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Title

Evaluating perceptions of self-efficacy and quality of life in patients with coronary artery bypass grafting and their family caregivers

Names and affiliations:

Patricia Thomson, PhD, RN, MA, MPH, Faculty of Health Sciences and Sport, University of Stirling, Stirling FK94LA Scotland, United Kingdom.

Kate Howie, BSc, Faculty of Natural Sciences, University of Stirling, Stirling FK94LA Scotland, United Kingdom.

Andrea RM Mohan, PhD, MPH, Institute of Social Marketing, University of Stirling, Stirling FK94LA Scotland, United Kingdom.

Misook L. Chung, PhD, RN, College of Nursing, University of Kentucky, Lexington KY, USA.

Corresponding author: Dr Patricia Thomson, Faculty of Health Sciences and Sport, Pathfoot Building, University of Stirling, Stirling FK9 4LA, Scotland. E-mail address: patricia.thomson@stir.ac.uk Tel: + 44 (0) 1786 466396; Fax: + 44 (0) 1786 466333

Abstract

Background: Self-efficacy is a critical factor of quality of life in patients who undergo coronary artery bypass grafting (CABG) as well as their family caregivers. However, there is lack of knowledge about whether patients' self-efficacy and caregivers' perceptions of patient self-efficacy are associated with quality of life in two member dyads.

Objectives: To compare self-efficacy and quality of life between patients and family caregivers and to examine whether patients' and caregivers' perceptions of patient self-efficacy were associated with their own, and their partner's quality of life who were waiting for CABG.

Methods*:* In this cross-sectional study, 84 dyads (85% male patients and 87% female caregivers) completed the Cardiac Self-Efficacy scale that consisted of self-efficacy for controlling symptoms and self-efficacy for maintaining function subscales, and the Short-Form 12 Health Survey for quality of life. Data were analyzed using the Actor-Partner Interdependence Model

Results: Caregivers' rated patient self-efficacy for maintaining function higher than the patients themselves and their perceptions were positively correlated with the patients' physical health. Patients' self-efficacy for maintaining function exhibited an *actor effect* on their own mental health. There were no other *actor* or *partner effects* of self-efficacy on quality of life.

Conclusions*:* Differences between patients' and caregivers' perceptions of patient self-efficacy for maintaining function should be addressed before surgery to reduce discordance.

Patients' self-efficacy for maintaining function was associated with their own quality of life. There was no *partner* (relationship) *effect* of self-efficacy on quality of life. More research is needed in this area.

Introduction

Coronary artery bypass grafting (CABG) is a surgical treatment option for patients with advanced atherosclerotic coronary heart disease. Quality of life of patients awaiting CABG is poor and it has been affected by physical factors such as poor physical health [1] and severity of angina,[2] and mental health,[3] including low self-efficacy.[4] High levels of self-efficacy have been shown to promote health behaviour change, support self management and improve health status through reducing symptom burden and physical limitations in patients with coronary artery disease. [4-8] Socioeconomic deprivation is also a predictor of poor cardiovascular outcomes in patients undergoing CABG**.**[9,10]

Self efficacy as a concept is derived from Bandura' social cognitive theory of behaviour; defined as an individual's confidence in his or her ability to perform a given task.[11,,12] The theory of self-efficacy proposes that an individual's perceptions of his or her ability to perform certain health behaviours influences their health outcomes.[11,**12**] Patient recovery and adjustment after CABG, although largely determined by their physical condition and treatment, may be influenced by perceived self-efficacy. Patients with similar levels of physical impairment may achieve different functional outcomes, depending on their

perceived self-efficacy.[13-14] Furthermore, a spouse's or partner's confidence in the patient's capabilities can influence health-related outcomes as well.[15,16]

