of emergency medicine for both widowers and widows. Nevertheless, diabetes significantly raised the utilization of emergency medicine for widows but not for widowers. Moreover, widowers were more likely to use emergency medicine than widows. Finally, the utilization of emergency medicine was strongly correlated with predisposing, enabling and need characteristics among the elderly widowhood.

1. Introduction

According to the 2014 report published by the Department of Statistics, Ministry of the Interior (MOI), life expectancy in Taiwan has been steadily increasing. In 2014, near 12% of the population was classified as the elderly. This is expected to more than double over the coming several decades (National Development Council, NDC, 2014). Therefore, Taiwan's population profile has been not only "ageing", but also gradually "aged". The trends reflect declining mortality rates and increasing survival rates in Taiwan.

It is well known that rates of morbidity increase with age, reflecting going deterioration in health. Older adults usually show worse health status and are more likely to use health-care services than that of relatively younger peers. In Taiwan, due to the "aging society", the percentage of medical expenditures for the age 65 and over was less than 10% in 2002, sharply increased to 33% in 2012 (Ministry of Health and Welfare, 2014). Moreover, nowadays, Taiwan's medical resources were seriously abused and gradually emerged scant from the deficit of National Health Insurance. Thus, population aging in Taiwan is important and timely issues to study the related issues.

In addition, social network is very important for older people, particularly the families' network (Berkman and Syme, 1979; Blazer, 1982). The approaches of "marriage protection" and "marriage selection" have been identified marriage as an important factor associated with health and health service. Married people generally enjoy better health (Duncan et al., 2006; Wu and Hart, 2002) and lower utilization of health-care service (Ho, 2008; Yang and Jinman, 2007) than their non-married counterparts. Widowed people typically experience the effects of bereavement, with spousal death affecting health and mortality, particularly in older people. These older widowed people need more family and spouse support to assist them using health care service and reducing mortality hazard. However, the statistic reports from the Department of Statistics in Ministry of the Interior (2014) indicate the percentage of widowhood of Taiwan was 5.54% in 2002 quickly raised to 10.07% in 2013. As the widowed people and elderly increasing, represents important related topics awaiting discussion and research among the specific groups. Therefore, this study wants to aim elderly widowhood and tries to cover the basic building blocks to study the related health-care service issue, including what are the impacts of widowhood on health-care service among the elderly? How great is this impact? What is the different between widowers and widows?

2. Literature review

Studies examining the association between marital status and health-care resource have documented higher utilization in older widowed individuals than their married and spouses were still alive counterparts (Chen et al., 2007; Ruledge et al., 2003; Ho, 2008). The reasons might be that marriage spouse could provide important psychological benefits such as reducing stress, improving one's disposition or integrating a person into community (Waite, 1995). A detailed literature in epidemiology has established that those with greater social ties have better health and lower health-care utilization (Cohen et al., 1997). In addition, marriage spouse further may discourage risky behavior such as smoking, heavy alcohol use or illicit drug use (Duncan et al., 2006); criminal activities (Laub et al., 1998) and encourage healthy behavior such as moderate exercise (Ho et al., 2009). In general, older widowed individuals were less likely to follow health promoting behaviors and more likely to die than those whose spouses were still alive (Ho & Hung, 2013). Finally, elderly widowhood living alone typically lacked adequate assistance and care from spouse or other families (Li et al., 2005). Those who have lost their spouses may experience greater social isolation than their non-widowed peers. Therefore, elderly individuals who experienced the death of their spouses would show a worse health status and higher health-care utilization than those who had not (Ho & Hung, 2013).

In addition, the antecedents for the current study flow from different but related strands to compare results between widowers and widows. The first group of papers documented excess mortality for surviving men compared with women (Chen et al., 2007; Moon et al., 2011; Ho et al., 2013; Rutledge et al., 2003; Zimmer at al., 2005). Next, women typically have broader social networks than men, which can help alleviate the physical and mental stresses after the death of a husband (Espinosa and Evans, 2008; Ho et al., 2013). Finally, Lee et al. (2001) further mentioned that impact of widowhood on the incidence of depression was greater for men than women. Many widowers adopt strategies such as remarriage to combat the bereavement effect. Elderly widowers have been reported as more likely to remarry than elderly widows (Smith et al., 1991).

