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ORIGINAL ARTICLE

Gender Differences in Stress and Coping among Elderly Patients on Hemodialysis

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Abstract The study investigated whether gender differences in the stressor, coping strategies, and how they associate stress and copings among 875 elderly patients undergoing hemodialysis in Taiwan. Chi-square tests, MANOVA and Structural Equation Modeling were used to attain the research purposes. The results found that the women had reported higher stress in response to physical and vessel problems and higher scores in using emotion-oriented and support-seeking coping strategies, while the men reported higher stress in reproductive system functioning and higher score in using avoidance as a coping strategy. Furthermore, the results from SEM demonstrated that after controlling for patient characteristics, no statistical difference was found between the two groups with regard to their linking of stress and coping strategies.

Keywords Stressor · Coping · Dialysis · ESRD · Gender difference

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Introduction

Stress is one of the many factors that affect men and women differently. Some research from western countries shows that males and females have unique sources of stress (Almeida et al. 2002; Gillespie and Eisler 1992; Porter and Stone 1995) and that the same stressors have a disparate impact on males and females (Frey 2000; Lindqvist et al. 1998; Ptacek et al. 1992). There is an extensive body of research investigating how males and females cope with stressors, but a clear pattern of differences cannot be determined (Cronqvist et al. 1997; Porter and Stone 1995; Tamres et al. 2002). In summary, despite many studies that have been done on gender difference in stress or coping, the relationship between stress and coping has not yet been clearly established between men and women, particularly for the elderly patients with hemodialysis.

Besides the generic factors make the difference for men and women, culture context may shape the meaning of behavioral pattern of coping. The culture of Taiwan is a hybrid blend of Confucianist Han Chinese cultures, Japanese, Holland, American, global, local and indigenous influences, which are often perceived in both traditional and modern understandings (Harrell and Huang 1994). The society of Taiwan values that males are strong, responsible for family finance, and the strict head of the household, while females are expected to be a good wife, mother, as well as taken care

of housekeeping stuff. The roles of a mother should be amiable and quiet. Under such impression, the females of this cohort (aged 65 and over) often feel helpless, powerless, lacking confidence, or un-respectfulness due to the roles of traditional family values and few chance of being educated since childhood. They often suppressed their own feelings and then may be outbreak or very emotional once they face tremendous pressure or getting older. In addition, people easily accept the impression of males to drink or smoke as one mechanism to cope with their stress; however, the similar situation in females is not acceptable, particularly in the cohort of aging 65 and older. Because of the social value in expecting differently between males and females, the society recognizes that the females will behave more emotion than the males do in general.

In different culture context, people can learn by observing what happens to other people and just by being told about something, as well as by direct experiences. Coping strategies are learned in a stimuli–response environment conducive to self-efficacy and observational learning. Therefore, coping strategies can be facilitated by incorporating culturally sensitive examples of both appropriate (or acceptable) and inappropriate (not acceptable) methods of coping. The value system of the surrounding society reflects the culture of the specific people and then further influences peoples' coping strategies. For example, from western lifestyle values, a successful person is expected to be active, happy and individualistic (Lazarus 1993). On the other hand, the Taiwanese value the importance of the family; the hierarchical structure of social life; the cultivation of morality and self-restraint and the emphasis on hard work and achievement. Since childhood, Taiwanese boys are expected to be brave and strong, not using crying to gain attention or as a coping strategy, while Taiwanese girls are allowed to be emotional or crying. Therefore, it may be rational that whereas Chinese women rated emotional support skills as more important than men, women and men differed only occasionally in their evaluations of the perceived appropriateness of different support goals and the perceived effectiveness of different support strategies and messages (Liu et al. 2008).

This study was designed to explore the gender differences in stress or in coping strategies as well as the relationship between stress and copings among 875 elders with hemodialysis in Taiwan. Specifically, the questions we addressed include (1) whether were the differences in stress between men and women; (2) what were the differences in coping between men and women; and (3) what were the differences in the association between stress and coping strategies.

Gender Difference in Stress and Coping

According to Lazarus's (1991) stress model, the nature of coping depends at least in part on the nature of stressor and how the stressor is appraised. Porter and Stone (1995), asking 156 men and women in one community to complete daily questionnaire booklets in USA that included items assessing stress and coping, found that women reported more problems focused on the self, parenting problems, and problems with other people than men, who reported more work-related problems and more miscellaneous problems. Women were more stressed by fears of unemotional relationships, being unattractive, being victimized, behaving assertively, and not being nurturing than men from a USA study (Gillespie and Eisler 1992). In a meta-analysis, Tamres et al. (2002) found that 17 of 26 studies revealed that women reported stressors as more severe than males. Women have been found to have a higher sensitivity to stressors and experience higher levels of strain than males. They have, for example, reported higher levels of physical, mental, and emotional exhaustion (Geller and Hobfoll 1994; Kohler et al. 2006), depression (Musil 1998), and perceived stress (Kohler et al. 2006; Ptacek et al. 1992). Using Masculine Gender Role Stress (MGRS) and Feminine Gender Role Stress (FGRS) scales, Tang and Lau (1995) studied 482 Chinese college students and professionals, Chinese men generally scored higher on the MGRS factors but lower on the FGRS factors than Chinese women.

Generally, as the two genders often operate in different social contexts, both tend to develop different emotional dispositions. Their responses to stress and coping mechanisms they use also vary. Different models may be needed to better understand gender differences in male and female responses to stress and their coping strategies. Several studies have suggested that a typical male response to stress is fight-or-flight, while a typical female response is more marked by a pattern of tending to offspring and affiliating with a social group, so called "tend and befriend" (Belle 1987; Jick and Mitz 1985; Luckow et al. 1998; Taylor 2006). In other words, female roles are defined by ability to experience, express, and communicate emotions to others as well as empathize with others' feelings, whereas male roles are defined by the ability to suppress and control one's emotions.