There may be differences between patients' and caregivers' perceptions of patient self-efficacy and this could influence the level of support provided to the patient, and also patient and caregiver outcomes[17,18] Poorer quality of relationship between caregiver and patient, greater patient symptoms and caregiver strain are associated with caregivers overestimating patient self-efficacy.[17] Whilst substantive research has examined the patient and caregiver relationship in heart failure,[19-23] and whether spouse confidence predicts patient survival following heart failure, [24] the effect of self-efficacy in patient-partner dyads in CABG has been rarely examined.[14] Previous self-efficacy research has mostly involved a single assessment of either patients or caregivers.[5-7,14,25-30] Such an individualised approach ignores the interdependency of behaviours or beliefs within the patient and partner relationship.[31]

Because patients and family caregivers are affected by the patients' health status, interactions in patient and caregiver dyads are inevitable. The relationship between patient and caregiver is nonindependent. The Actor-Partner Interdependence Model (APIM), based on Interdependence theory, allows investigators to examine the inter-relatedness of variables in dyads.[32] It provides insights into dyadic interactions by taking both the individual and family caregiver contribution into account in a single regression model. In the APIM, the association between a predictor (independent variable) and outcome (dependent

variable) for members of a dyad is composed into two distinct parts: the *actor effect* is the impact of a person's own predictor variable on his or her outcome. The *partner effect* is the impact of a person's predictor variable on his or her dyadic partner's (family caregiver's) outcome.[32-34] No pre-operative studies of CABG were found that examined the relation between patients' and caregivers' perceptions of patient self-efficacy and quality of life at the dyadic level. This study aimed to compare patients' and caregivers' perceptions of patient self-efficacy and quality of life before CABG; to examine whether patients' and caregivers' perceptions of patient self-efficacy were related to their own, and their partner's quality of life before CABG.

Methods

Design, sample and setting

This was a secondary analysis of cross-sectional data from a study of patients and family caregivers recruited from a regional cardiology centre in Scotland.[13] The population consisted of patients due to have a first time elective CABG procedure, aged 40 – 80 years of age, with stable angina pectoris – Canadian Cardiovascular Score (CCS) ii, iii, or iv) or grade ii -iv moderate to severe coronary artery disease, confirmed by coronary angiography as greater than 70% stenosis or 50%, if left main stem disease. Spouses, partners and close family members (hereafter referred to as family caregivers) were invited to participate in the study providing they lived in the same household as the patient and were identified by them as their primary carer. Patients were excluded if they were having emergency surgery, and patients and caregivers excluded if there were any major co-morbidities such as stroke

or cancer, or psychological or communication limitations likely to affect their ability to consent.

Procedure

After we received approval from the University and local Research and Ethics Committees, patients and their family caregivers were recruited prior to their first visit to the surgical out-patient clinic. Study information and consent forms were posted out to the participants with the patient's clinic appointment card. Following receipt of the signed consent forms, questionnaire packets were distributed to the participants at the clinic visit, or mailed to their home address. Patients and caregivers were asked to complete the questionnaires separately from each other and to refrain from discussing their answers. Completed questionnaires were returned to the investigator by mail or at the clinic. A reminder letter was sent after 2 weeks.

Measures

Self-efficacy

Patients' and caregivers' perceptions of patient self-efficacy were assessed using the 16 item Cardiac Self-Efficacy scale,[35] containing two sub-domains: self-efficacy for controlling symptoms (SE-CS) and self-efficacy for maintaining functioning (SE-MF). All items are rated on a five-point Likert scale ranging from 0 (not at all confident) to 4 (completely confident). The scores for SE-CS range from 0 to 32 and the scores for SE-MF range from 0 to 20, with higher scores indicating greater self-efficacy. The scale measures patient's belief in their

ability to perform certain behaviour rather than the actual measure of a given behaviour. In this study, the introduction of the scale was modified to fit the context relevant to caregivers. The validity and reliability of the Cardiac Self-Efficacy scale has been established in research.[26-29,35] No studies were found that had used the scale with caregivers. In this study, the Cronbach alpha for SE-CS was 0.75 for patients and 0.74 for caregivers; SE-MF was 0.79 for patients and 0.76 for caregivers.

