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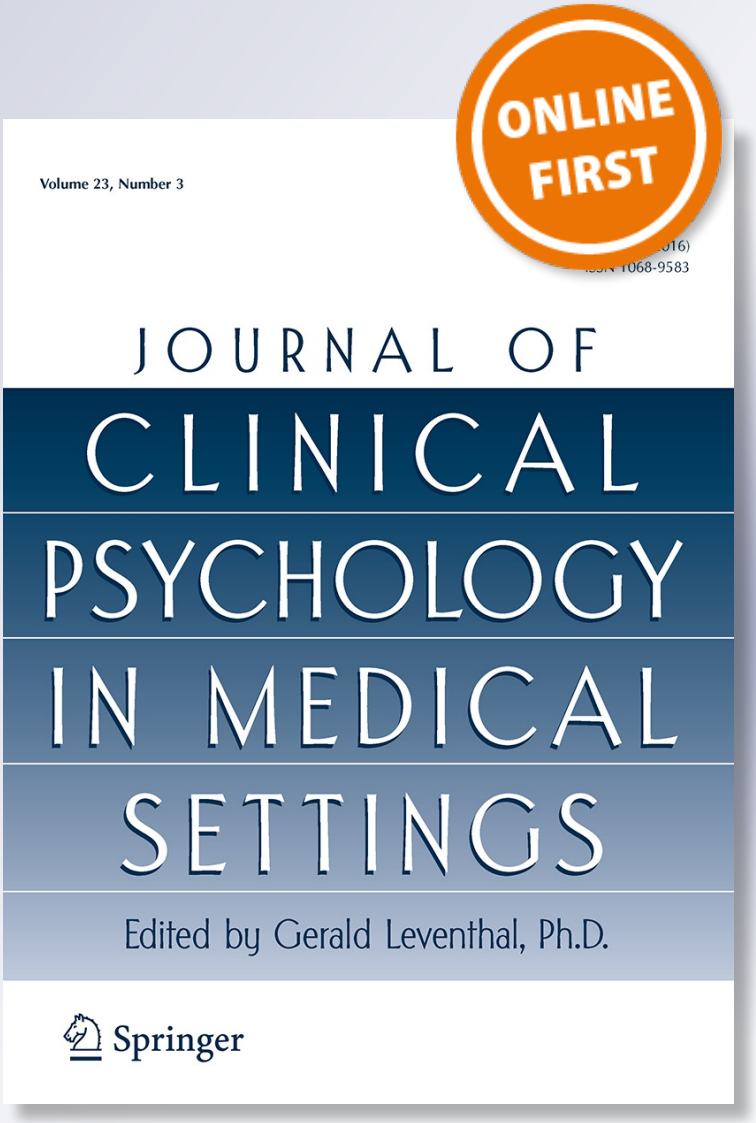
Journal of Clinical Psychology in Medical Settings

ISSN 1068-9583

J Clin Psychol Med Settings
DOI 10.1007/s10880-016-9470-y



Springer

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Self-Care Adherence and Psychological Functioning of Older Patients with Type 2 Diabetes: Effects of Persuasion, Social Pressure, and Self-Efficacy

Fang Yang[1] · Joyce S. Pang[2] · Wendy J. Y. Cheng[3]

Abstract This cross-sectional study examined the role of family members' use of persuasion versus pressure as distinct forms of social control by which family members attempt to encourage better diabetes management among older adults with type 2 diabetes mellitus (T2DM). The study also examined how self-efficacy might moderate the relationship between persuasion/pressure, psychological functioning, and self-care adherence. Participants were 96 men and 103 women with T2DM, with a mean age of 63.3 years. Regression results show that neither persuasion nor pressure was significantly related to self-care adherence, but persuasion and pressure were associated in complex ways with diabetes-related emotional distress and depressive symptoms for which significant interaction effects were found. Patients with lower self-efficacy benefited from persuasion, but were adversely affected by pressure. In contrast, patients with higher self-efficacy were adversely affected by persuasion, but were less negatively affected by pressure. Findings highlight the importance of reducing pressure-based social control, considering patients' self-efficacy when family members seek to influence patients' self-care behaviors, and targeting patient-family interactions in future interventions.

Keywords Persuasion · Pressure · Self-efficacy · Diabetes · Psychological functioning

Introduction

Diabetes mellitus is one of the most prevalent chronic diseases globally, and the prevalence continues to increase. In Singapore, type 2 diabetes mellitus (T2DM) accounts for more than 90 % of patients with diabetes, and the prevalence in people aged 50–59 and 60–69 was 19.3 % and 29.1 % respectively (Ministry of Health, Singapore, 2011). Individuals with T2DM have to make persistent efforts in multiple domains to manage the disease (De Ridder, Geenen, Kuijer, & van Middendorp 2008). For instance, patients have to engage in daily self-care activities (e.g., following a dedicated diet, exercising regularly, and testing blood glucose), all of which are crucial in glycemic control and complication prevention (Barlow, Wright, Sheasby, Turner, & Hainsworth, 2002). However, patients may face challenges to better adherence, including difficulty changing lifestyle habits and experience of emotional distress or even depression (Delamater, 2006; Elliott, Shewchuk, Miller, & Richards, 2001).