Other studies from USA and Netherlands have also concluded that women use more emotion-focused coping behaviors to cope with stress, while men use more instrumental, active, problem-focused behaviors (Ptacek et al. 1992; Vingerhoets and Van Heck 1990). Expressed another way, women respond by focusing inwardly on the self and men by direct action (Porter and Stone 1995). The meta-analysis by Tamres et al. (2002) found women more likely to use strategies that involve expressing themselves verbally, seeking emotional support, ruminating about problems, and using positive self-talk. In a sample of 2,816 people between 15 and 65 years old from Spain, Matud (2004) found that women were more likely to use emotional and avoidance styles and less on rational and detachment coping than men.

However, Kohler et al. (2006), investigating the sex differences in how stress is perceived, appraised, and handled by 804 employees at five Veterans Affair medical centers in the USA, found that the pattern of relationships for control (defined as the extent to which behaviors or cognitions were used to proactively control problems and/or emotions) and avoidance (defined as the extent to which behaviors or cognitions were used to escape problems and/or emotions) to be similar for males and females (Kohler et al. 2006). Using Jalowiec Coping Scale, Cronqvist et al. (1997) did not find any statistically significant difference in coping strategies and styles between the genders from 268 Swedish population. They found that men used the confrontational and self-reliant coping styles more while women used the supportive coping style more than men.

Gender Difference in Patients with Chronic Diseases

There is evidence that adaptation to chronic illness might be affected by psychological factors, especially by how patients appraise and cope with the stress of their illness. Frey (2000), studying gender differences in coping styles and coping effectiveness from 154 patients with chronic obstructive pulmonary diseases in Ohio, USA, found most subjects, regardless of gender, to use an optimistic coping style, such as talking the problem with medical staff. Lindqvist et al. (1998) studied 30 hemodialysis patients from Sweden and indicated that men with end-stage renal disease (ESRD) regard themselves as better able to cope with physical aspects of ESRD and that they were more likely to use problem-oriented coping strategies than women. Yeh and Chow (2007) have suggested that more men than women on hemodialysis rely on avoidance (smoking or heavy smoking, irregular overeating, and drinking) as means of coping with the stress of their illness. Few studies have treated gender as a moderator when exploring the relationship between stressor and coping behavior. Only one study, Takaki et al. (2005), studied 416 hemodialysis patients from Japan, investigating relationship between stress and coping mechanisms in depression or anxiety, included the interactive effect of gender as the moderator, and it did not find an interactive effect.

Another problem is that most research in this area had been done in the West, only few in Asia (Takaki et al. 2005; Tang and Lau 1995). Since the expected demands and norms on male and female role differ across cultures, the findings obtained in West might not be generalized to Asia. Tang and Lau (1995) investigated the gender role stress for Chinese and found the meaning of stressors in China differ to that in West. The same rationale may also apply to the meaning of coping strategies, as well as to the relationship between stress and coping.

Patients Characteristics with Stress and Coping

Several personal factors may influence on the relationship between stress and coping, including age, education, occupation, religion, marital status, causes of diseases, comorbidity, and length of time on dialysis. Human behavior is the result of what is learned through experiential reinforcement (Naughton 1997); thus, age, religion, occupation, education, etc. may contribute to the learning experience. Marital status was used as a proxy for social support (Cohen et al. 2007; Ikeda et al. 2007; Morgan et al. 1984), known to generally influence psychosocial perspective (Wyke and Ford 1992). In addition, several studies also showed that comorbidity is a crucial risk factor for HD patients and has been related to survival rate (Plantinga et al. 2007), re-hospitalization (White and Fitzpatrick 2006), cognitive functioning (Pereira et al. 2005), and stress (Yeh and Chow 2007). The length of time on dialysis determined how much stress he or she perceives and which coping strategies he or she prefers. For example, one Canadian study of 99 dialysis patients, Craven et al. (1987) demonstrated patients under 24 months or less of dialysis tended toward depression. A similar study done in America with 128 dialysis patients suggested an inverse correlation between duration of dialysis and depression/anxiety levels (Kutner et al. 1985). On the other hand, both researches from an American study of 149 HD patients (Kimmel et al. 1995) and from a Swedish study of 700 HD (Theorell et al. 1991) found no relationship existed between duration of HD and depression. The relationship between duration of HD and perception of stressors has also been investigated to some extent. For example, although the prospect of long-term restriction of food and fluid is a difficult challenge for HD patients, they gradually learn how to get along with these restrictions (Yeh and Chow 2007).

In summary, evidence might demonstrate that the gender difference existed in stress and coping, but inconclusive due to various sizes and areas of sample. Neither the clear association between stress and coping was determined. Therefore, this study investigates whether men and women on hemodialysis differ in how they perceive and cope with their stress and whether the two groups vary in how they associate stress with coping strategy. Results of this study can increase our understanding of gender differences in how stress and coping related to each other, particularly in elderly patients on hemodialysis and Asians.

Conceptual Framework

The conceptual framework in Fig. 1 directed this study. Underlying this model is the assumption that coping is a complex process, based on the work of Lazarus and Folkman (1984), and can be defined as “constantly

changing cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the persons" (p. 141). Many factors may influence on how patients cope with their illness-related stress. Stress was assumed to exert an influence on coping. In addition, personal forces, social forces, type of environment, personality and culture are the possible factors that influencing coping. We employed patients' characteristics (e.g., age, education, marital status, occupation, and religion) as the personal forces. Literature indicated that gender is an important factor that influences on how people perceive their stress, and can have essential effects on how people cope with their stress. The relationship between stress and coping may differ according to gender (i.e., this is the definition of a moderator). Therefore, we hypothesize (1) older patients with HD perceived differences in stress between men and women; (2) older patients with HD perceived differences in coping between men and women; and (3) the relationship between stress and coping would be different in women and men.

Method

Sampling and Samples

Between October, 2002 and January, 2003, patients were asked to complete questionnaires during face-to-face interviews with trained nursing managers. The interviewer training program involved both a general introduction to survey interviewing and fieldwork techniques and procedures and a review of stress and coping strategies. Kappa was used to represents the rating agreement among interviewers. Inter-rater agreement was high (kw=.859, $p<.001$). Each interview, conducted during a hemodialysis visit, lasted from one-half to 1 h. This study was approved by the institutional review board of Kaohsiung Veterans Hospital. All participants gave written informed consent.