Quality of Life

Patients' and caregivers' own quality of life was assessed using the Medical Outcomes Short-Form 12 Health Survey (SF-12 UK),[36] which contains a physical component score and mental component score. Rated items reflect what the individual is able to do functionally, how they felt and how they evaluated their health status. Quality of life was regarded as a multidimensional construct, to include subjective evaluation of the individual's physical and mental health, and social functioning. The physical and mental components scores were converted to t-scores and standardised against UK population data. Totalled scores ranged from 0 to 100, with higher scores indicating better physical or mental health. The psychometric properties of the SF-12 have been well established in research.[37-38] In this study, the Cronbach alpha for the physical component score was 0.77 for patients and 0.72 for caregivers; the mental component score was 0.78 for patients and 0.78 for caregivers.

Sociodemographics and clinical characteristics

Sociodemographics and past medical history were collected in brief separate interviews with the participants, using a structured questionnaire. Occupation was identified in accordance with the Office of National Statistics.[39] Social deprivation was identified using an index which takes account of income, residential postcode etc.[40] Categories range from 1 (most affluent) to 7 (most deprived). Clinical characteristics were identified from the patient's clinical records.

Data analysis

Sociodemographics, self-efficacy and quality of life were compared using the paired sample t test, or chi-square statistics. Pearson's product moment correlations were used to identify associations among continuous variables. Multilevel dyadic modelling i.e. the actor–partner interdependence model (APIM) regression for distinguishable dyads was used, based on interdependence theory.[32-34] In this study, the *actor effect* measured the impact of patient self-efficacy on his or her own quality of life; and the impact of caregivers' perception of patient self-efficacy on his or her own quality of life. The *partner effect* examined the impact between each person's perceptions of patient self-efficacy on his or her partner's quality of life.

For the dyadic analysis, all data were restructured to a pairwise dyadic data set. Grand-mean centred scores were created that were standardised using *z* scores to obtain unstandardised and standardised regression coefficients for the actor and partner effects. The residual structure was treated as heterogeneous compound symmetry.[32] Four separate

APIM models were computed; physical health was regressed on SE-MF; mental health was regressed on SE-MF; physical health was regressed on SE-CS; and mental health was regressed on SE-CS. All analyses were performed using SPSS version 21.0 for Windows, with $p < 0.05$ indicating statistical significance. A power calculation was not performed as this was a secondary analysis of data. The data came from a study of 84 patients having CABG and their caregivers.[13] In this analysis, we used multilevel dyadic modelling i.e. the APIM to evaluate perceptions of self-efficacy on the quality of life of patients and family caregivers. Previous research using the APIM has shown that 40 dyads was sufficient for conducting the dyadic analysis.[23] Given our actual sample of 84 patients and caregivers is larger we hope to achieve at least the same power.

Results

Characteristics of the participants

A total of 84 patient-caregiver dyads participated in the study (Table 1). There were 79 patient-spouse or partner pairs and five patient-family pairs. Most patients were male (85%) aged 64.5 years (SD 9.22). Most caregivers were female (87%) aged 61.0 years (SD 10.80). Additional information on the participants' characteristics is shown in Table 1.

Differences for perceptions of self-efficacy and quality of life

Patients' SE-CS was low and caregivers perceptions of patient's SE-CS was similarly low ($p = 0.164$) (Table 1). Patients' SE-MF and caregivers' perceptions of patient SE-MF were

particularly low; there was a significant difference between them for perceptions of SE-MF ($t = 2.51$, $p = 0.014$), but not for SE-CS ($t = 1.40$, $p = 0.164$) (Table 1).