All of the studies mentioned above discussed that the marital status, health, mortality and health-care service issues among the elderly, but litter attention has been the utilization of emergency services. Particularly, elderly are less likely to enjoy better health and more likely to have emergency case after the death of a spousal. Therefore, to fill the gap, this paper emphasizes the utilization of emergency medicine and examines the impact of bereavement effect among the elderly widowhood in Taiwan.

This paper followed the health behavior of previous studies (Andersen, 1995; Andersen et al. 1973, 1994) and controlled predisposing, enabling and need characteristics to examine the utilization of emergency medicine among the elderly widowhood. Predisposing characteristics included age, education and living arrangement. Enabling characteristics included life satisfaction, economic status residence and health insurance. Need characteristics included self-reported health, chronic disease and functional limitations respectively. Furthermore, because being married likely imposes different impacts between males and females in terms of health (Duncan et al., 2006; Liu, and Umberson, 2008) and because the gender variable showed significance ($p < 0.001$) in our initial empirical test, this study examined the utilization of emergency medicine by gender.

3. Methods

3.1 Research Design

Data were derived from the 2009 National Health Interview Survey (NHIS) of Taiwan conducted by the Nation Health Research Institutes, Food and Drugs Administration, and Health Promotion Administration, Ministry of Health and Welfare, Taiwan. The NHIS used a multistage stratified systematic sampling scheme. First, the research divided 358 townships or districts of Taiwan into seven strata according to geographic location and degree of urbanization. Townships or districts in each stratum were selected by probability proportional to their size (PPS). Next, in each selected township/district, the second-stage sampling unit, *lin* (the smallest administrative unit) also were selected by using the same method of PPS. Finally, four households were selected randomly from each selected *lin*. All members in selected households were interviewed by trained interviewers using a structured questionnaire.

The target population for the original survey was 22,942,706 individuals whose households were registered in any 1 of the 23 counties in Taiwan in the year 2008. A total of 164 townships (or districts) and 30,528 persons were sampled. Among them, 25,632 persons completed the survey; the response rate was about 84.0%. To increase study sample homogeneity, inclusion was restricted to elderly aged 65 and over. A total of 2,904 elderly were recruited as participants. Among these, subjects who reported never married, married with a currently living spouse, separate and divorce were excluded. The final sample size was thus 998. This paper tracks the survival of the 998 respondents in 2009 and analyzes the relative utilization of emergency medicine for specific subgroups.

3.2 Chi-Square Test

Chi-square test is usually known as the goodness-of-fit test or test for independence. Since this study examine whether significant difference on the utilization of emergency medicine between the predisposing, enabling and need variables among the elderly widower and widow, all of these are quantitative variables, one or more categories and independent samples, this study uses the chi-squared test for independence.

This study calculates the p-value and determines to accept or reject hull hypothesis. When $p < 0.05$, it rejects hull hypothesis and alternative hypothesis is set up to establish. It indicates significant difference on the utilization of emergency medicine between the predisposing, enabling and need variables among the elderly widower and widow. In contrast, when $p > 0.05$, it accepts hull hypothesis and indicates independence between the predisposing, enabling and need variables among the elderly widowhood.

3.3 Logistic Regression

This paper further uses binary logistic regression models simultaneously to compare the utilization of emergency medicine services between widows and widowers among the elderly. Based on Greene (2012), the model assumes $y_i = 0$ as the baseline outcome for the probability of emergency medicine utilization of widow, and to form logistic regression comparing $y_i = 1$ for the probability of emergency medicine utilization of widower. The general expression for the conditional probability in the binary logistic model is:

$$\Pr ob(y_i = j) = \frac{e^{\beta_j' x_i}}{\sum_{j=0}^{1} e^{\beta_j' x_i}}, \quad j = 0, 1. \tag{1}$$

Where j denotes the $j+1$ possible choices, y_i is the indicator variable of emergency medicine utilization, x_i denotes the vector of the explanatory variables, including widows and widowers; predisposing, enabling and need characteristics. β_j is the corresponding coefficient vector. Since this paper would compare the utilization of emergency medicine services between widows and widowers among the elderly, the estimation function could then be formulated as:

$$\ln (p_j / p_0) = x_i \beta_j' \tag{2}$$

Where p_j denotes the probability of emergency medicine utilization j, such as the

emergency medicine utilization of widower. p_0 denotes the probability of the benchmark, such as the utilization of widow.