To be included in this study, participants were required to have been on dialysis for at least 3 months and be no less than 65 years of age. Out of the 333 hemodialysis centers open in 2002, only 27 centers were willing to participate in this study. In total, we interviewed 877 elderly hemodialysis out-patients from five medical centers, five regional hospitals, ten community hospitals, seven independent hemodialysis centers located in 13 counties. Two patients were excluded because their questionnaires were incomplete, leaving us with 875 participants from outpatient hemodialysis units or centers and making an effective response rate of 99.77%.

Instruments

The questionnaire had three sections. The first collected demographic data, including age, gender, marital status, education, occupation, and religion, as well as information about dialysis treatment (length of time on dialysis, major reasons for the dialysis, comorbidities, and frequency of dialysis). The second section contained a 32-item stressor scale made up of 29 questions from the Hemodialysis Stressor Scale (HSS) (Baldree et al. 1982) and three questions suggested by a panel of experts was used to rate incidence and severity of stressors associated with hemodialysis. The three questions were about the operation for an arteriovenous fistula, puncture failure, and frequent dialysis staff change. Subjects rated the extent to which they were troubled by each of the 32 stressors on a four-point scale (0=not at all, 1=slightly, 2=moderately and 3=a great deal). A subtotal stressor scale score was computed by adding the ratings for items belonging to the same construct. Therefore, the higher the score, the greater the stress. The internal consistency alpha coefficient reported by previous studies ranged between .89 and .93, indicating good internal reliability (Baldree et al. 1982; Yeh and Chow 2007). The reliability of this study was .93. The instrument also has an established test–retest reliability coefficient of

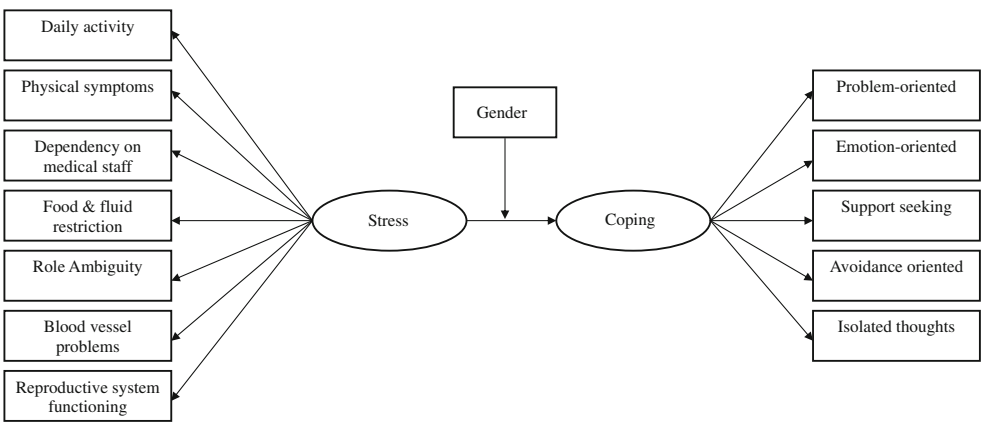

Fig. 1 Conceptual framework.

r=.71 (Baldree et al. 1982). The Composite reliability of the measurement model for this scale was .848.

The third section contained the Jalowiec Coping Scale (JCS) developed by Jalowiec and Powers (1981) and translated into Chinese by Mok and Tam (2001). This instrument covers 40 different coping behaviors (25 affective-orientated and 15 problem-orientated). A four-point (0–3) Likert scale is used (0=never used, 1=seldom used, 2=sometimes used and 3=often used). Construct validity of the scale was tested by a panel of experts from the Midwest Nursing Research Society who were familiar with stress and coping literature and thus yielded a high percentage of agreement (Jalowiec and Powers 1981). The internal consistency reliability coefficient of the total scale has been reported to be .92 (Yeh and Chow 2007) and .84 for the problem-orientated coping sub-scale and .74 for the affective-orientated coping sub-scale (Gurklis and Menke 1988). The test–retest reliability of the Chinese instrument was assessed by a pilot study in which four chronic hemodialysis patients were administered the questionnaire twice over a 2-week span, and was found to have a reliability of .87 (Mok and Tam 2001). In this study, the independent reliability was .92, while the composite reliability of this scale was .755.

Measure

Endogenous Variable

Coping was the latent and endogenous variable in this study. We used five observed variables which theoretically reflected coping strategies from previous works (Yeh and Chow 2007). They were: (1) problem-orientation (e.g., looking at the problem objectively and seeing all sides, finding out more about the problem, and establishing a plan of action); (2) emotion-orientation (e.g., telling yourself that the problem was someone else's fault, worrying about the problem, or blaming yourself for getting into such as situation); (3) support seeking (e.g., talking the problem over with a professional person and praying or putting your trust in God); (4) avoidance-orientation (e.g., smoking more than usual and eating more than usual); and (5) isolated thoughts (e.g., getting away from the problem and thinking of something else). We summed the items to receive a subtotal score for each subscale.

Exogenous Variable

Stress, our exogenous variable, was subcategorized into type of hemodialysis related stressors: (1) daily activity, defined as the changes influencing daily activities (e.g., limitation what kind of clothes that can be worn or limitations in what kind of work can be done, etc.); (2) physical symptoms, including nausea, vomiting, muscle cramps, joint stiffing, fatigue, and loss of bodily function; (3) dependence on medical staff, defined as frequent hospital admissions, dependence on staff and doctors, fear of staff turnover and fear of being alone; (4) food and fluid restriction, defined as intake restriction; (5) role ambiguity, defined as change in family responsibility, spousal role and children's roles; (6) blood vessel problems, those related to the problems of A–V fistula operation, A–V fistula that cannot be punched and insufficient blood flow through A–V fistula; and (7) reproduction system functioning, defined as decreased sexual drive (including erectile dysfunction) and infertility. Items were summed to get a subtotal score for each subscale.

Control Variables

We controlled for age, education (illiterate [as reference group], elementary and junior high, high, as well as bachelor and above), occupation (employed [as reference group], unemployed, retired), religion (traditional [as reference group], Taoism, Buddhism, Catholic, Christian, and others), and marital status (married coded as 1; others coded as 0) in all analyses. The decision of what factors would be control variables in the model was based on the differences existing between two groups from the results of univariate analysis.