In order to further examine differences between patients' and caregivers' perceptions of patient self-efficacy new variables were computed for each patient and caregiver dyad, by subtracting the caregiver score from the patient score. Based on qualitative observations of scores being the same, higher or lower, patient-caregiver dyad members with the same score (i.e. no difference in self-efficacy) were coded as 0; one person (i.e. the caregiver) in the dyad with a higher score in self-efficacy than the patient was coded as 1; and one person (i.e. the patient) in the dyad with a higher score in self-efficacy than the caregiver was coded as 2. Forty-three patients (51%) had higher scores for SE-CS than the caregivers; 33 caregivers (40%) had higher scores for SE-CS than the patients; and 8 patient-caregivers (9%) had the same score. Thirty-nine caregivers (46%) had higher scores for SE-MF than the patients; 25 patients (30%) had higher scores for SE-MF than the caregivers; and 20 patient-caregivers (24%) had the same score.

The patients' physical health was particularly poor pre-operatively, and poorer still compared to the caregivers ($t = 7.48$, $p < 0.001$) (Table 1). The patients' and caregivers' scores for mental health were similarly low ($t = 1.10$, $p = 0.275$)**.**

Correlations between ratings of self-efficacy and quality of life

Both patients' and caregivers' ratings for patient SE-MF were positively weakly correlated with the patients' physical health ($r = 0.39$, $p < 0.001$ and $r = 0.29$, $p = 0.007$, respectively) (Table 2). In addition, caregivers' ratings for patient SE-MF were weakly positively correlated with their own mental health ($r = 0.23$, $p = 0.005$). There were moderate to strong positive correlations for patients' and caregivers' perceptions of patient SE-CS and SE-MF. There were significant correlations between patients' physical health and mental health; and between patients' mental health and caregivers' physical and mental health; and between caregivers' physical and mental health (Table 2).

S*elf-efficacy and quality of life in dyadic relationships*

Patients' SE-MF exhibited an *actor effect* on their mental health (Table 3, Figure 1). Figure 1 shows the *actor effect* of the patient's SE-MF on his or her own mental health. Patients with higher SE-MF had better mental health. There was no *partner effect* of the patient's SE-MF on the caregiver's mental health. (Table 3) Thus, patients' SE-MF did not impact the caregiver's mental health. With respect to caregiver's perception of patient SE-MF, there was no *actor effect* on their own mental health, or *partner effect* on the patient's mental health (Table 3, Figure 1). Thus, caregiver' perception of patient SE-MF did not impact their own, or the patients' mental health. There were no *actor effects* or *partner effects* found for patients' and caregivers' SE-MF on their own, or their partner's physical health (Table 3), Also,, there were no *actor effects* or *partner effects* found for patients' and caregivers' SE-CS on their own, or their partner's physical or mental health (Table 3),

Discussion

This study was unique in that it compared patients' and caregivers' perceptions of patient self-efficacy and quality of life before CABG. It also examined interdependence between patients' and caregivers' in their perceptions of patient self-efficacy. Patients' SE-MF was particularly low which may be linked to their poorer physical health before CABG.[3,41] Previous research has shown that patients' low self-efficacy is related to increased symptom burden, impaired physical function and poorer quality of life, independent of disease severity and depression.[35] Evidence from the Heart and Soul Study showed that patients with stable coronary artery disease have low SE-MF.[7] Our patients awaiting CABG had lower scores for SE-MF compared to previous research.[7,42] In this study, our patients also reported low SE-CS which may be related to symptom burden and poor mental health. It is possible though that the patients' poorer mental health came first and contributed to their low self-efficacy.[8,26] However, previous research [4,7] and clinical experience indicate that patients awaiting CABG often have low self-efficacy. Use of a quality of life measure and a Cardiac Self-Efficacy scale may help in deciphering this relationship as part of pre-operative assessment.

