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BRIEF REPORT

Medication Adherence Is Associated with Having a Caregiver Among Cardiac Patients

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Abstract
Background Medication non-adherence is a significant contributor to suboptimal control of blood pressure and lipids.
Purpose This study determined if having a paid and/or family caregiver was associated with medication adherence in patients hospitalized for cardiovascular disease.
Methods Consecutive patients admitted to the cardiovascular service at a university medical center who completed a standardized questionnaire about medication adherence and caregiving (paid/professional or family member/friend) were included in this analysis (N=1,432; 63 % white; 63%male).
Results Among cardiac patients, 39 % reported being prescribed ≥7 different medications, and one in four reported being non-adherent to their medication(s). Participants who reported having/planning to have a paid caregiver were 40 % less likely to be non-adherent to their medications compared to their counterparts. The association remained significant after adjustment for demographic confounders and comorbid conditions (OR=0.49; 95 %CI=0.29–0.82).
Conclusion Cardiac patients with a paid caregiver were half as likely to be non-adherent to medications as those without caregivers.

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Introduction

Cardiovascular disease (CVD) remains the leading cause of death and health care expenditures in the USA [1]. Non-adherence to CVD preventive medications has been associated with a significant increase in risk for all-cause mortality, CVD mortality, hospitalization for myocardial infarction and/or heart failure, and coronary revascularization procedures [2]. Cardiovascular rehospitalizations have been shown to be 12–26 % higher among patients who were non-adherent to their statin medications [3]. Only 36 % of chronic coronary artery disease patients, and 40 % of acute coronary syndrome patients, were shown to be adherent to statin therapy after 2 years [4]. A study of community-dwelling patients with heart failure revealed that over half took at least one medication three times per day, and 13–20 % of patients demonstrated poor adherence to their heart failure medications [5]. Rates of medication non-adherence as high as 57 % have been documented in Medicare beneficiaries with heart failure [6]. These data document that medication non-adherence is highly prevalent and a major contributor to CVD morbidity and mortality, suggesting that novel evidence-based strategies to increase adherence to medications are needed.

Cardiac patients often rely on assistance from paid or non-paid/informal caregivers (such as family or friends) to help care for them after hospital discharge and support them with daily tasks such as taking medications. In one of the first systematic studies of patterns of caregiving among hospitalized cardiac patients, we showed that over half of 4,500 patients admitted to a CVD service in a major academic medical center reported access to a caregiver [7]. We also documented that family cardiac caregivers assisted patients with tasks such as tracking/administering medications, nutrition (grocery shopping/meal preparation), and medical

follow-up (transport to/arranging doctor visits) [7]. Others have shown that medication-related tasks account for at least 8 % of total caregiving time [8]. Family caregivers could potentially provide a unique and low-cost opportunity to improve adherence to evidence-based preventive therapies, yet few data have evaluated if access to a caregiver is associated with adherence to medications among cardiac patients.

The purpose of the present study was to determine if having a paid and/or family (non-paid) caregiver was associated with adherence to medications among patients at the time of hospitalization for CVD, and to assess if the relation varied according to gender and racial/ethnic minority status to evaluate potential interactions. A secondary aim was to evaluate additional predictors of adherence to medication among hospitalized cardiac patients.

Methods

The National Heart, Lung, & Blood Institute-sponsored *F*amily Cardiac Caregiver *I*nvestigation *T*o Evaluate *O*utcomes Study was a prospective study designed to evaluate patterns of caregiving among cardiac patients and its association with clinical outcomes of patients hospitalized with CVD [9]. Participants were asked to complete a standardized questionnaire in English or Spanish regarding caregiving (93 % enrollment rate). Consecutive patients admitted to the CVD service (cardiology and cardiac surgery) at Columbia University Medical Center/New York Presbyterian Hospital (CUMC/NYPH) between May and September 2010, who also completed questions about their adherence to medications, were included in this cross-sectional baseline analysis (N=1,432).

The baseline characteristics and patterns of caregiving of the target population have been published previously [9]. Briefly, hospital admission logs were reviewed daily to identify patients admitted to the CVD service, and trained bilingual research staff systematically distributed surveys to potential participants to assess caregiver status and medication adherence. The study was approved by the Institutional Review Board of CUMC.