Data Analysis

Descriptive analysis was used to present demographic data, type and intensity of stress and coping styles. The group differences in continuous variables (e.g., age, duration, and comorbidities) were examined using t tests. The association between categorical variables and gender were tested using chi-square tests. Mean differences between the elderly males and females in coping and stress scores were also examined. Since stressors were interrelated, MANOVAs were performed to examine if the gender difference existed. Similar analyses were performed for coping.

In order to conclude whether or not there were any associations between stressors and coping strategies across groups, we had to examine whether there were any differences in measurement models across the groups. To do this, we performed two-group confirmatory factor analysis (CFA) to test the equivalence of the measurement models across the two groups. If consistency was found from both groups, then we proceeded to multi-group testing. Measurement invariance was defined with varying degrees of stringency, depending on which parameters were constrained to be equal. First, we tested for measurement invariance in the unconstrained model (baseline model, configural equivalence) for all groups combined, then for a model where certain parameters were constrained to be

equal between the groups. If the chi-square difference statistic did not reveal a significant difference between the baseline and the constrained-equal (metric equivalence) models, then we concluded that there was measurement invariance across groups in the model, i.e. it could be applied across groups. Second, we tested for invariance on factor loadings. Measurement invariance was defined when the factor loadings of indicator variables on their respective latent constructs did not differ significantly between the two groups. Third, we tested equality of error term variances across groups, i.e. uniqueness equivalence (Byrne 2001; Cheung and Rensvold 1999). The purpose of testing uniqueness variance was to examine the proportion of the variance of an observed variable that is not attributable to the variance of the underlying construct. Fourth, we examined whether the variability in constructs was equal across groups. Equivalence in construct variance had to be supported before we could compare construct correlations across groups (Byrne 1994). Finally, invariant construct covariance was also examined (Byrne 2001). Covariance reflects the strength of the relationships among the constructs. Cross-group comparisons of covariance are preferred to comparisons of correlation, because correlation is standardized within groups and therefore has different units across groups (Cheung and Rensvold 1999; Singh 1995). The Tucker–Lewis Index (TLI) or Comparative Fix Index (CFI) were used as the indexes for comparison in this study. Chi-square was used to compare the differences between male and female groups.

After we examined the equivalence of measurement models across groups, we performed two-group structural analysis to test whether the structural coefficients (βs) between stress and copings were equal or unequal across the two groups. Specifically, we constrained the structural coefficient of stress to coping in male and female group as equal (constrained model) and next freely estimated the coefficient of which in both groups (unconstrained model). If the chi-square values between the constrained and unconstrained models revealed a statistically significant difference, this indicates that the relationships of stress to coping vary by gender for elderly hemodialysis patients. In our structural equation model, age, education, marital status, occupation and religion were considered as exogenous or control variables. Stress was assumed to exert a direct influence on coping.

Results

Table 1 reports the sample profile and individual differences between female and male elders. The mean age of the study sample was 72.9 years (SD=5.63; ranged 65–95 years). Females, who made up 52.9% of our sample, were almost 1 year younger than males (t value=−2.515; p value=.012). About 79% were married, with females lower than males (25.3% vs. 84.2%; χ^2=11.93; p value=.001). The two genders were also differences in education (χ^2=144.46; p value<.001), occupation (χ^2=298.64; p value <.001), as well as religion (χ^2=59.54; p value<.001). The women had been on dialysis for an average of 49.4 months and the men for 48.5 months without statistical significant difference. The men had a higher average number of comorbidities than the women, though this difference was not significant (men, .813; women, .786). Most of the participants were undergoing dialysis three times weekly.

The MANOVA results indicated that there were significant difference in overall stress (F(7, 867)=4.18, p<.001; η^2=.03) between females and males (Table 2). One-way analysis of variance indicated that three out of seven stressors were significant difference between two genders, including physical symptoms (F=7.320, p=.007), blood vessel problems (F=8.159, p=.004), and reproductive system functioning (F=8.275, p=.004). As shown in Table 2, women had reported higher stress in response to physical stress (women's mean=5.575, men's mean=4.937) and vessel stress (women's mean=3.758, men's mean=3.254) than the men. On the other hand, the men reported higher stress in response to reproductive system functioning (women's mean=1.514, men's mean=1.790) than the women. Hypothesis 1 was supported.

For coping strategies, the results from MANOVA showed that there were differences between females and males (F(5, 869)=14.25, p<.001; η^2=.08). Then, the results from series one-way ANOVAs indicated three out of five copings, including motion-oriented (F=15.389, p<.001), support seeking (F=3.290, p<.001), and avoidance-oriented (F=8.397, p=.004), were statistical difference between the two genders. The female participants had significantly higher scores than the males in two coping strategies: emotion-orientation (women's mean=6.747, men's mean=5.447) and support-seeking (women's mean=4.546, men's mean=3.575). The male participants had significantly higher scores than the females in avoidance (women's mean=.586, men's mean=.839). Hypothesis 2 was supported.

CFAs were used to test the adequacy of the measurement models across groups. Table 3 summarizes the hierarchical tests. First, the model without constraints provided a baseline chi-square for further comparisons. The results showed good measurement model fit, $\chi^2_{(106)}$ = 693.62, CFI=.93, TLI=.96, and Root Mean Square Error of Approximation (RMSEA)=.08. This meant the number of constructs and the particular observed variables associated with each construct were the same across groups (Meredith 1993). Second, the strength of the relationship between an observed variable and its underlying construct was indicated by the size of factor loading. We constrained the equality of factor loadings across

Table 1 Sample profile and individual differences between male and female elders (n=875).