As diabetes requires life-long self-care activities, family members could play a significant role in patients' disease management by providing hands-on help with blood glucose testing, or exercising with patients (Rosland, 2009; Umberson, Crosnoe, & Reczek, 2010). Family members also could provide emotional support or use social

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Published online: 13 October 2016

influence to encourage patients' use of appropriate self-care behaviors (Stephens, Franks, Rook, Hemphill, & Salem, 2013). Given the importance of family members' involvement, family-oriented interventions have been developed (Armour, Norris, Jack, Zhang, & Fisher, 2005). However, such interventions have been found to produce only small effects (Martire, Lustig, Schulz, Miller, & Helgeson, 2004). For example, Martire et al., (2004) found that psychosocial interventions targeting a patient's family member or both the patient and their family members had positive, yet small effects on patients' psychosocial adjustment (e.g., a decrease in depression) compared to usual medical care interventions. Martire and Schulz (2007) argued that perhaps previous research did not sufficiently bolster healthy interaction between family members and patients. This view implies that there is merit in further addressing the interaction between family members and patients.

Social Control, Behavioral Adherence, and Psychological Functioning

Health-related social control (hereafter referred to as social control) is one such interpersonal mechanism wherein family members exert regulatory influence on patients' health behaviors (Umberson, 1987). This mechanism operates when members of a social network attempt to regulate, influence, or constrain health behaviors, with the aim of preventing health-damaging behaviors, or increasing health-enhancing behaviors (Lewis & Rook, 1999; Umberson, 1987). When a patient's family members believe that the patient is falling behind in diabetes self-care activities, they may engage in social control attempts with the aim of encouraging better self-care adherence. However, social control from family members may not always be beneficial to patients. Family members' attempts may communicate a sense of disapproval of or dissatisfaction with the patient's current health behaviors. As a result, even though patients might change unhealthy behaviors, they also may experience emotional distress or negative affect (Hughes & Gove, 1981; Lewis & Rook, 1999). This "dual effects model" suggests that family members' social control attempts could facilitate positive behavioral change, but simultaneously increase psychological distress (Lewis & Rook, 1999).

A dual effects model of social control is not consistently supported in previous chronic illness research (Franks et al., 2006; Khan, Stephens, Franks, Rook, & Salem, 2013; Stephens et al., 2009). In the diabetes literature, for instance, Grzywacz et al. (2012) found that T2DM patients who received greater social control displayed poorer self-management and more depressive symptoms. Stephens et al. (2013) studied the differential effects of pressure (e.g., criticizing or persistent nagging from family members) versus persuasion (e.g., convincing by reasoning or using logic), and they found that pressure, but not persuasion, was associated with more diabetes-related emotional distress (e.g., worries about diabetes complications). Given these differing findings in the literature, the relationship between social control, psychological functioning, and behavioral adherence is complex and requires more analysis.

More recent research has examined the variables that moderate the relationship between social control, psychological functioning, and behavioral adherence, including gender, ethnicity, and relationship satisfaction (August & Sorkin, 2010, 2011; Tucker, 2002; Westmass, Wild, & Ferrence, 2002). For instance, August and Sorkin (2010) found that women reported more appreciation of social control than men in T2DM patients. Moreover, Rook et al. (2011) examined the role of patients' expectations of spousal social control in their diabetes management. They found that social control had beneficial effects only when patients had greater expectations of spousal social control. Thus, patients may have differential responses to social control attempts, and these variations could be due to patients' demographics, personality, and other individual difference variables. Despite the existing evidence on the moderators of this relationship, it is possible that many other moderators remain undiscovered. Specifically, we examined one such individual difference variable, self-efficacy, aiming to investigate its moderating effect on the relationship between social control, psychological functioning, and behavioral adherence.

Self-Efficacy, Behavioral Adherence, and Psychological Functioning

Self-efficacy is the perception of one's ability to carry out a certain behavior (Bandura, 1986). People with higher self-efficacy are able to better cope with the stress due to chronic illness, and are strongly motivated to perform self-care activities, thus leading to better adjustment (DeVellis & DeVellis, 2001; Schüz, Wurm, Warner, & Ziegelmann, 2012). T2DM patients with higher self-efficacy are less likely to suffer from depression (Cherrington, Wallston, & Rothman, 2010; Sacco et al., 2005), whereas T2DM patients with lower self-efficacy are more likely to experience diabetes-related emotional distress (Law, Walsh, Queralt, & Nouwen, 2013). Moreover, self-efficacy facilitates patients' daily foot exam practice (Chin, Huang, & Hsu, 2013) and physical activity (Dutton et al., 2009). Thus, self-efficacy is beneficial for psychological functioning and behavioral adherence among T2DM patients.

Self-Efficacy and Social Control

Levels of self-efficacy have a regulatory effect on patients' response to social control (Pajares, 1997). Self-perceived confidence might influence patients' views of social control from family members, in turn leading to differential emotional or behavioral reactions. For patients with higher self-efficacy, social control may be viewed as an intrusion in their diabetes management, which threatens their confidence to manage diabetes effectively (Berg et al., 2013). The lack of fit between patients' higher self-efficacy and a home environment with overly solicitous family members could be psychologically damaging. However, patients with lower self-efficacy may welcome and value such family members' involvement, thus benefitting psychologically from social influence.

Accordingly, evidence shows that self-efficacy moderates the effect of external influence on psychological outcomes in patients with chronic illness. In a recent review regarding the moderators of the effects of psychosocial interventions in oncology, Tamagawa et al. (2012) found that patients with lower self-efficacy had better psychological adjustment (e.g., decreased depressive symptoms) than those with higher self-efficacy. Similarly, patients with lower self-efficacy displayed greater improvements in health-related quality of life compared with patients with higher self-efficacy after participating in lay-led self-management courses and psychoeducational interventions (Helgeson, Lepore, & Eton, 2006). These findings suggest that patients with lower self-efficacy achieve greater psychological benefits from psychosocial and behavioral interventions compared to patients with higher self-efficacy.