Caregiving and Medication Adherence Assessment

The definition of caregiving was adapted from the report of the National Alliance of Caregiving and AARP [10]. A caregiver was defined as (1) a paid professional (e.g., nurse/home aide) or (2) a family caregiver (non-paid), who assists the patient with medical and/or preventive care. Patients who reported having or planning to have *both* paid and informal caregivers [n=37, (3 %)] were categorized as having a paid caregiver.

Participants were systematically queried by standardized and validated questions as used in our prior research [11, 12]. Two simple validated questions that have been highly correlated with pill counts were used: "Have you missed any pills in the past week?," and if participants answered yes, they were then asked "how many pills they have missed in the past week?"[12]. Non-adherence to medication was defined as missing one or more pills/doses during a typical week in the past 6 months. Participants were also asked to report the number of different medications they had been prescribed, given the choices "3 or fewer," "4 to 6," "more than 6," or "unsure."

Demographics and Comorbidity Assessment

Demographics, medical history, admission diagnoses, and prescription medications were documented by standardized electronic medical review. Patient medical records were accessed via a secure and comprehensive electronic clinical information system at CUMC/NYPH. All research staff members were HIPAA trained and certified in the use of this clinical information system. Current and prior medical conditions including diabetes mellitus, renal disease, myocardial infarction, peripheral vascular disease, heart failure, and chronic obstructive pulmonary disease were determined using ICD-9 billing codes and physician or nurse practitioner notes. Prior medical history information was collected by a trained nurse research assistant and was available for 99 % of this population. The number of different prescribed medications was obtained from discharge summary notes and supplemented by ambulatory electronic records if needed.

Data Analysis

Surveys were created and processed using the intelligent character recognition software EzDataPro32™ (version 8.0.7, Creative ICR, Inc., Beaverton, OR) and ImageFomula (version Dr-2580C, Canon U.S.A., Inc., New York, NY). The data were double checked for errors and stored in a Microsoft Access database. Descriptive data are presented as frequencies and percentages. Caregiving was categorized as having paid, family (non-paid), any (either paid or family), or no caregivers. Chi-square tests were performed to determine the association between medication non-adherence and baseline characteristics of hospitalized CVD patients. The independent association between caregiving and medication adherence was evaluated by logistic regression adjusted

for confounders. Stratified analyses by racial/ethnic status (white versus minority) and gender (male versus female) were also conducted to evaluate potential interaction.

Analyses were conducted using SAS software (version 9.2, SAS Institute, Cary, NC). Statistical significance for logistic regression models was set at $p<0.05$.

Results

The characteristics of the 1,432 consecutively hospitalized cardiac participants are presented in Table 1. The mean age was 66 ±14 years. Thirty-seven percent of participants were minorities, and 37 % were female. The majority (89 %) had health insurance, and nearly half were married. There were 214 (15 %) of patients classified as having a paid caregiver, 732 (51 %) as having an informal caregiver, and 486 (34 %) as having no caregiver.

One third of participants reported being prescribed between four and six different medications within the last 6 months, and 40 % reported being prescribed more than seven or more different medications (Table 2). Nearly one in four patients reported being non-adherent to their medications. Adherence to medications varied significantly by race/ethnicity (28 % minorities non-adherent vs. 21 % whites, $p=.02$), but not by gender (23 % males non-adherent vs. 24 % females, $p=.62$).

The association between type of caregiving and medication non-adherence overall and stratified by gender and minority status is presented in Table 3. Overall, participants who reported having or planning to have a paid caregiver were

Table 1 Baseline characteristics of participants ($N=1,432$)