Finally, since the coefficient estimates are the normalization procedure of the logistic regression, and represent only the effects of independent variables on the relative probability of emergency medicine utilization, we cannot meaningfully compare absolute values of coefficients across emergency medicine utilization. We can obtain the correct odd ratios of the characteristics on the probabilities (Long, 1997). Since the purpose of this study is to compare the probabilities of emergency medicine utilization, this paper only lists odd ratios to explain the comparative results between widow and widower among the elderly. Coefficients descriptive statistics were omitted.

4. Results

As mentioned earlier, this paper controlled predisposing, enabling and need characteristics to examine the utilization of emergency medicine among the widowhood groups. Table 1 summarizes descriptive statistics for the 998 married subjects lost their spouse in 2009. Among these, 786 (78.8%) married women lost their husbands and 212 (21.2%) married men lost their wives during the study period. Not surprisingly, the proportion of widows was larger than that of widowers. The number of widows was nearly 3.7 times that of widowers. Mean ages were 77.13 and 78.52 for widows and widowers respectively. Widows with a higher education showed a lower proportion of widowhood. Less than 10% (9.9%, $n = 78$) of survey respondents with more than primary educational levels lost their husbands. On the contrary, widowers with a lower education showed a lower proportion of widowhood (20.8%, $n = 44$). In terms of enabling characteristics, nearly 70% elderly widowhood satisfied (and average) their life status and had enough money, with some left over or no difficult in living and household expenses for their later life. Finally, in terms of need characteristics, more than half elderly widowhood showed physical function limitations. Particularly, widows (71.8%, $n = 564$) showed a higher proportion than widowers (56.6%, $n = 120$). Furthermore, about 50% elderly widowhood (53.7% for widows, 49.5% for widowers) experienced high blood. Less than 10% elderly widowhood experienced asthma and kidney diseases. Approximately 3% of respondents submitted missing information on the widowhood.

Variables	Widow		Widower	
	n	*%*	*n*	*%*
Predisposing Characteristics				
Age				
65-74	324	41.2	73	34.4
75-84	338	43.0	95	44.8
85 over	124	15.8	44	20.8
Education				
No formal education	441	56.1	44	20.8
Primary education	267	34.0	116	54.7
More than primary	78	9.9	52	24.5
Living Arrangement				
Alone	188	23.9	62	29.3
Others	598	76.1	150	70.7
Enabling Characteristics				
Life Satisfaction				
Satisfaction	248	31.6	69	32.5
Average	291	37.0	72	34.0
Dissatisfaction	237	31.4	71	33.5
Economic Status*				
Surplus	562	71.5	149	70.3
Deficit	224	28.9	63	29.7
Residence				
Urban	411	51.3	95	44.8
Town	135	17.2	44	20.8
Rural	240	30.5	73	34.4
NHI**				
Yes	783	99.6	211	99.5
No	3	0.4	1	0.5
Need Characteristics				
Self-Reported Health				
Good	203	25.8	61	28.8
Average	303	38.6	73	34.4
Poor	280	35.6	78	36.8
Functional limitation				
Yes	564	71.8	120	56.6
No	222	28.2	92	43.4
Chronic disease				
High blood pressure				
Yes	422	53.7	105	49.5
No	364	46.3	107	50.5
Diabetes				
Yes	165	21.0	36	17.0
No	621	79.0	176	83.0
Cholesterol				
Yes	189	24.1	36	17.0
No	597	75.9	176	83.0
Stroke				
Yes	69	8.8	29	16.7
No	717	91.2	183	83.3
Asthma				
Yes	37	4.7	15	7.1
No	749	95.3	197	92.9
Kidney				
Yes	48	6.1	17	8.0
No	738	93.9	195	92.0
Observations	786		212	

Note:

* The surplus of economic status shows that person has enough money, with some left over or no difficult in living and household expenses; the deficit of economic status shows that person has some difficulty or much difficulty in living and household expenses.