In addition, according to the person-environment fit model, the influence from the social environment (e.g., social control from family members) should lead to better psychosocial adjustment provided that the social environment fits with individual characteristics (e.g., self-efficacy; French, Rodgers, & Cobb, 1974; Parmelee & Lawton, 1990). Thus, we suggest that the type of social control demonstrated by the family members (persuasion vs. pressure) determines the environment in which patients have to adapt to and cope with diabetes. In turn, the family environment interacts with patients' level of self-efficacy to affect their psychological adjustment to their condition.

The social control literature highlights the importance of distinguishing between forms of social control, here defined as either persuasion or pressure (Stephens et al., 2013). Persuasion refers to positive strategies (e.g., motivating by pointing out the benefits of adherent behaviors, or convincing by means of reasonable and logical comment), whereas pressure involves negative strategies (e.g., criticizing or nagging). Research shows that persuasion is associated with improved blood glucose in adolescents with diabetes (Berg et al., 2013), behavioral adherence (Lewis & Rook, 1999; Stephens et al., 2009), and positive emotions (Lewis & Rook, 1999; Okun, Huff, August, & Rook, 2007; Stephens et al., 2009). On the other hand, research shows that pressure is related to the hiding of unhealthy behavior, decreased behavioral adherence, and negative emotions (Okun et al., 2007; Stephens et al., 2013). Nevertheless, other studies show that persuasion is related to sadness and guilt (Lewis & Rook, 1999) and decreased behavioral adherence (Stephens et al., 2013), while pressure is associated with behavioral change (Lewis & Rook, 1999; Stephens et al., 2009). Given the inconsistent findings regarding the effects of persuasion-based versus pressure-based tactics in social control, it is important to examine the circumstances under which the negative effects of persuasion and the positive effects of pressure are more likely to occur.

The Present Study

Thus, our study has two major aims. First, we examined the role of persuasion-based and pressure-based social control in diabetes management. We hypothesized that both persuasion-based and pressure-based social control tactics exerted by family members are associated with better self-care behavioral adherence. We expected that patients try to improve their behavioral adherence at the urging of family members, regardless of the strategies their family members use. Second, we examined whether self-efficacy moderated the association between persuasion/pressure, psychological functioning, and behavioral adherence. It was expected that patients with lower self-efficacy benefit more from persuasion than those with higher self-efficacy, but are more adversely affected by pressure than those with higher self-efficacy. By testing the moderating role of self-efficacy, the present study endeavored to elucidate the differential associations between persuasion/pressure, psychological outcomes, and behavioral adherence at different levels of self-efficacy and to inform current family-oriented intervention programs.

Methods

Participants and Procedure

Participants were eligible for study participation if they met the following criteria: (a) diagnosed with Type 2 diabetes for 1 year or longer; (b) 50 years of age or older; (c) Chinese Singaporeans (Singapore citizens with Chinese ethnicity); and (d) no major complications or other severe diseases that would interfere with their self-care activities.

Singapore is a multi-cultural society, however since cultural norms affect family structures and attitudes towards health, we limited our study only to Chinese participants, which form the major ethnic group in the country. Considering the multi-lingual context for Chinese Singaporeans, we prepared two sets of survey (English and Chinese) to fit participants' language preference. We translated the questionnaires from English to Chinese, and nine patients participated in cognitive interviewing (Conrad & Blair, 2004) to finalize the translated scales. During the cognitive interviewing, participants were asked to answer the items of the scales and respond to the probes, which were used to capture participants' cognitive process and detect possible translation issues. Patients diagnosed with diabetes for at least 1 year were recruited, as the medical regimen in the first year may change frequently and it takes time for patients to find a routine that ensures adequate glycemic control (Denham, Manoogian, & Schuster, 2007).

Participants were recruited through the use of flyers and key community contacts, including the Diabetic Society of Singapore (DSS). For example, participants were approached in DSS centers and DSS mobile clinics. This included times when they were waiting for their appointment or after attending support group activities. Data were collected during in-person interviews by trained research assistants in the meeting room of DSS or in a quiet place near the mobile clinics. Participants were first screened for eligibility based on the aforementioned inclusion criteria. Their cognitive abilities were also screened using the Mini-Mental State Exam (MMSE; Folstein, Folstein, & McHugh, 1975) by trained interviewers to ensure they had adequate cognitive abilities (e.g., MMSE score $\geq$24/30). Two hundred fourteen participants were screened for eligibility. Of these, nine were those who participated in cognitive interviewing to finalize the translated scales, five were ineligible due to age, and one was excluded due to an invalid score on the multidimensional health locus of control scale. As a result, a sample of 199 participants was included in the final quantitative analysis. Each participant was compensated with a S$ 10 voucher. All methods and procedures were approved by the Institutional Review Board of the University and the data collection was conducted between February 2012 and July 2013.