Characteristic	Overall ($N=1,432$) *n* (%)	No caregiver ($n=486$) *n* (%)	Paid caregiver ($n=214$) *n* (%)	Informal caregiver ($n=732$) *n* (%)	*p* value
Age ≥65 vs. <65	800 (56)	268 (55)	155 (72)	377 (52)	**<0.0001**
Male vs. female	894 (63)	312 (64)	101 (47)	481(66)	**<.0001**
White vs. minority[a]	894 (63)	292 (60)	129 (60)	473 (65)	0.19
Married/life partner vs. not married/no partner[b]	691 (48)	212 (44)	74 (35)	405 (55)	**<.0001**
Have health insurance vs. do not have	1,267 (89)	435 (90)	188 (88)	644 (88)	0.68
Health insurance type[c]					
Commercial	864 (60)	292 (60)	103 (48)	469 (64)	**0.0002**
Medicare	742 (52)	256 (53)	145 (68)	341 (47)	**<0.0001**
Medicaid	215 (15)	72 (15)	60 (28)	83 (11)	**<0.0001**
Self-pay	630 (44)	205 (42)	77 (36)	348 (48)	**0.01**
Unknown	184 (13)	73 (15)	19 (9)	92 (13)	0.08
Medical Cardiology Service vs. Cardiac Surgery Service	1,149 (80)	407 (84)	162 (76)	580 (79)	**0.03**
Taking ≥9 different medications at discharge (from medical chart) vs. <9 medications	722 (53)	227 (50)	134 (66)	361 (52)	**0.0002**
Current smoker vs. non-smoker	98 (7)	43 (9)	8 (4)	47 (6)	**0.04**
Hypertension (history) vs. None	826 (58)	288 (59)	132 (62)	406 (55)	0.19
Dyslipidemia (history) vs. none	735 (51)	256 (53)	114 (53)	365 (50)	0.52
Prior cardiovascular disease vs. none[d]	1,044 (73)	360 (74)	158 (74)	526 (72)	0.66
Renal disease vs. none[e]	170 (12)	43 (9)	35 (16)	92 (13)	**0.01**
Chronic obstructive pulmonary disease vs. none	97 (7)	28 (6)	24 (11)	45 (6)	**0.02**
Diabetes mellitus vs. none	349 (24)	108 (22)	60 (28)	181 (25)	0.24
Abnormal body mass index vs. normal[f]	342 (77)	115 (78)	50 (75)	177 (76)	0.81

The significance of the values in bold is $p<.05$

[a] $n=14$ without reported race/ethnicity

[b] $n=212$ without marriage information

[c] May have more than one plan type

[d] Includes prior/current myocardial infarction, prior/current heart failure, prior/current peripheral vascular disease, prior/current stroke

[e] Defined as chronic renal insufficiency, chronic renal disease, or renal failure on dialysis;

[f] Defined as body mass index ≥25 or <18.5 kg/m^2

Table 2 Prevalence of medication usage and non-adherence (*N*=1,432)

	N (%)
Medications	
Number of different medications: 3 or fewer	374 (26)
Number of different medications: 4 to 6	465 (32)
Number of different medications: more than 6	553 (39)
Not sure	40 (3)
Non-adherence	
Missed pills in a typical week: 0 (none)	1,020 (71)
Missed pills in a typical week: 1 or more	310 (22)
Do not take any medications/not sure	102 (7)

40 % less likely to be non-adherent to their medications compared to those who reported not having or planning to have a paid caregiver [odds (OR)=0.57, 95 % confidence interval (CI)=0.37–0.87]. There was a similar but nonsignificant trend for informal caregiving (OR=0.87, 95 %CI=0.63–1.07). A significant association between paid caregiving and medication non-adherence was observed among minorities (OR=0.51, 95 % CI=0.27–0.99), but not whites (OR=0.62, 95 % CI=0.35–1.10). There were no differences by race/ethnicity for the association between informal caregiving and medication non-adherence. In univariate analyses stratified by gender, paid caregiving was associated with significantly less likelihood of non-adherence to medications among women (OR=0.53, 95 % CI=0.29–0.98), but not men (OR=0.58, 95 % CI=0.32–1.08). There were no significant differences by gender for the association between informal caregiving and medication non-adherence.

Other significant univariate associations with non-adherence to medication were racial/ethnic minority status (OR=1.50, 95 % CI=1.16–1.95), smoking (OR=1.68, 95 % CI=1.06–2.67), and history of dyslipidemia (OR=1.37, 95 % CI=1.06–1.78; Table 4).

The multivariable association between caregiving and medication non-adherence adjusted for confounders including demographics and comorbidities is shown in Table 5. The association between paid caregiving and medication non-adherence remained significant after adjustment (OR=0.49, 95 % CI=0.29–0.82).

In multivariable models stratified by race/ethnicity, the association between paid caregiving and medication non-adherence remained statistically significant after adjustment among minorities (OR=0.29, 95 % CI=0.12–0.70), but not among whites (OR=0.67, 95 % CI=0.35–1.29). In multivariable models stratified by gender, the association between paid caregiving and medication non-adherence was attenuated after adjustment among both females (OR=0.48, 95 % CI=0.23–1.01) and males (OR=0.49, 95 % CI=0.23–1.06).