Our results indicate there were some similarities and differences between the patients and caregivers in their perceptions of patient self-efficacy, based on our qualitative observation of scores being higher or lower. Only 9% of patient-caregiver dyads had the same scores for SE-CS, although more patient and caregiver dyads (24%) had the same scores for SE-MF. Notably, 46% of caregivers' rated patient SE-MF higher than the patients themselves, indicating some over-optimism on the part of the caregiver which could have a detrimental

effect on the patient.[14] In contrast, 51% of patients scored higher for SE-CS than the caregivers, suggesting some underestimation of the patient's capacity to self-manage. Our findings are consistent with other studies that have found patient and caregiver incongruence.[21] Such incongruence may cause conflict and distress in relation to self-care and advance care planning.**[21]** Our findings reiterate the significance of considering both patients and caregivers perspectives ,which is especially important in the education and preparation of patients awaiting CABG.

Further, our results indicate that both patients' and caregivers' perceptions of patient SE-MF were significantly positively correlated with the patients' physical health. Previous longitudinal research has shown that spousal confidence in the patient's ability to perform specified behaviours is related to patient outcomes.[15,24] The caregivers' ratings for patient SE-MF were correlated with their own mental health. No dyadic studies of patients awaiting CABG were found for comparison of our results. Previous studies of self-efficacy have mainly focused on its role in cardiac rehabilitation,[42-43] or after myocardial infarction,[8] or coronary revascularization.[35,44] In caregivers, studies of self-efficacy or caregivers' confidence in their partner (i.e. the patient) have rarely been examined.[14-16] The importance of patient and caregiver dyads in heart failure has been given much more attention,[21,24,45] and there have been studies of heart failure dyads using the APIM, which have identified actor-partner effects of self care and depression and anxiety on quality of life.[19-20,**23**]

Our study was novel in that it used the APIM as a way of examining the dyadic effect of self-efficacy on patient and family caregiver quality of life in CABG. The results revealed an *actor effect* of patients' SE-MF on his or her own mental health but not the caregivers' mental health. This indicates that self-efficacy was based more on the 'self' than on the dyad, which is consistent with Bandura's proposal that personal information has the most potential to impact self-efficacy beliefs.[12] Other studies have found that patients and caregivers influenced one another's mental and physical health, but not their self-efficacy.[18]

Our finding of an *actor effect* of patients' SE-MF on their mental health is consistent with previous research that has identified patient self-efficacy is significantly related to their mental health.[14] It was an interesting finding that patients' SE-MF and their physical health were significantly correlated in simple correlation, but yet there were no actor or partner effects. Other studies have found positive correlations between self-efficacy and physical health albeit post-operatively, and the APIM was not used.[43] This may be explained by the fact that in this type of analysis the researcher is examining associations controlling for both partner and role, so it is possible for a non-significant simple correlation to be a significant regression coefficient. To our knowledge, this is the first study to examine cross-sectionally pre-operative cardiac self-efficacy and quality of life in patients and caregivers at the dyadic level. Further research using the APIM is needed which may lead to a better understanding of the interaction in dyad members. The aim would be to work with the dyad to build self-efficacy and optimise the patient's physical and mental health and functioning before surgery.

Limitations

There were limitations to this study. First, it was a secondary data analysis using cross-sectional data which meant that the direction of causality of associations could not be determined. Second, the study sample was relatively small which limits the generalizability of the findings. This makes it difficult to know whether our null results i.e. no *partner effects* indicate unimportant dyadic relations or insufficient power. Further study is needed to support or refute our findings. Third, length of marriage or cohabitation and marital quality of the respondents was not known.

Conclusions

Patients' SE-MF was particularly low pre-operatively which may be related to perceptions of impaired physical function and poorer quality of life. Differences between patients' and caregivers' perceptions of patient SE-MF should be addressed before surgery to help promote patient functioning. Whilst the patients' SE-MF predicted with their own quality of life using the APIM, there was no dyadic effect. Further research is needed in this area.

What's New and Important:

- Patients' self-efficacy for maintaining function was particularly low before coronary artery bypass grafting (CABG), which may be linked to their impaired physical function and perceived quality of life. Use of a quality of life measure and Cardiac Self-Efficacy scale may be useful as part of pre-operative assessment.