Among the participants, the mean age was 63.34 years ($SD = 8.46$), and 48.2 % were male (see Table 1). The majority were married, lived with spouse and/or children, had medical insurance, and attained secondary school as their highest education level. With respect to the clinical features, the mean time since diagnosis of diabetes was about 11.98 years ($SD = 9.25$). The majority were on medication, either insulin, oral hypoglycemic drugs, or both; 7.5 % of participants adopted lifestyle modification, 7.5 % used insulin, 73.9 % took oral hypoglycemic drugs, and 11.1 % were on both insulin and oral hypoglycemic drugs. Comorbid medical conditions were noted among 71.9 % of the participants. Of these, 115 had hypertension, 64 had hyperlipidemia, 13 had heart disease, 5 had cancer,

Table 1 Descriptive results for demographic information and diabetes-related variables

	Mean	*SD*
Age	63.34	8.46
Duration of diabetes	11.98	9.25
HbA1c	7.30	1.41
Relationship satisfaction	5.80	1.60
		n (%)
Gender		
Male		96 (48.2)
Female		103 (51.8)
Employment		
Retired		75 (37.7)
Unemployed/homemaker		30 (15.1)
Full-time		72 (36.2)
Part-time		22 (11.0)
Marital status		
Married		149 (74.9)
Others		50 (25.1)
Living arrangement		
Live with spouse and/or children		170 (85.4)
Live alone		23 (11.6)
Live with other relative		6 (3.0)
Highest education level		
Non-educated		17 (8.5)
Primary		44 (22.1)
Secondary		86 (43.2)
Junior college/polytechnic		28 (14.1)
Bachelor or above		24 (12.1)
Medical insurance		
Yes		134 (67.3)
No		65 (32.7)
Treatment		
Lifestyle modification		15 (7.5)
Insulin		15 (7.5)
Medication		147 (73.9)
Insulin and medication		22 (11.1)
Number of comorbid illness		
0		56 (28.1)
1		88 (44.3)
2		49 (24.6)
3		5 (2.5)
4		1 (0.5)

and 4 had other conditions that were not specified. With respect to one important index of glycemic control, 46.8 % of the participants reported a level of HbA1c no greater than 7, 44.2 % of the participants reported a level higher than 7 and 9 % of the HbA1c values were missing ($M = 7.30$, $SD = 1.41$; American Diabetes Association, 2014). HbA1c information was obtained from the DSS nurses after getting the informed consent from patients.

Measures

Covariates

General information was collected, including socio-demographics, diabetes duration, diabetes treatment, most recent HbA1c, comorbidity, and relationship satisfaction level with family members (Lewis & Rook, 1999; Tucker, 2002). Relationship satisfaction was measured by one item "How satisfied do you feel about the relationship with your family?" This item was measured on a 7-item scale ranging from 1 = *extremely dissatisfied* to 7 = *extremely satisfied* (Tucker, 2002). In addition, internal health locus of control (IHLC) was measured; IHLC is the degree to which individuals attribute own health to internal factors, i.e., their own behaviors (Wallston, Stein, & Smith, 1994). Patients with higher IHLC are more likely to engage in health behaviors, deal better with stress, and achieve better well-being (e.g., Spikmans, Brug, Doven, Kruizenga, Hofsteenge, & van Bokhorst-van der Schueren, 2003). IHLC was measured by the 6-item subscale of the Multidimensional Health Locus of Control Scale (Wallston, Stein, & Smith, 1994). Two example items are: "If my diabetes worsens, it is my own behavior which determines how soon I will feel better again" and "I am directly responsible for my diabetes getting better or worse." Each item was assessed on a 6-point Likert scale ranging from 1 = *strongly disagree* through 6 = *strongly agree*. The sum of values of the six items indicated IHLC level, with higher scores denoting a high level of internal health locus of control. The reliability of the scale for the present study was Cronbach's $\alpha = .80$.

Health-Related Social Control

Participants were asked how often their family members used persuasion and pressure strategies to influence them to change diabetes-related behaviors (Lewis & Rook, 1999; Tucker, Elliott, & Klein, 2006; Tucker & Mueller, 2000). Persuasive social control strategies were measured by 6 items; sample items include "Reward me when I try to change diabetes-related behaviors (e.g., diet, exercise)" and "Offer to help me change diabetes-related behaviors (e.g., diet, exercise)." Pressure strategies of social control were measured by 4 items; sample items include "Try to make me feel guilty" and "Pressure me to change diabetes-related behaviors (e.g., diet, exercise)." Each item was rated on a 7-point Likert scale ranging from 1 = *never* to 7 = *at least once a day*. Persuasion was measured by averaging responses to the six persuasion items; pressure was measured by averaging responses to the four pressure items. For both the persuasion score and the pressure score, possible scores ranged from 1 to 7, with higher scores denoting greater persuasion or pressure. The internal consistency reliability of the persuasion and pressure scales for the present study was Cronbach's $\alpha = .91$ and .86 respectively.

Diabetes Self-Efficacy

Diabetes self-efficacy was measured by the subscale of the Multidimensional Diabetes Questionnaire (MDQ; Talbot, Nouwen, Gingras, Gosselin, & Audet (1997). The self-efficacy subscale comprises seven items measuring patients' confidence in their ability to perform diabetes self-care activities (e.g., diet, exercise, medication). For example, "How confident are you in your ability to follow your diet?" and "How confident are you in your ability to test your blood glucose at the recommended frequency?" Responses were rated on a scale ranging from 0 = *not at all confident* to 100 = *very confident*. The average of the responses was used to indicate self-efficacy level in diabetes management, with higher scores denoting higher self-efficacy. Self-efficacy has been found to be positively associated with regimen adherence ($\beta = .77$), and physical and mental health quality of life ($\beta = .20$ and $\beta = .34$ respectively; Lee & Lin, 2009). The reliability of the scale in this study was Cronbach's $\alpha = .88$.

Self-Care Activities

Self-care activities were measured by a multidimensional measure, the Summary of Diabetes Self-Care Activities (SDSCA; Toobert & Glasgow, 1994). The SDSCA has 11 items that assess the following six aspects: general diet, specific diet, exercise, blood glucose testing, foot care, and smoking. For example, for the general diet domain, one item asked: "How many of the last 7 days have you followed a healthy eating plan?" For the exercise domain, one item asked: "On how many of the last 7 days did you participate in at least 30 min of physical activity? (Total minutes of continuous activity, including walking)." For the blood glucose testing domain, one item asked: "On how many of the last 7 days did you test your blood glucose?" For the foot care domain, one item asked: "On how many of the last 7 days did you check your feet?"