Discussion

This study documented that cardiac patients with paid caregivers were 50 % less likely to report non-adherence to their medications than those without a caregiver, independent of confounders including demographics and comorbidities. The association was statistically significant among racial/ethnic minorities but not among whites; it did not significantly vary by gender. Medication non-adherence was associated with racial/ethnic minority status, smoking, and history of dyslipidemia. We also documented that the majority of cardiac patients were prescribed seven or more different medications and nearly a quarter reported being non-adherent to their medications.

Studies assessing the type of caregiving (paid or family), and the impact of paid caregivers specifically, on adherence to medication in the home setting post-hospital discharge are limited. Consistent with our findings, Lam et al. showed that the involvement of a professional caregiver/community nursing services with medication administration reduced drug non-adherence among Chinese geriatric patients by one quarter, compared to patients without this support [13].

Table 3 Association between caregiving and nonadherence to medications according to gender and race/ethnicity among hospitalized cardiac patients

Characteristic	Overall (*N*=1,432)		Among minorities only (*n*=524)		Among whites only (*n*=894)		Among males only (*n*=894)		Among females only (*n*=538)	
	OR (95 % CI)		OR (95 % CI)	*p* value	OR (95 % CI)	*p* value	OR (95 % CI)	*p* value	OR (95 % CI)	*p* value
Paid vs. none	**.57 (0.37–0.87)**	**.009**	**.51 (.27–1.00)**	**.049**	.62 (.35–1.10)	.09	.58 (.32–1.08)	.08	**.53 (.29–.98)**	**.04**
Informal vs. none	.87 (0.67–1.15)	.33	.97 (.64–1.49)	.90	.83 (.58–1.19)	.32	.93 (.66–1.31)	.67	.87 (.55–1.37)	.55
Paid vs. informal	**.63 (0.42–0.95)**	**.03**	**.50 (.27–.96)**	**.03**	.74 (.43–1.27)	.27	.63 (.35–1.4)	.12	.61 (.34–1.10)	.09
Any caregiver vs. none	.82 (0.63–1.07)	.14	.62 (.35–1.10)	.55	.88 (.59–1.33)	.20	93 (.66–1.32)	.77	1.22 (.80–1.86)	.36

The significance of the values in bold is $p<.05$

Table 4 Caregiving and other potential confounders of non-adherence to medications (N=1,432)

Characteristic	OR (95 % CI)	p-value
Paid vs. none	0.57 (0.37, 0.87)	**0.01**
Informal vs. none	0.87 (0.66, 1.15)	0.33
Paid vs. informal	**0.63 (0.42, 0.95)**	**0.03**
Any caregiver vs. none	0.82 (0.63, 1.07)	0.14
Age≥65 years	0.78 (0.60–1.00)	0.05
Male	0.94 (0.72–1.22)	0.62
Minority race/ethnicity[a]	**1.50 (1.16–1.95)**	**0.002**
No health insurance	1.19 (0.81–1.76)	0.38
Not married/no partner[b]	1.08 (0.82–1.44)	0.57
Taking >9 different medications (at discharge)	1.00 (0.77–1.30)	0.99
Current smoker	**1.68 (1.06–2.67)**	**0.03**
Hypertension (history)	1.19 (0.92–1.54)	0.19
Dyslipidemia (history)	**1.37 (1.06–1.78)**	**0.02**
Prior cardiovascular disease[c]	1.01 (0.78–1.30)	0.93
Renal disease[d]	0.77 (0.51–1.17)	0.22
Chronic obstructive pulmonary disease	0.92 (0.55–1.54)	0.76
Diabetes mellitus	1.13 (0.85–1.51)	0.40
Abnormal body mass index[e]	1.20 (0.69–2.10)	0.52

Patients who reported having both paid *and* informal caregivers (n=37) were categorized as having a paid caregiver

The significance of the values in bold is $p<.05$

[a] n=14 without reported race/ethnicity

[b] n=212 without marriage information

[c] Includes prior/current myocardial infarction, prior/current heart failure, prior/current peripheral vascular disease, prior/current stroke

[d] Defined as chronic renal insufficiency, chronic renal disease, or renal failure on dialysis

[e] Defined as body mass index ≥25 or <18.5 kg/m^2

Others have shown that that the support of a family caregiver was strongly correlated with patients' drug adherence level in other clinical settings. For example, in persons living with HIV in China, patients with family caregiving support reported nearly four times greater adherence to anti-retroviral therapy than those without family caregiving support [14]. Among African American HIV-positive men with informal care, higher reciprocity of support to caregivers was associated with greater adherence to medications [15]. The presence of a spouse or other caregiver has also been associated with increased compliance to medications among heart failure patients compared to patients living alone; the authors speculate that this may be due to reminders to take medications or supervision of medication administration [16].