- Differences between patient and caregiver dyads in their perceptions of patient self efficacy may lead to caregivers underestimating the patient's capacity to self manage. Addressing these differences is especially important in the education and preparation of patients awaiting CABG.

- Patients' self-efficacy for maintaining function impacted on their own mental health, but not the caregiver's mental health. There were no other *actor effects* or *partner effects* of self-efficacy on quality of life. More dyadic research is needed in this area.

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Table 1 Patients and caregivers characteristics, perceived self-efficacy and quality of life

Characteristics	Patients	Caregivers	*p*
Age in years (median, range)	65.0 (40-80)	63.0 (24-82)	<0.001*
Males	71 (85%)	11 (13%)	<0.001*
Employment:			
Employed	17 (20%)	31 (37%)	0.030
Unemployed or retired	67 (80%)	53 (63%)	
Occupation:			
Professional – intermediate	26 (31%)	11 (13%)	0.046
Skilled non manual –manual	19 (23%)	20 (24%)	
Partly skilled – unskilled	39 (46%)	53 (63%)	
Education in years (median, range)	10.0 (9-21)	10.0 (9-20)	0.742
Social deprivation:			
Depcat 1 - 2	24 (28%)	-	
Depcat 3 – 5	41 (49%)	-	
Depcat 6 – 7	19 (23%)	-	
Hypertension	53 (63 %)	7 (8%)	<0.001*
Diabetes mellitus	19 (23%)	2 (2%)	<0.001*
Angina	78 (93%)	-	
Age onset of angina (median, range)	60.0 (40-79)	-	
Breathlessness	46 (55%)	-	
Myocardial infarction	32 (38%)	-	
Age of first MI (median, range)	60.5 (32-75)	-	
Number of first MI	27 (32%)	-	
Canadian Cardiovascular Society (CCS)			
CCS 1 – 2	42 (50%)	-	
CCS 3 – 4	47 (56%)	-	
Missing or no chest pain	6 (7%)	-	
New York Heart Association (NYHA)			
Class 1 – 2	32 (38%)	-	
Class 3 – 4	36 (43%)	-	
Missing	5 (6%)	-	
Left ventricular ejection fraction			
> 50%	55 (65%)	-	
30 – 49% (moderate impairment)	20 (24%)	-	
< 29% (severe impairment)	2 (3%)	-	
Missing	7 (8%)	-	
Waiting time for CABG (mean, days)	63.17	-	
Number of diseased vessels			
Single-two vessel disease	35 (42%)	-	
Three-vessels	43 (51%)	-	
Missing	6 (7%)	-	
SE-CS (mean, SD)	18.5 (6.12)	17.5 (5.93)	0.164
SE-MF (mean, SD)	5.1 (4.71)	6.3 (5.42)	0.014*
PCS (mean, SD)	30.4 (8.64)	46.9 (10.92)	<0.001*
MCS (mean, SD)	44.17 (11.50)	45.8 (11.34)	0.275

Depcat, social deprivation category; CABG, coronary artery bypass grafting; SE-CS, self-efficacy for controlling symptoms; SE-MF, self-efficacy for maintaining function; PCS, physical component score; MCS, mental component score. $p < 0.05$*

Table 2 Correlations among patients' and caregivers' perceptions of patient self-efficacy and quality of life

	Correlation matrix							
	1	2	3	4	5	6	7	8
1. Patients' self-efficacy for control symptoms (SE-CS)	-							
2. Patients' self-efficacy for maintain function (SE-MF)	.176							
3. Caregivers' perceptions of patient (SE-CS)	.427**	.176						
4. Caregivers' perceptions of patient (SE-MF)	.263*	.618**	.239*					
5. Patients' physical component score (PCS)	.067	.399**	.083	.291*				
6. Patients' mental component score (MCS)	-.125	.193	-.146	.123	.239*			
7. Caregivers' physical component score (PCS)	-.038	-.002	.070	-.019	.177	.357**		
8. Caregivers' mental component score (MCS)	-.043	.159	.149	.237*	.160	.324*	.282*	-