Participants responded to each item on a scale that ranged from 0 = 0 *days* to 7 = 7 *days*. Due to the low inter-item correlation for specific diet, the two items assessing that aspect were excluded (Toobert, Hampson, & Glasgow, 2000). Moreover, the majority of participants did not smoke, and so item 11 was also excluded. Thus, the version of the SDSCA used in this study consisted of 8 items that covered four domains, general diet, exercise, blood glucose testing, and foot care, with each domain represented by two items. Average scores for each domain were created first, such that each domain was assessed by an average number of days that could range from a minimum of zero to a maximum of seven. The averages for the four domains were then added up to form a composite score with higher scores indicating more frequent overall self-care activities. The score ranged from 0 to 28. The reliability of the scale in this study was Cronbach's $\alpha = .70$. Diabetes self-care is multidimensional (e.g., exercise, diet, glucose monitoring) and often these dimensions do not overlap, which might be the reason for the relatively low reliability for the 8 items of SDSCA in this study (Delamater, 2006).

Diabetes-Related Emotional Distress

The Problem Areas in Diabetes Scale-1 (PAID-1) assesses emotional functioning of patients with diabetes (Polonsky et al., 1995). Participants were asked to what extent they experienced diabetes-related problems. For example, "Feeling overwhelmed by your diabetes" and "Worrying about the future and the possibility of serious complications." Each item was assessed on a 5-point scale ranging from 0 = *not a problem* to 4 = *serious problem*. The sum of the 20 items was multiplied by 1.25 to yield a final score ranging from 0 to 100 with higher scores denoting higher distress. High internal reliability (Cronbach's $\alpha = .90$) and sound 2-month test–retest reliability ($\gamma = .83$) have been established (Resource Centers for Minority Aging Research, 2006). The reliability of the scale in this study was Cronbach's $\alpha = .96$.

Depressive Symptoms

The Patient Health Questionnaire-9 (PHQ-9) is a reliable and valid screening measure of depression (Kroenke, Spitzer, & Williams, 2001). The PHQ-9 consists of nine items, which are directly based on the nine diagnostic criteria for major depression disorder in the DSM-IV. Two examples of items are: "Over the last 2 weeks, how often have you been bothered by little interest or pleasure in doing things?" and "Over the last 2 weeks, how often have you been bothered by feeling down, depressed, or hopeless?" Each item was assessed on a 4-point Likert scale ranging from 0 = *not at all* through 3 = *nearly every day*. It has been shown to be reliable and effective in geriatric Chinese population (Wang et al., 2014). Responses to the nine items were added up to yield an index of depressive symptomology ranging from 0 to 27, with higher scores denoting more severe depressive symptomology (Lamers et al., 2008; Sacco & Bykowski, 2010). The reliability of the scale in this study was Cronbach's $\alpha = .85$.

Method of Analysis

IBM SPSS 19 was used to perform the analyses. Descriptive statistics were first calculated for sample characteristics. Then three sets of hierarchical regression analyses were conducted to test the interaction between persuasion/pressure and self-efficacy on diabetes-related emotional distress, depressive symptoms, and self-care adherence respectively, with control for seven covariates that are often associated with psychological functioning in patients with diabetes—age, gender, marital status, relationship satisfaction, duration of the disease, the number of comorbid illnesses (Lewis & Rook, 1999; Stephens et al., 2013), and IHLC (Spikmans et al., 2003). Continuous variables were mean-centered, and the mean-centered values were then used to create the interaction term (i.e., persuasion × self-efficacy). In the hierarchical regression, covariates were included in Model 1, persuasion, pressure, and self-efficacy were added in Model 2, and the interaction between persuasion/pressure and self-efficacy was added in Model 3. The slope of outcome variables on persuasion or pressure at high and low levels of self-efficacy (1 SD above and below the mean, respectively) was examined using unstandardized regression coefficient (Cohen, Cohen, West, & Aiken, 2003).

Results

Preliminary Analyses

The mean of diabetes-related emotional distress was 23.59 ($SD = 21.19$). For depressive symptoms, the mean for PHQ-9 was 4.08 ($SD = 4.38$); 14 participants had scores higher than 10, denoting potential major depressive disorder based on the widely used cut-off point (Manea, Gilbody, & McMillan, 2012). We informed the DSS nurses about these participants, and the nurses provided a referral. Regarding self-care activities, the mean of general dietary behavior was 5.24 ($SD = 1.83$), the mean of exercise was 3.01 ($SD = 2.12$), the mean of blood glucose monitoring was 2.46 ($SD = 2.63$), and the mean of foot care was 3.39 ($SD = 3.03$). The mean of overall self-care activities was 14.01 ($SD = 5.74$).

The inter-correlations among the key variables can be seen in Table 2: persuasion was positively related to self-

Table 2 Correlations among the key variables

	1	2	3	4	5	6
1. Persuasion	–					
2. Pressure	.46***	–				
3. Self-efficacy	.12	−.10	–			
4. Emotional distress	.08	.31***	−.29***	–		
5. Depressive symptoms	−.02	.12	−.28***	.61***	–	
6. Self-care activities	.18**	.08	.36***	−.14	−.19**	–
Mean	3.89	2.03	72.90	23.59	4.08	14.01
SD	1.77	1.37	16.24	21.19	4.38	5.74
N	198	198	199	199	199	198

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

care activities, and pressure was positively related to diabetes-related emotional distress. In addition, self-efficacy was positively related to self-care activities, and negatively related to diabetes-related emotional distress and depressive symptoms.