	Female (n=463)	Male (n=412)	Mean difference	t value (χ^2 value)	p value
Age (years; mean)	72.50	73.45	−.950	−2.515	.012
Duration of dialysis (months)	49.44	48.52	.910	.337	.736
Education				(144.46)	<.001
Illiterate	256 (55.77%)	86 (20.98%)			
Elementary	140 (30.50%)	145 (35.37%)			
Middle school	27 (5.88%)	62 (15.12%)			
High school	27 (5.88%)	57 (13.90%)			
Undergraduate and above	9 (1.96%)	60 (14.63%)			
Marital status (yes)	117 (25.3%)	347 (84.2%)		(11.93)	.001
Occupation				(298.64)	<.001
Employed	10 (2.18%)	52 (12.81%)			
Unemployed	350 (76.42%)	72 (17.73%)			
Retired	98 (21.40%)	282 (69.46%)			
Religion				(59.54)	<.001
None	29 (6.35%)	101 (24.63%)			
Traditional	124 (27.13%)	88 (21.46%)			
Taoism	102 (22.32%)	59 (14.39%)			
Buddhism	159 (34.79%)	126 (30.73%)			
Catholic, Christian, others	43 (9.41%)	36 (8.78%)			
Causes of hemodialysis				(3.649)	.456
Diabetes	130 (28.32%)	110 (26.76%)			
Hypertension	36 (7.84%)	35 (8.53%)			
Renal diseases	184 (40.09%)	164 (39.90%)			
Others	35 (7.63%)	45 (10.95%)			
Unknown	74 (16.12%)	57 (13.87%)			
Number of comorbidities (mean)	.786	.813	−.027	−.519	.604
Heart disease	117 (26.1%)	90 (22.4%)		(1.552)	.213
Hypertension	145 (32.29%)	148 (36.82%)		(1.921)	.116
Cancer	6 (1.34%)	8 (1.99%)		(.560)	.454
Tuberculosis	4 (.89%)	7 (1.74%)		(1.202)	.273
Other pulmonary diseases	9 (2.01%)	11 (2.74%)		(.495)	.505
Liver diseases	25 (5.57%)	23 (5.72%)		(.009)	.923
Others	47 (10.47%)	40 (9.95%)		(.062)	.804

groups to test factor loadings invariance. The non-significant difference in chi-square between the model 2 (metric equivalence) and model 1 (baseline model) indicated that the factor loadings of the two measurement models were invariant $\left(\Delta\chi^2_{(10)} = 11.05;\ p\,\text{value} > .05\right)$.

We found that the observed variables reflect the constructs with the same degree of measurement error across groups. The results (model 3) indicated that the error variances of the measurement models (uniqueness equivalence) across the two groups were not equivalent $\left(\Delta\chi^2_{(10)} = 35.89,\ p\,\text{value} < .05\right)$.

Then, we examined the invariance in construct variance (model 4, equivalence in construct variance) and found that non-significant in construct variance between male and female groups $\left(\Delta\chi^2_{(1)} = 1.10, p\,\text{value} > .05\right)$. Based on the results of the model 4, the equality of covariance of the latent variables across the two groups could be finally tested (model 5, equivalence in construct covariance). The results showed that the men and women were no different in construct covariance $\left(\Delta\chi^2_{(1)} = 0.55,\ p\,\text{value} > .05\right)$. In summary, the results of measurement equivalence indicated that in four out of the five models there was no across-group difference. We found consistent factor loading to the respective latent variables, stress and coping, across the male and female groups (Figs. 2 and 3).

Table 4 shows the results of structure equation modeling that investigate the relationship between stress and coping between male and female elders with hemodialysis. Controlling for age, education, marital status, occupation and religion, we found that the results from two-group structural coefficient between stress and copings were equal across groups $(\Delta\chi^2_{(1)} = .73,\ p\,\text{value} > .05)$. This meant that there were no significant differences in the relationship between stressors and coping strategies between the elderly male and female hemodialysis patients in our study, which was different with our expectation from hypothesis 3.

Table 2 Mean difference in stress and coping between male and female elders (n=875).

	Female mean (n=463)	Male mean (n=412)	Mean difference	F	η^2	p value
Stress						
MANOVA results	$F(7, 867)=4.18$, $p<.001$; $\eta^2=.03$					
Daily activity	4.242	4.253	−.011	.001	.000	.971
Physical symptoms	5.575	4.973	.602	7.320	.008	.007
Dependency on medical staff	4.635	4.243	.393	2.655	.003	.104
Food and fluid restriction	5.017	5.125	−.107	.257	.000	.612
Role ambiguity	1.675	1.496	.179	1.249	.001	.264
Blood Vessel problems	3.758	3.254	.504	8.159	.009	.004
Reproductive system functioning	1.514	1.970	−.456	8.275	.010	.004
Coping						
MANOVA results	$F(5, 869)=14.25$, $p<.001$; $\eta^2=.08$					
Problem-oriented	11.013	11.637	−.624	1.253	.001	.263
Emotion-oriented	6.747	5.447	1.299	15.389	.017	<.001
Support seeking	4.546	3.575	.971	30.290	.034	<.001
Avoidance-oriented	.586	.839	−.254	8.397	.010	.004
Isolated thoughts	2.899	2.812	.086	.329	.000	.567

Stressors and copings are in scores. The ranges of each subscales as follows: daily activity (0–18), physical symptoms (0–15), dependency on medical staff (0–15), food and fluid restriction (0–12), role ambiguity (0–6), blood vessel problem (0–12), reproductive system functioning (0–9), problem-oriented (0–39), emotion-focused (0–24), seeking support (0–12), avoidance-oriented (0–12), and isolated thoughts (0–9). MANOVA were used to test the variance difference between female and male elders

Additionally, we added path coefficients to each parameter of the different diagrams for both females and males. Figures 4 and 5 demonstrated statistically significant difference in the positive relationship between stress and coping both for males (.671) and females (.673). The coefficient has no big difference for both groups while controlling several patient characteristics. Thus, Hypothesis 3 was not supported. For those control variables, several variables were affecting the stress-coping relationship in male and female subgroups. For example, education (middle school versus illiterate, $t=-3.07$, $p<.001$; high school versus illiterate, $t=-2.52$, $p<.05$) and marital status ($t=-2.77$, $p<.01$) demonstrated statistical significance in male group. For female group, education (middle school

Table 3 Tests for the equivalence of the measurement models across groups.