In contrast, a study by Magacho et al. found that non-adherence to drug therapy among persons with chronic kidney disease was associated with dependence on medication administration by a family caregiver rather than self-administration [17]. Beals et al. found that caregivers often reminded persons living with HIV to take their medications, but the reminders were not significantly associated with adherence [18].

One potential explanation for our finding that paid caregiving, rather than informal/non-paid caregiving, was associated with significantly greater adherence to medications is that paid caregivers have both training and accountability. This suggests that non-paid caregivers could also be trained, and if family members are given more accountability as part of an expanded care team, they could potentially improve quality outcomes.

Education and/or training of family caregivers may help to facilitate greater adherence to medications among patients such as that observed in those with access to paid caregivers. Deficits in professional knowledge by family caregivers may contribute to missed doses [19]. For example, caregivers have

Table 5 Multivariable model: association between caregiving (prior to hospitalization and/or planned post-discharge) and medication nonadherence overall (N=1,432)

Variable	Model 1: Bivariate OR (95 % CI)	Model 2: Demographic adjusted OR (95 % CI)	Model 3: Fully adjusted OR (95 % CI)
Have/plan to have a paid caregiver vs none[a]	**.57 (.37–.87)**	**.48 (.28–.81)**	**0.49 (0.29–0.82)**
Had/plan to have an informal caregiver vs none[a]	.90 (.69–1.19)	.91 (.67–1.24)	0.92 (0.68–1.25)
Age ≥65 years		.82 (.61–1.09)	0.81 (0.61–1.09)
Minority race/ethnicity		**1.52 (1.12–2.05)**	**1.52 (1.12–2.05)**
Men		0.92 (0.68–1.25)	0.91 (0.67–1.23)
Not married/no partner		1.02 (.76–1.37)	1.01 (0.75–1.37)
No health insurance		1.19 (.79–1.81)	1.21 (0.80–1.84)
Dyslipidemia (history)			**1.34 (1.00–1.79)**
Current smoker			1.45 (0.85–2.4)

The significance of the values in bold is $p<.05$

[a] Patients who reported having both paid *and* informal caregivers (n=37) were categorized as having a paid caregiver; referent group is no caregiver

been shown to have considerable concerns about the side effects of medications; male caregivers especially [20]. Education may help in this regard as providing information about side effects and safety of medications is a recommended strategy to enhance medication adherence in patients with chronic diseases [21]. In addition, caregiver agreement with treatment recommendations has been shown to predict adherence to medical recommendations among geriatric patients [22].

Major strengths of this study were the diverse population, systematic approach, and use of standardized measures of caregiving and adherence which have previously been linked to clinical outcomes. Studies that have compared self-report to other methods of adherence measurement, including electronic lids and prescription refill records, have shown similar estimates of overall adherence [23]. Despite the standardized approach, due to the self-reported nature of medication adherence and caregiver status, there may have been misclassification which was likely non-differential, and may have reduced the ability to detect significant differences. Sociodemographic data for caregivers and information on the amount of time spent caregiving were not available; therefore, associations between medication adherence and these variables could not be tested. Similar to other research in this area, our data were observational in nature, and the finding that caregivers may improve medication adherence needs to be confirmed in prospective randomized controlled studies.

In conclusion, medication non-adherence was highly prevalent among hospitalized cardiac patients and paid caregiving was associated with lower risk of non-adherence, particularly among racial/ethnic minorities and females. Training family caregivers to assist patients with the management of medications using the strategies of paid caregivers (e.g., pillboxes, automated alerts) may have the potential to enhance medication adherence among cardiac patients, and facilitate improved clinical outcomes, but needs to be formally tested.

Conflict of Interest The authors have no conflict of interest to disclose.