** NHI shows that persons' eligibility for National Health Insurance.

To compare different utilization rates of emergency medicine between widowers and widows, this study used chi-square test to identify examination items that whether significantly related to utilization of emergency medicine among the elderly widowhood. Descriptive statistics for predisposing, enabling and need characteristics were presented as frequencies or proportions. First of all, in terms of predisposing characteristics, Table 2 indicates that the utilization of emergency medicine showed significant associations with age for widows and education for widowers (all $p < 0.05$). The proportions of utilization of emergency medicine significantly decreased with higher education levels among elderly widowers. Next, in terms of enabling characteristics, Table 3 indicates that the utilization of emergency medicine showed significant associations with life satisfaction and economic status for both widows and widowers. The prevalence rates of utilization of emergency medicine in deficit groups were significantly higher than in surplus groups regardless of widows and widowers.

Table 2: The Proportions of Predisposing Characteristics and Their Association with Emergency Medicine

Variables	Widow			Widower		
	Yes	No	p -Value	Yes	No	p -Value
	n (%)	n (%)		n (%)	n (%)	
Age			0.011*			0.609
65-74	47 (14.5)	277 (85.5)		19 (26.0)	54 (74.0)	
75-84	80 (23.7)	258 (76.3)		21 (22.1)	74 (77.9)	
85 over	23 (18.5)	101 (81.5)		8 (18.2)	36 (81.8)	
Education			0.085			0.035*
No formal education	89 (20.2)	352 (79.8)		12 (27.3)	32 (72.7)	
Primary education	41 (15.4)	226 (84.6)		31 (26.7)	45 (73.3)	
More than primary	20 (25.6)	58 (74.4)		5 (9.6)	87 (90.4)	
Living Arrangement			0.059			0.069
Alone	27 (14.4)	161 (85.6)		9 (14.5)	53 (85.5)	
With others	123 (20.6)	475 (79.4)		39 (26.0)	111 (74.0)	

Note: *, ** and ***denote statistical significance at 0.05, 0.01 and 0.001 levels, respectively

Table 3: The Proportions of Enabling Characteristics and Their Association with Emergency Medicine

Variables	Widow			Widower		
	Yes	No	p -Value	Yes	No	p -Value
	n (%)	n (%)		n (%)	n (%)	
Life Satisfaction			0.000***			0.016*
Satisfaction	32 (12.9)	216 (87.1)		16 (23.2)	54 (76.8)	
Average	46 (15.8)	245 (84.2)		11 (15.3)	61 (84.7)	
Dissatisfaction	72 (30.4)	155 (69.6)		22 (31.0)	49 (69.0)	
Economic Status			0.009**			0.022*
Surplus	96 (17.1)	466 (82.9)		31 (20.8)	118 (79.2)	
Deficit	54 (24.1)	170 (75.9)		17 (27.0)	46 (73.0)	
Residence			0.930			0.247
Urban	80 (19.5)	331 (80.5)		16 (16.8)	79 (83.2)	
Town	23 (17.1)	112 (82.9)		11 (25.0)	33 (75.0)	
Rural	47 (19.6)	193 (80.4)		21 (28.8)	52 (71.2)	
NHI			0.399			0.588
Yes	150 (19.2)	638 (80.8)		48 (22.7)	163 (77.3)	
No	0 (0.0)	3 (100.0)		0 (0.00)	1 (100.0)	

Note: *, ** and ***denote statistical significance at 0.05, 0.01 and 0.001 levels, respectively

Finally, in terms of need characteristics, Table 4 indicates that the utilization of emergency medicine showed significant associations with self-reported health ($p < 0.001$) and functional limitations ($p < 0.05$) for both widows and widowers. The prevalence rates of utilization of emergency medicine significantly increased with higher self-reported poor health. The prevalence rates of utilization of emergency medicine in those with functional limitations were significantly higher than those without. Moreover, for the chronic disease, stroke showed significance on the utilization of emergency medicine regardless of widows ($p < 0.001$) and widowers ($p < 0.01$). Nevertheless, diabetes significantly raised the utilization of emergency medicine for widows ($p < 0.05$) but not for widowers.