Regression Analyses

Separate hierarchical regression analysis was performed for each outcome variable. Tables 3, 4, and 5 show the regression results for each outcome variable.

In the case of diabetes-related emotional distress (Table 3), results of Model 1 show that age, marital status, and IHLC were negatively associated with diabetes-related emotional distress, and the effects of other covariates were not significant. Patients who were older, currently married, and had higher IHLC tended to experience less diabetes-related emotional distress. Results of Model 2 show that pressure was positively associated with diabetes-related emotional distress. In Model 3, the interaction between persuasion and self-efficacy was significant, whereas the interaction between pressure and self-efficacy was not. As indicated in Fig. 1, simple slope tests showed that persuasion was positively related to diabetes-related emotional distress for those with higher self-efficacy, $t(181) = 5.99$, $p < .001$, i.e., for persons with greater self-confidence in their own ability to perform diabetes self-care activities, the more frequent attempts by family members' to use persuasion to influence the patients, the greater the patients' diabetes-related emotional distress. In contrast, persuasion was negatively associated with diabetes-related emotional distress for those with lower self-efficacy,

Table 3 Regression results of persuasion/pressure and self-efficacy for diabetes-related emotional distress ($N = 194$)

Variables	Step 1 Model 1 β	Step 2 Model 2 β	Step 3 Model 3 β
Age	−.20**	−.13	−.13
[a]Gender	−.02	−.05	−.05
[b]Marital status	−.20**	−.15*	−.13
Relationship satisfaction	−.11	−.07	−.05
Duration of the disease	−.10	−.07	−.07
Number of comorbid illness	.07	.05	.07
Internal health locus of control	−.20**	−.16*	−.19**
Persuasion		−.02	−.04
Pressure		.29***	.29***
Self-efficacy		−.13	−.12
Persuasion × self-efficacy			.16*
Pressure × self-efficacy			−.13
R^2	.134	.229	.250
F for ΔR^2	4.141***	7.503***	2.652
ΔR^2		.095	.021

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

[a] Gender: male versus female, female is the reference group

[b] Marital status: married versus others. others is the reference group

Table 4 Regression results of persuasion/pressure and self-efficacy for depressive symptoms ($N = 194$)

Variables	Step 1 Model 1 β	Step 2 Model 2 β	Step 3 Model 3 β
Age	−.06	−.02	−.02
[a]Gender	−.07	−.08	−.08
[b]Marital status	−.20**	−.17*	−.12
Relationship satisfaction	−.09	−.06	−.01
Duration of the disease	−.09	−.07	−.08
Number of comorbid illness	.04	.03	.07
Internal health locus of control	−.22**	−.19**	−.25***
Persuasion		−.05	−.09
Pressure		.14	.14
Self-efficacy		−.11	−.08
Persuasion × self-efficacy			.32***
Pressure × self-efficacy			−.28***
R^2	.123	.152	.241
F for ΔR^2	3.738***	2.119	10.614***
ΔR^2		.029	.089

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

[a] Gender: male versus female, female is the reference group

[b] Marital status: married versus others. others is the reference group

Table 5 Regression results of persuasion/pressure and self-efficacy for self-care activities ($N = 194$)

Variables	Step 1 Model 1 β	Step 2 Model 2 β	Step 3 Model 3 β
Age	.11	.06	.06
Gender[a]	−.01	−.02	−.02
Marital status[b]	−.02	−.08	−.10
Relationship satisfaction	.17*	.10	.09
Duration of the disease	.05	.05	.06
Number of comorbid illness	−.01	.04	.03
Internal health locus of control	.11	.06	.08
Self-efficacy		.32***	.31***
Persuasion		.08	.10
Pressure		.11	.11
Persuasion × self-efficacy			−.12
Pressure × self-efficacy			.14
R^2	.053	.166	.184
F for ΔR^2	1.486	8.292***	1.910
ΔR^2		.113	.018

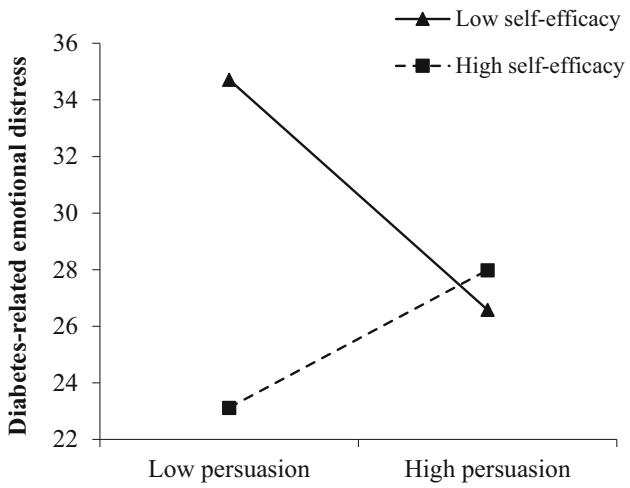
* $p < .05$, ** $p < .01$, *** $p < .001$

[a] Gender: male versus female, female is the reference group

[b] Marital status: married versus others. others is the reference group

$t(181) = -8.55$, $p < .001$, i.e., for persons with lower self-confidence in their ability to perform diabetes self-care activities, more frequent attempts by family members' to use persuasion to influence the participants were associated with reduced participants' diabetes-related emotional distress.