Measurement model	Goodness of fit	Tests of equivalence of measurement model
Model 1: configural equivalence (baseline model, no constraints)	$\chi^2_{(106)} = 693.62$ CFI=.93 TLI=.96 RMSEA=.08	
Model 2: metric equivalence (factor loadings specific invariant)	$\chi^2_{(116)} = 704.67$ CFI=.94 TLI=.96 RMSEA=.08	Model 2–model 1: $\Delta\chi^2_{(10)} = 11.05$, $p>.05$
Model 3: uniqueness equivalence (factor loadings and error variances specified invariant)	$\chi^2_{(128)} = 740.56$ CFI=.94 TLI=.95 RMSEA=.07	Model 3–model 2: $\Delta\chi^2_{(12)} = 35.89$, $p<.05$
Model 4: equivalence in construct variance (factor loadings, error variances, and construct variance specified invariant)	$\chi^2_{(130)} = 741.66$ CFI=.94 TLI=.95 RMSEA=.07	Model 4–model 3: $\Delta\chi^2_{(2)} = 1.10$, $p>.05$
Model 5: equivalence in construct covariance (factor loadings, error variances, construct variance, and construct covariance specified invariant)	$\chi^2_{(131)} = 742.21$ CFI=.94 TLI=.93 RMSEA=.07	Model 5–model 4: $\Delta\chi^2_{(1)} = .55$, $p>.05$

Number of subjects in females and males were 463 and 412, respectively

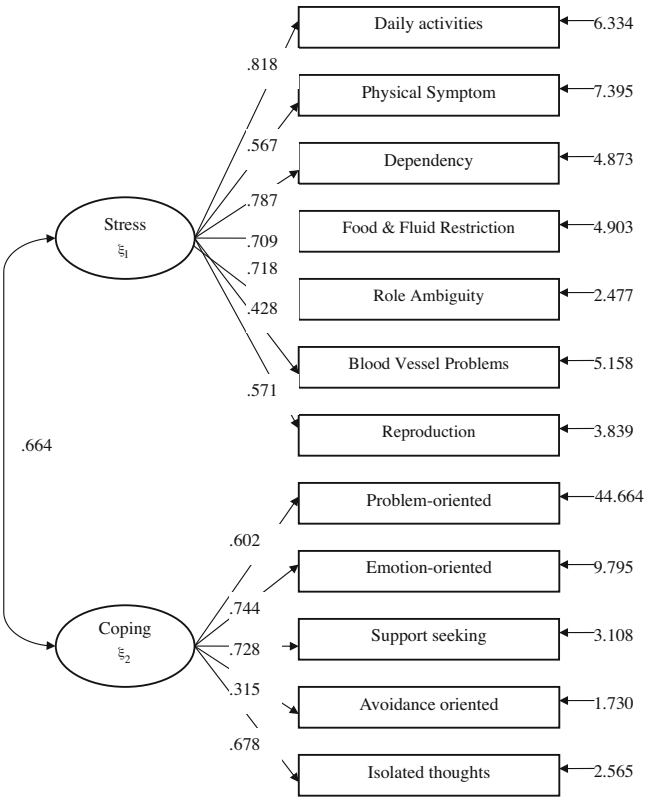

Fig. 2 Stress and copings measurement model for male (n=412). Models adjusted for individual differences, age, education, marital status, occupation, and religion.

versus illiterate; t=−3.07, p<.001) was negatively related to coping, and retired (versus employed; t=2.23, p<.05) were statistically and positively related to coping. Other control variables did not appear statistical significance.

Discussion

Based on the results of univariate analyses, elderly male patients on hemodialysis perceived different stressors and used different coping strategies than their female counterparts. The female participants felt higher stress than males in response to physical symptoms and vessel status, a result that is similar to that of Lindqvist et al. (1998), in which men regarded themselves as better able to cope with physical aspects of the illness, though they had not included the issue of reproductive ability. Previous studies have also found women to perceive more personal changes (Trocki and Orioli 1994), perceive more stress (Matud 2004), and have greater physical symptoms (Krantz et al. 2005; Trocki and Orioli 1994). Men, as stated above, report greater stress than women in response to possible problems in reproduction system functioning. Literature has indicated that male patients on hemodialysis experience a higher prevalence of erectile dysfunction (up to 86.6%) especially in those over 50 years old (Arslan et al. 2002). The sample that we studied here were elderly and their sex drive played a more crucial role for their overall sexual functioning than their ability to procreate.

Our results indicated that women were more inclined to emotion-focused coping strategies than men. This is consistent with others' findings (Lindqvist et al. 1998; Ptacek et al. 1994; Vingerhoets and Van Heck 1990). Women also feel powerless more often when they are angry (Crawford et al. 1992). Crying is one response item that falls under the domain of emotion-focused strategies and thus seems to fulfill a useful and valuable function to women. Emotional experience pervades our entire life both directly and indirectly. The occasions to learn about emotions are countless. We learn from experiencing our own emotions, or from others' reaction to them, from observing other's experience of emotions, or from emotional stories as told in novels or movies. Moreover, we are motivated to become emotionally competent, because, as most of us discover quite early in life, emotional incompetence is likely to result in social rejection, loneliness, or greater stress (Saarni 1988).

Emotionality is an ambiguous concept. If women are expected to be more emotional than men, does this mean that, in comparison with men, they have more intense emotions, longer-lasting emotions, more frequent emotions,

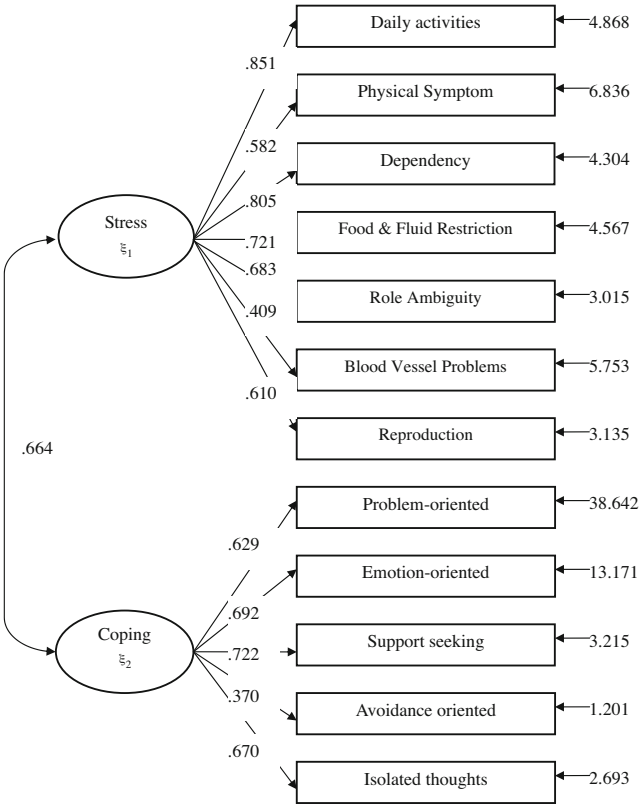

Fig. 3 Stress and copings measurement model for female (n=463).