SE-CS, self-efficacy for controlling symptoms; SE-MF, self-efficacy for maintaining function; PCS, physical component score; MCS, mental component score; ** $p < .001$; * $p < .005$

Table 3 The Actor-Interdependence Model demonstrating the *actor* and *partner* effects of self-efficacy and quality of life

Effect MCS	Patients			Caregivers			Effect PCS	Patients			Caregivers		
SE-MF	Beta	*t*	*p*	Beta	*t*	*p*	SE-MF	Beta	*t*	*p*	Beta	*t*	*p*
Actor	.450	2.234	.027*	.039	.195	.845	Actor	.279	1.612	.109	.079	.440	.661
Partner	-.056	-.238	.813	.025	.108	.915	Partner	.300	1.537	.127	.088	.439	.662

Effect MCS	Patients			Caregivers			Effect PCS	Patients			Caregivers		
SE-CS	Beta	*t*	*p*	Beta	*t*	*p*	SE-CS	Beta	*t*	*p*	Beta	*t*	*p*
Actor	.123	.818	.414	-.230	-1.524	.130	Actor	.124	.912	.364	-.025	-.191	.849
Partner	-.269	-1.561	.121	.012	.070	.944	Partner	-.070	-.477	.634	.123	.844	.400

SE-MF, self-efficacy maintaining function; SE-CS, self-efficacy controlling symptoms; MCS, mental component score; PCS, physical component score; * $p < 0.05$

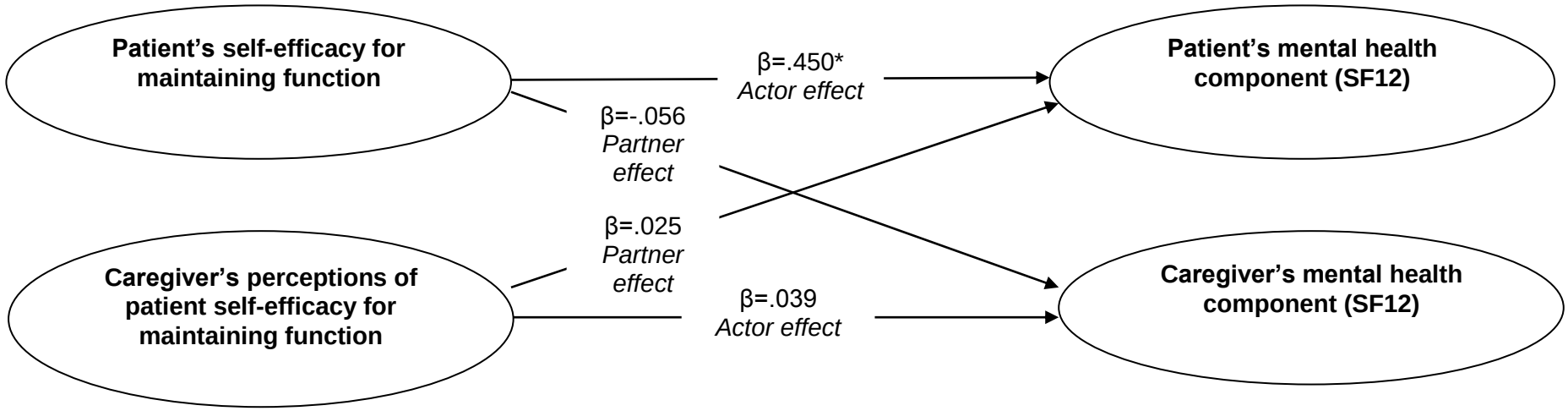

Figure 1 The Actor-Partner Interdependence Model with distinguishable dyads. Results for the *actor* and *partner* effects of patient's self-efficacy for maintaining function and caregiver's perceptions of patient self-efficacy for maintaining function on patients and caregivers mental health.
* $P < 0.05$