In the case of depressive symptoms (Table 4), results of Model 1 show that marital status and IHLC were negatively associated with depressive symptoms, such that patients who were currently married and had higher IHLC tended to experience fewer depressive symptoms. Results of Model 2 show that persuasion, pressure, and self-



Note Persuasion was associated with higher diabetes-related emotional distress for patients with higher self-efficacy, and with lower diabetes-related emotional distress for patients with lower self-efficacy

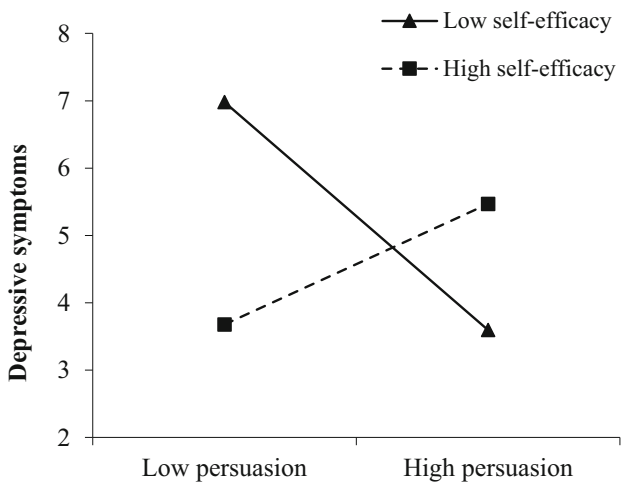
Fig. 1 Interaction between persuasion and self-efficacy on diabetes-related emotional distress

efficacy were not significantly associated with depressive symptoms. In Model 3, the interaction between persuasion and self-efficacy and the interaction between pressure and self-efficacy were significantly associated with depressive symptoms. As indicated in Fig. 2, further analysis demonstrates that greater persuasion by family members was associated with elevated depressive symptoms for patients with higher self-efficacy, $t(181) = 2.21$, $p = .029$, whereas greater persuasion by family members was associated with decreased depressive symptoms for patients with lower self-efficacy, $t(181) = -3.56$, $p < .001$. Moreover, as seen in Fig. 3, for the pressure-by-family-members variable, a very different pattern emerged. Greater pressure was positively related to depressive symptoms for patients with lower self-efficacy, $t(181) = 4.21$, $p < .001$, but greater pressure was not significant associated with depressive symptoms for patients with higher self-efficacy, $t(181) = -1.25$, *ns.*

In the case of self-care activities (Table 5), across the three models, only self-efficacy was positively related to self-care activities, but the covariates, persuasion, pressure, and their interaction terms were not significant.

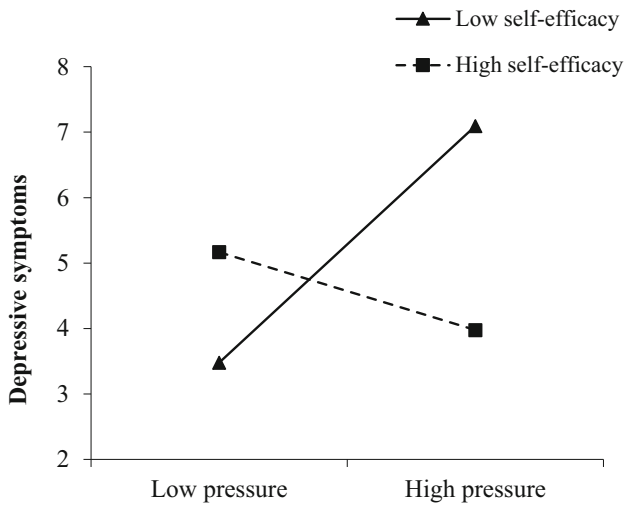
Discussion

To the best of our knowledge, the present study is the first attempt to test the role of family members' use of persuasion and pressure as strategies of social control that are intended to improve a patient's self-care diabetes management and adherence among late-middle-aged and older adults with T2DM. Additionally, we believe the study may be the first to focus on the moderating role of patient self-efficacy as a factor that affects the actual (vs. intended) impact of family members' social influence attempts to improve adherence among adults with T2DM. Regression results show that, irrespective of family members' intentions and objectives, neither their use of persuasion nor use of pressure was significantly associated with self-care adherence. Perhaps external influence (e.g., social control) plays a trivial role in self-care adherence for the current



Note Persuasion was associated with higher depressive symptoms for patients with higher self-efficacy, and with lower depressive symptoms for patients with lower self-efficacy

Fig. 2 Interaction between persuasion and self-efficacy on depressive symptoms



Note Pressure was associated with higher depressive symptoms for patients with lower self-efficacy, and was not significantly associated with depressive symptoms for those with higher self-efficacy

Fig. 3 Interaction between pressure and self-efficacy on depressive symptoms

sample; instead, internal factors (e.g., self-efficacy) significantly facilitate self-care adherence. In light of inconsistent findings of the effect of social control on behavioral adherence (Khan et al., 2013; Stephens et al., 2013), more research is needed to explore this relationship. Moreover, patients' self-efficacy moderated the relationship between persuasion/pressure and psychological functioning. Patients with lower self-efficacy benefitted from family members' persuasion attempts, but were adversely affected by family members' use of pressure. In contrast, patients with higher self-efficacy were adversely affected by family members' persuasion attempts, and were less negatively affected by family members' use of pressure. Taken together, the current study elucidated the relationship between persuasion- and pressure-based social control, psychological functioning, and behavioral adherence, especially the moderating role of self-efficacy in the relationship.