Table 4 Structural equation modeling across male and female groups.

Variables	χ^2 differences test	Standardized path coefficients (t value)	
		Male	Female
Stress→copings	$\Delta\chi^2_{(1)} = .73, p > .05$	.671 (14.78)***	.673 (14.78)***
Age	$\Delta\chi^2_{(1)} = 3.39, p > .05$	−.058 (−1.786)	−.058 (−1.786)
Education			
Elementary	$\Delta\chi^2_{(1)} = .23, p > .05$	−.033 (−.897)	−.033 (−.897)
Middle school	$\Delta\chi^2_{(1)} = .19, p > .05$	−.130 (−3.07)***	−.089 (−3.07)***
High school	$\Delta\chi^2_{(1)} = 4.10, p < .05$	−.138 (−2.52)*	.022 (.50)
Undergraduate and above	$\Delta\chi^2_{(1)} = .64, p > .05$	−.071 (−1.41)	−.029 (−1.41)
Marital status	$\Delta\chi^2_{(1)} = 9.19, p < .05$	−.129 (−2.77)**	.057 (1.25)
Occupation			
Unemployed	$\Delta\chi^2_{(1)} = .66, p > .05$	.049 (.93)	.057 (.93)
Retired	$\Delta\chi^2_{(1)} = 5.60, p < .05$	−.058 (−.91)	.237 (2.23)*
Religion			
Traditional	$\Delta\chi^2_{(1)} = .00, p > .05$	.032 (.72)	.036 (.72)
Taoism	$\Delta\chi^2_{(1)} = 1.19, p > .05$	.010 (.25)	.012 (.25)
Buddhism	$\Delta\chi^2_{(1)} = .26, p > .05$	−.073 (−1.59)	−.079 (−1.59)
Catholic, Christian, others	$\Delta\chi^2_{(1)} = .19, p > .05$	.006 (.16)	.006 (.16)

*p<.05; **p<.01; ***p<.01

emotions that occur in a larger variety of contexts, or in reaction to stimuli of lesser magnitude? Does "emotionality" imply greater competence in emotion-related behaviors, such as expressing one's emotions and understanding others, or does it instead imply emotional incompetence (Zammuner 2000; page 48).

We also found the elderly female hemodialysis patients in this study tended to seek more social support than the males. Seeking social support deserves some attention, because it refers to attempt to mobilize informational, emotional, and/or instrumental support from one's social network (Vingerhoets and Scheirs 2000; page 143). Previous literature has demonstrated that women are tending to affiliate with a social group (Taylor 2006) as well as expressing and communicating emotions to others (Luckow et al. 1998). Through communicating or networking with others, female patients might gain knowledge they need to deal with their stressors. Knowledge helps patients regain a sense of control over their experiences and environment and helps reduce feelings of vulnerability. Therefore, encouraging patients to seek professional support from medical staff is a key element to ease their distress. Seeking support from not just health professionals but also some type of counseling, therapy, or support group can benefit elderly patients and families experiencing HD. Social support has been documented in reducing stress (Bolger and Eckenrole 1991; House et al. 1988). Future studies may clarify which categories of social support (e.g., emotional, tangible, and informational) might contribute more significantly to how well we deal with stress.

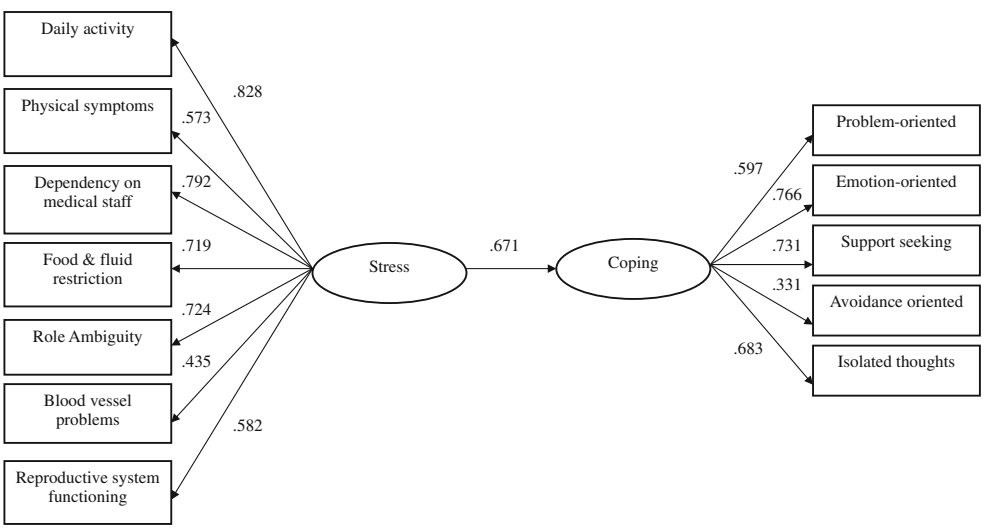

Fig. 4 Path coefficients for elderly males with HD. Path coefficients for individual differences, age, education, marital status, occupation, and religion were controlled but not shown.