References

1. Roger VL, Go AS, Lloyd-Jones DM, et al. Heart disease and stroke statistics–2012 update: A report from the American Heart Association. *Circulation*. 2012;125(1):e2-e220.
2. Ho PM, Magid DJ, Shetterly SM, et al. Medication nonadherence is associated with a broad range of adverse outcomes in patients with coronary artery disease. *Am Heart J*. 2008;155(4):772-9.
3. Pittman DG, Chen W, Bowlin SJ, et al. Adherence to statins, subsequent healthcare costs, and cardiovascular hospitalizations. *Am J Cardiol*. 2011;107(11):1662-6.
4. Jackevicius CA, Mamdani M, Tu JV. Adherence with statin therapy in elderly patients with and without acute coronary syndromes. *JAMA*. 2002;288(4):462-7.
5. Dunlay SM, Eveleth JM, Shah ND, McNallan SM, Roger VL. Medication adherence among community-dwelling patients with heart failure. *Mayo Clin Proc*. 2011;86(4):273-81.
6. Nichol MB, Knight TK, Priest JL, et al. Nonadherence to clinical practice guidelines and medications for multiple chronic conditions in a California Medicaid population. *J Am Pharm Assoc*. 2010;50(4):496-507.
7. Mosca L, Mochari-Greenberger H, Aggarwal B, et al. Patterns of caregiving among patients hospitalized with cardiovascular disease. *J Cardiovasc Nurs*. 2011;26(4):305-311.
8. Ranelli PL, Aversa SL. Medication-related stressors among family caregivers. *Am J Hosp Pharm*. 1994;51(1):75-9.
9. Mosca L, Aggarwal B, Mochari-Greenberger H, et al. Association between having a caregiver and clinical outcomes 1 year after hospitalization for cardiovascular disease. *Am J Cardiol*. 2012;109(1):135-9.
10. National Alliance for Caregiving and AARP. Caregiving in the U.S. Washington, DC: National Alliance for Caregiving and AARP; 2004:83. http://www.caregiving.org/data/04finalreport.pdf. Accessed 24 Apr 2012.
11. Aggarwal B, Mosca L. Lifestyle and psychosocial risk factors predict non-adherence to medication. *Ann of Behav Med*. 2010;40:228-233.
12. Haynes RB, Taylor DW, Sackett DL, et al. Can simple clinical measurements detect patient noncompliance? *Hypertension*. 1980;2(6):757-64.
13. Lam PW, Lum CM, Leung MF. Drug non-adherence and associated risk factors among Chinese geriatric patients in Hong Kong. *Hong Kong Med J*. 2007;13(4):284-92.
14. Fredriksen-Goldsen KI, Shiu CS, Starks H, et al. "You must take the medications for you and for me": Family caregivers promoting HIV medication adherence in China. *AIDS Patient Care STDS*. 2011;25(12):735-41.
15. Knowlton AR, Yang C, Bohnert A, et al. Informal care and reciprocity of support are associated with HAART adherence among men in Baltimore, MD, USA. *AIDS Behav*. 2011;15(7):1429-36.
16. Rich MW, Gray DB, Beckham V, et al. Effect of a multidisciplinary intervention on medication compliance in elderly patients with congestive heart failure. *Am J Med*. 1996;101(3):270-6.
17. Magacho EJ, Ribeiro LC, Chaoubah A, et al. Adherence to drug therapy in kidney disease. *Braz J Med Biol Res*. 2011;44(3):258-62.
18. Beals KP, Wight RG, Aneshensel CS, et al. The role of family caregivers in HIV medication adherence. *AIDS Care*. 2006;18(6):589-96.
19. Buetow S, Henshaw J, Bryant L, et al. Medication timing errors for Parkinson's disease: Perspectives held by caregivers and people with Parkinson's in New Zealand. *Parkinsons Dis*. 2010;2010:432983.
20. Letizia M, Creech S, Norton E, et al. Barriers to caregiver administration of pain medication in hospice care. *J Pain Symptom Manage*. 2004;27(2):114-24.
21. Laufs U. Medication adherence in patients with chronic diseases: Significance and new approaches. *Nervenarzt*. 2011;82(2):153-4. 156–8.
22. Bogardus ST Jr, Bradley EH, Williams CS, et al. Achieving goals in geriatric assessment: Role of caregiver agreement and adherence to recommendations. *J Am Geriatr Soc*. 2004;52(1):99-105.
23. Hansen RA, Kim MM, Song L, et al. Comparison of methods to assess medication adherence and classify nonadherence. *Ann Pharmacother*. 2009;43(3):413-22.