The moderating role of self-efficacy emphasizes the importance of the person-environment fit to patients' psychological functioning. Results on persuasion and psychological functioning suggest that persuasion may produce a compensation effect for patients with low self-efficacy, whereas an interference effect for patients with high self-efficacy. Patients with lower self-efficacy may view persuasion from family members as a useful way of remedying their low level of confidence in self-care behaviors, and perceive that family members are offering genuine help to encourage better self-care behavioral adherence. Thus, these patients might experience less diabetes-related emotional distress and fewer depressive symptoms than those with higher self-efficacy. Conversely, patients with higher self-efficacy tend to exert control over their environment or behaviors, whereas external influence might reduce these patients' own sense of internal control and they may perceive the influence from family members as a sign of dissatisfaction of or mistrust in their abilities, thus producing more diabetes-related emotional distress and depressive symptoms. With respect to pressure, we found that increased pressure from family members was associated with higher diabetes-related emotional distress, and that pressure was associated with more depressive symptoms among low self-efficacious patients than among their high self-efficacious counterparts. Higher self-efficacy could help patients buffer the negative consequence of pressure due to their high confidence level and coping resources, whereas the poor psychological functioning for patients with lower efficacy is further exacerbated by pressure from family members. This finding suggests the importance of remaining alert to the negative consequences of pressure, especially for patients with lower self-efficacy.

Furthermore, we found that those who were currently married and had higher IHLC tended to experience less diabetes-related emotional distress and fewer depressive symptoms, and age was associated with less diabetes-related emotional distress. The findings were consistent with previous research (Fisher et al., 2008; Lipscombe, Burns, & Schmiz, 2015; Rubin & Peyrot, 1999). Marriage could provide social support and help patients better deal with diabetes-related stress, which in turn, reduces the overall level of psychological distress (Cutrona, 1996; Lipscombe, Burns, & Schmiz, 2015). Similarly, the beneficial effect of higher IHLC is likely due to greater resources and personal coping abilities, and these could enable patients to achieve better psychological adjustment (Peyrot & Rubin, 1994; Rubin & Peyrot, 1999). Regarding the negative association between age and diabetes-related emotional distress, perhaps older patients may cope with diabetes-related challenges more effectively using adaptive strategies than their younger counterparts, thus leading to a lower level of diabetes-related emotional distress (Fisher et al., 2008; Yang, Gu, & Mitnitski, 2016).

The study has important implications for the clinical practice. Singapore's culture places high values on the role of family, and Singaporeans view family as the center of their social structure. In addition, there is a significant cultural emphasis on respect for the elderly. Thus, it is meaningful to understand how to better mobilize the resource of the family to help the elderly with their diabetes management and show respect to them through the family's involvement. In addition, family members should consider patients' levels of self-efficacy in diabetes management. Such a recommendation is in line with other research that highlights the importance of open communication between family members and patients (Lewandowski & Palermo, 2009). It would be beneficial for family members to be mindful of patients' perspectives about their own abilities to manage diabetes, and such a practice promotes patients' needs for autonomy (Schokker et al., 2011; Williams et al., 1998). Future interventions could teach family members how to support patients' inherent need to make their own choices and carry out daily activities independently (Martire & Schulz, 2007). More importantly, family members should reduce the use of negative social control strategies, which produce adverse consequences for those with lower self-efficacy. Meanwhile, it is equally important for patients to communicate their needs and preferences with their family members, and identify the aspects of their health in which they want family members to get involved.

Several limitations for the study should be noted. First, it is important to consider the potential selection bias of participants. It is possible that those who are active in their self-care activities or who achieve relatively good psychological adjustment self-selected to participate in this study. Moreover, the focus on late-middle-aged and older

Chinese Singaporeans with certain demographic characteristics may limit the generalizability of the results. Second, social control from family members was measured by patients' self-report, rather than family members' report. This may cause some discrepancy between the two. However, social support literature demonstrates that perceived social support is more informative than received social support (Haber, Cohen, Lucas, & Baltes, 2007). Moreover, previous research shows that patients' reports of social control are more informative for understanding their own self-care activities and psychological health than family members' reports (Berg et al., 2013). Thus, the use of patients' report of social control is not an issue. Third, this study used a cross-sectional survey, and so cannot demonstrate directionality between the variables and the results should be interpreted with caution. Studies using daily diary methods, in which self-efficacy, family members' social control, self-care activities and psychological health can be measured more frequently are needed to substantiate the causal relationships between the variables in future research (Stephens et al., 2013).

Despite these limitations, this study added to the literature by examining the role of self-efficacy in the relationship between family persuasion/pressure, psychological functioning, and self-care adherence in older adults with diabetes. We found that persuasion and pressure have differential associations with diabetes-related emotional distress and depressive symptoms for patients with varying levels of self-efficacy. The findings highlight the importance for family members to consider patients' self-efficacy level when they are trying to get involved in patients' diabetes management and to reduce the use of negative social control tactics, which has meaningful implications for future intervention programs. Taken together, effective health-related social control from family members may be a useful way of helping patients improve self-care adherence and achieve better psychological functioning.

Acknowledgments Dr. Fang Yang's work was supported by a grant from Shanghai Municipal Education Commission "Chenguang Scholar Program" (15CG46) and a grant from Mitsui Sumitomo Insurance Welfare Foundation (M4060918.100). The authors gratefully acknowledge their support. The authors also thank research assistants for their assistance with data collection, the Diabetic Society of Singapore and all the patients for their support in the data collection.

Compliance with Ethical Standards

Conflict of Interest Authors Fang Yang, Joyce Pang, and Wendy J.Y. Cheng declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation of the participating institutions (Nanyang Technological University, Diabetic Society of Singapore) and with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all subjects for being included in the study.

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