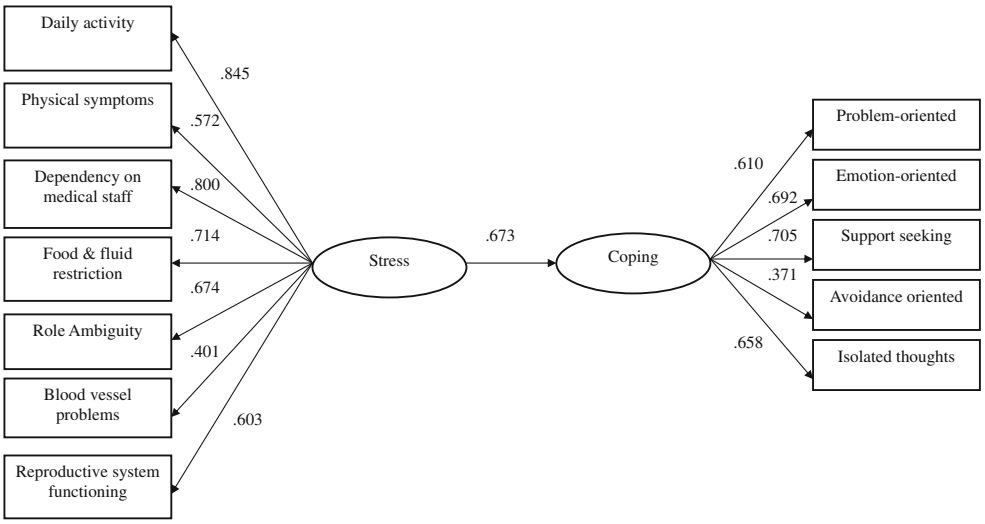

Fig. 5 Path coefficients for elderly females with HD. Path coefficients for individual differences, age, education, marital status, occupation, and religion were controlled but not shown.

The male hemodialysis patients in this study used more avoidance than the female patients. According to Holahan and Moos (1987), avoidance coping strategies lead people into activities (such as alcohol use) or mental states (such as withdrawal) that keep them from directly addressing stressful events. This avoidance behavior included starting the habit of smoking or increasing the number of cigarettes they smoke, engorging food irregularly, and getting drunk more often than before HD treatment. The behavior commonly has gender stigma on men than women in oriental countries. Namely, men used avoidance coping were more likely to be accepted in the society. These findings may be limited to Asian cultures; only further studies can substantiate were they can further generalized.

The results also indicated that male hemodialysis patients had higher stress in reproductive system functioning than female patients had. The measurement of reproductive system functioning in this study included decreased sexual drive (including erectile dysfunction) and infertility. Sexual dysfunction is highly prevalent in ESRD patients on hemodialysis (Peng et al. 2007; Peng et al. 2005; Rosas et al. 2001). According to Palmer (1999) and Procci et al. (1981), approximately 50% of ESRD men complain of erectile dysfunction while an even greater percentage of both men and women complain of decreased libido and a marked decline in the frequency of intercourse.

Sexual dysfunction is composed of both physiological (Ledda 2000; Peng et al. 2007; Rosas et al. 2001) and psychological factors (Baldwin 2001; Kimmel 2000; Rosas et al. 2001). For example, diseases (i.e., hypertension, diabetes, coronary heart disease), pain, and aging process are the physiological factors, whereas depression and emotion are the psychological factors. Several studies showed that erectile dysfunction should be a serious problem among older men, but may not for younger patients. However, studied on 281 patients (20–60 years) with four groups (hemodialysis, peritoneal dialysis, kidney transplantation, and rheumatoid arthritis (comparison group), Toorians et al. (1997) found that sexual dysfunction in men on hemodialysis or peritoneal dialysis was not so much due to erectile failure but largely to loss of sexual interest, subjectively ascribed to fatigue. The latter was also found in women on hemodialysis or peritoneal dialysis. Since we did not respectively use the designated scales, such as the index of erectile dysfunction for male, the results from this study could not only represent the frequent problem, erectile dysfunction, for male only. Instead, the construct of reproductive system functioning for male included sexual drive decreased and erectile dysfunction.

We did not find elderly male hemodialysis patients in our study to use problem-oriented coping style more frequently than their female counterparts, a finding that differs from previous reports (Erosy-Kart and Guldu 2005; Ptacek et al. 1992; Vingerhoets and Van Heck 1990). The difference might be found due to age; the previous studies did not focus on patients over 65 years old.

Both stress and coping are processes which cannot be directly observed. Our results indicated that the measurement models were not serious distinctive across male and female groups. However, there was a difference in error variance, which is frequently rejected in social science research (Cheung and Rensvold 1999). Thus, we can conclude that the association between stress and coping strategies are quite similar across male and female groups. These results did not come from a difference in measurement models. Regardless of gender, the effects of stress are directly linked to coping strategies. Stress is difficult for scientists to define because it is a subjective sensation or perception associated with various symptoms.

Coping is clearly a complex process influenced by many factors, including personality characteristics (Bolger 1990; Friedman et al. 1992), situational demands (Folkman et al. 1986; Heim et al. 1993), and the social and physical characteristics of the setting (Folkman et al. 1986). In

addition, cultures and societies also have their own set of rules for what they perceive as stressful (Colby 1987). Furthermore, since each factor has the power to influence the others, the true relationship between stress and copings can only be captured when time is included as one of the variables. Thus, longitudinal studies are crucial in order to truly reflect the long-term effects and processes that take place within this relationship.

In conclusion, elderly female patients on hemodialysis perceived higher stress in physical symptoms and vessel problem, while male patients had greater stress in reproduction system functioning. With regard to coping strategies female patients often used emotion-focused or support-seeking strategies, and male patients used more avoidance. These findings were comparable with previous studies although most of them did not use elderly as their study subjects. In addition, the association between stress and coping strategies were quite similar across male and female groups after controlling for demographic factors and measurement models. Although we believe many chronic diseases, like ESRD, possess similar characteristics, further research is needed with other populations to validate the gender difference in the linkage between stress and coping, particularly for the elderly groups. Psychological factors play a crucial role in the disease evaluation process in patients with chronic disease. They usually are very complex and involve multi-factorial processes. By exploring the gender difference between stress and coping, our results provide evidence on how male and female elderly perceived and coped with their stress. The experience may facilitate medical staff developing different methods in helping elders adjusting to the disease related stressors.

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