Table 4: The Proportions of Need Characteristics and Their Association with Emergency Medicine

Variables	Widow			Widower		
	Yes	No	p -Value	Yes	No	p -Value
	n (%)	n (%)		n (%)	n (%)	
Self-Reported Health			0.000***			0.000***
Good	26 (12.8)	177 (87.2)		6 (9.8)	55 (90.2)	
Average	40 (13.2)	263 (86.8)		13 (17.8)	60 (82.2)	
Poor	84 (30.0)	196 (70.0)		29 (37.2)	49 (62.8)	
Functional Limitation			0.000***			0.024*
Yes	127 (22.5)	437 (77.5)		34 (28.3)	86 (71.7)	
No	23 (10.4)	199 (89.6)		14 (15.2)	78 (84.8)	
Chronic Disease						
High blood pressure			0.174			0.290
Yes	88 (20.9)	334 (79.1)		27 (25.7)	78 (74.3)	
No	62 (17.0)	302 (83.0)		21 (19.6)	86 (80.4)	
Diabetes			0.010*			0.711
Yes	43 (26.1)	122 (73.9)		9 (25.0)	27 (75.0)	
No	107 (17.2)	514 (82.8)		39 (22.2)	137 (77.8)	
Cholesterol			0.282			0.947
Yes	31 (16.4)	158 (83.6)		8 (22.2)	28 (77.8)	
No	119 (19.9)	478 (80.1)		40 (22.7)	136 (77.3)	
Stroke			0.000***			0.009**
Yes	25 (36.2)	44 (53.8)		12 (41.4)	7 (58.6)	
No	125 (17.4)	592 (82.6)		36 (19.7)	147 (80.3)	
Asthma			0.091			0.305
Yes	11 (29.7)	26 (70.3)		5 (33.3)	10 (66.7)	
No	139 (18.6)	610 (81.4)		43 (21.8)	154 (78.2)	
Kidney			0.146			0.051
Yes	13 (27.1)	35 (92.9)		7 (41.2)	10 (58.8)	
No	137 (18.6)	601 (81.4)		41 (21.0)	154 (79.0)	

Note: *, ** and ***denote statistical significance at 0.05, 0.01 and 0.001 levels, respectively

In addition, this paper further used logistic regression and four different models to compare the utilization of emergency medicine between widows and widowers. Odds ratios and 95% confidence intervals were calculated in Table 5. The estimated odd ratio related to utilization of emergency for widowers in Model 1 was 1.240. This means that the utilization probabilities of emergency for widower compared to that of the widow, was 1.240 times higher in terms of utilization of emergency. Furthermore, the estimated odd ratios in other three models also were greater than one and significantly higher than that for widows. This illustrates that widowers were more likely to use emergency medicine than widows after the death of a spouse. Moreover, odd ratios of emergency increased when variables related to predisposing, enabling and need characteristics were included (1.240, 1.293, 1.328 and 1.376 respectively). These results show that the utilization of emergency medicine was strongly correlated with predisposing, enabling and need characteristics among the elderly widowhood.

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Table 5: Emergency Medicine Estimation for Widowhood

Variable	Model 1			Model 2			Model 3			Model 4		
	Odd. ratio	95% Confidence Interval		Odd. ratio	95% Confidence Interval		Odd. ratio	95% Confidence Interval		Odd. ratio	95% Confidence Interval	
Widow	**1**			**1**			**1**			**1**		
Widower	**1.240****	**0.859**	**1.792**	**1.293***	**0.876**	**1.908**	**1.328***	**0.894**	**1.973**	**1.376***	**0.911**	**2.079**
Include												
Predisposing Factor				Yes			Yes			Yes		
Enabling Factor							Yes			Yes		
Need Factor										Yes		
Log likelihood	-496.527			-482.558			-479.950			-463.75		
Log Likelihood ratio	$x^2(1)$=29.88***			$x^2(3)$=30.23***			$x^2(5)$=34.85***			$x^2(10)$=66.84***		

Note: *, ** and ***denote statistical significance at 0.05, 0.01and 0.001 levels, respectively

Logistic regression used significant predisposing, enabling and need factors to examine the utilization of emergency medicine.

5. Discussion

Much of the current literature examined the utilization of emergency medicine from predisposing, enabling and need characteristics. This paper was different from previous literature, focused on elderly widowhood and used econometric analysis to estimate the utilization of emergency medicine in Taiwan. A number of findings supported previous results, whereas others present results either not or less frequently cited elsewhere.

In terms of predisposing characteristics, age illustrated a significant effect on emergency among the elderly widows. However, for the elderly widowers, age lost significance, perhaps due in part to the optimism of respondents and in part to respondents' feeling of self-respect. This result was different from the findings of Chen et al. (2007); Ho et al. (2013). Moreover, there was an education gradient in emergency for elderly widowers. One possible explanation is that the higher education individuals were likely also to be in the higher income categories. The higher education and income were both associated with better life skills, the higher your education/income, the better able you were to cope with bereavement effect, and thereby avoided many health problems (Buckley et al., 2006). Therefore, utilization of emergency medicine was lower among those with higher education levels. These findings were consistent with a substantial body of international evidence (Chen et al., 2007; Slaughter et al., 2005).

In terms of enabling and need characteristics, life satisfaction, economic status, self-reported health and functional limitations showed significance on emergency for both widows and widowers. The results provided evidence that self-reported health and functional limitations might be relatively reliable indicators of health status (Malmstrom et al., 2007; Zimmer et al., 2005). Moreover, for the chronic disease, when other factors were excluded, stroke showed significance on emergency for both widows and widowers. This analysis echoes the opinions of Chen et al. (2007) and Ho et al. (2009) that subjective reports of stroke were overall more strongly associated with emergency than were reports of other related ailments. Therefore, elderly widowhood should pay more attention to their cardiovascular status to reduce the utilization of emergency medicine in later life.

Furthermore, the estimated odd ratios of emergency for widowers in all four models were greater than 1 and significantly higher than that for widows, indicating that widowers were more likely to use emergency than widows for their later life. The widowers suffered from poor nutrition right after the death of their spouses (Espinosa and Evans, 2008). Thus, many widowers adopt strategies such as visiting their doctors to combat the increased risks to health after spousal death. Moreover, the odd ratios of emergency medicine begin at 1.240 and increase to 1.376. The findings provided suggestive evidence that the utilization of emergency medicine was strongly

correlated with predisposing, enabling and need characteristics among the elderly widowhood. Therefore, emergency analysis of elderly widowhood should take these characteristics into account.

6. Conclusions

This study indicated that elderly with worse life satisfaction, economic status, self-reported poor health, more functional limitations and stroke were significantly more likely to use emergency for both widows and widowers. Nevertheless, diabetes significantly raised the utilization of emergency medicine for widows but not for widowers, and the utilization of emergency medicine showed significant associations with age only for widows and education for widowers. In addition, this study further found that a relatively higher utilization of emergence for widowers than widows among these elderly. Moreover, the utilization of emergency medicine was strongly correlated with predisposing, enabling and need characteristics among the elderly widowhood.

Finally, due to data limitations, results might not be generalized for emergency medicine associated with widowers and widows following the death of a spouse in the general population. Indeed, health-care service differences may be reflected in elderly widowhood variance among subjects. Therefore, this emergency analysis of the study represents only a preliminary assessment to understand the relationship between widows and widowers. In the near future, the author plans to examine more carefully the different health-care service among the specific groups.

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