# Relationship between blood pressure levels and adherence to medication in patients with chronic heart failure: How come?



Mahsa Mohammadi[1]
Inger Ekman[2]
Maria Schaufelberger[3]

[1]Department of Medicine; [2]Institute of Health and Care Sciences; [3]Departments of Emergency and Cardiovascular Medicine, The Sahlgrenska Academy at Goteborg University, Goteborg, Sweden.

**Objective:** To investigate whether change in objective signs during up-titration of angiotensin-converting enzyme (ACE)-inhibitors in patients with chronic heart failure affect perception of information about medicines and subjective activities such as self-care.

**Methods:** Consecutive patients referred for up-titration of ACE-inhibitors were included. Patients were given the Satisfaction with Information about Medicines Scale and the European Heart Failure Self-Care Behaviour Scale at their first visit and when the target dose was reached. Blood pressure, pulse and s-creatinine were measured at each visit.

**Results:** Relationships were found between change in systolic ($r = 0.224$, $p = 0.044$) and diastolic ($r = 0.361$, $p = 0.001$) blood pressure and change in self-care scores and were also observed at baseline ($r = 0.324$, $0.398$, $p = 0.001$, $0.000$) and follow-up ($r = 0.317$, $0.253$, $p = 0.004$, $0.022$). Diastolic blood pressure correlated with the "potential problem of medication" score ($r = -0.263$, $p = 0.007$).

**Conclusion:** Patients with a more advanced disease usually have a lower blood pressure. Hence, the relationship between blood pressure and self-care scores might indicate that patients are more motivated to adhere to prescriptions the more advanced the stage of their disease.

**Keywords:** blood pressure, chronic heart failure, adherence, scales

## Introduction

Chronic heart failure (CHF) is a major health problem in the Western world. Despite considerable advances in treatment to increase survival, CHF is still associated with a high rate of hospitalization and mortality,[1] with a 5-year survival reported to be about 50%.[2] Although the incidence of CHF is decreasing.[1] An aging population, improved pharmacological treatment of CHF and decreased mortality in acute myocardial infarction are suggested to be underlying causes of a numerous amount of patients with CHF in the future.[3] Not only does CHF have a substantial impact on the lives of patients because of a reduced quality of life, but also directly on the national health economy.[4] Severe symptoms such as fatigue and dyspnea affect the physical ability of the patients.[5] Nonadherence to medication, poor diet, and lack of monitoring of symptoms has been identified as contributing to the vast majority of CHF-related hospitalization.[6] Patient education that involves motivating patients to commit to a course of therapy is an important component of management and outcome.[7] However, many patients with CHF are unaware of the relation between symptoms and their condition and its treatment.[8] The development of CHF clinics, most of which are nurse-directed, has expanded in industrialized countries. These clinics have been successful in improving knowledge, self-care behavior, quality of life, survival, adherence to therapeutic regimen and decreasing the hospitalization rate.[9,10] The causative factors of these improvements, however, are unclear.[11]

Correspondence: Mahsa Mohammadi
Barken Storegrunds gata 5, 417 60
Goteborg, Sweden
Tel +46702028716
Email mahsa@student.gu.se

In order to offer patients with CHF the best management, communication between professionals and patients should be optimized and the reasons why some patients do not incorporate or ask for information should be clarified.

In a recent report, patients' understanding of their diagnosis of CHF was found to be independent of age, gender or cognitive functioning.[12] Yet, as far as we know, no study has scrutinized the concordance between patients' blood pressure and their satisfaction with information they are given about medication and self-care.

The aim of this study was therefore to investigate whether adhering to a complex medication regimen that influences blood pressure affects the patients' perception of information given about medication, as well as to evaluate its impact on self-care.

Approval to conduct this study was obtained from the Research Ethics Board at Göteborg University and participants gave their written, informed consent to participate in the study.

# Methods

## Patients

Consecutive patients with chronic heart failure or asymptomatic left ventricular dysfunction (n = 124) were referred to two nurse-led outpatient heart failure clinics for up-titration of angiotensin-converting enzyme (ACE)-inhibitors (Table 1). During their visit to the clinic, the patients received information about their medication regimes. Of these 124 patients, 109 completed the Satisfaction with Information about Medicines Scale (SIMS)[13] at their first visit and then again when the maintenance or goal dose was reached. During the period of up-titration of medication, the patients visited one of two outpatient clinics, where they talked with specially trained nurses on an individual level about their medication. Both written information and verbal reinforcement were given concerning what the medicines were for, their effects, interactions and side effects. The patients were encouraged to talk about their perception of the medication (eg, the medication's effectiveness). Finally, questions that the patients raised concerning the medication were individually addressed.

One hundred eight of these patients also completed the European Heart Failure Self-Care Behaviour Scale[14] at baseline and at follow-up.

The patients were divided into two groups: patients with blood pressure above 140/90 mmHg (hypertensive group) and below 140/90 mmHg (normotensive group). This is the limit between high-normal and grade 1 hypertension according to the definition and classification of blood pressure levels.[16]

## The instruments

The SIMS is a 17-item instrument designed to assess the extent to which patients feel they have received sufficient information about prescribed medication. The amount of information received is asked to be rated using the following response scale: "too much", "about right", "too little", "none received", "none needed". Responses indicating dissatisfaction ("too much", "too little", or "none received") are scored 0, while the other responses indicating satisfaction with information ("about right" or "none needed") were given a score of 1. The items are derived from the published recommendations of the British Pharmaceutical Industry for the type of information that patients require in order to facilitate the self-management of medication. Each item refers to a particular aspect of the prescribed medicines. Examples include "How to use your medicine" and "What you should do if you experience side effects". The items can be summed up as a total satisfaction rating (TSR) and in two subscale scores: Action and usage of medication and potential problems of medication (PPM). Permission to use SIMS was received from the author (Prof. Robert Horne, University of Brighton, UK). The English version of the SIMS was translated into Swedish using a back-translation procedure.[15]

The European Heart Failure Self-Care Behaviour Scale is a 12-item, self-administered questionnaire that covers items

**Table 1** Up-titration of angiotensin-converting enzyme-inhibitors according to local guidelines

| | Captopril | Enalapril | Ramipril/Lisinopril | Cilazapril |
|---|---|---|---|---|
| Week 1 | 6.25 mg × 2 | Day 1–3: 2.5 mg × 1 | Day 1–3: 1.25 mg × 1 | 0.5 mg × 1 |
| | | Day 4–7: 2.5 mg × 2 | Day 4–7: 1.25 mg × 2 | |
| Week 2 | 6.25 mg × 3 | 5 mg × 2 | 2.5 mg × 2 | 1 mg × 1 |
| Week 3 | 12.5 mg × 2 | 5 mg × 3 | 5 mg × 2 | 2 mg × 1 |
| Week 4 | 12.5 mg × 3 | 10 mg × 2 | | 2.5 mg × 1 |
| Week 5 | 25 mg × 2 | | | |

concerning self-care behaviour of patients with heart failure.[14] Examples include "I weigh myself every day" and "I eat a low salt diet". The scale is used as a total scale and is scored from 1 to 5, where 1 = I completely agree and 5 = I do not agree at all. A total score is calculated by adding the ratings (from one to five) on each of the 12 items. If more than three items are missing, a total score cannot be obtained. In case of less than three missing items the three are used to replace the missing score per item.

## Statistical analysis

All analyses were conducted using the SPSS Advanced Statistics for Windows statistical package, version 12.0 (SPSS Inc., Chicago, IL, USA). Descriptive analysis was used to determine mean scores and sample characteristics. Analysis of differences in patients' clinical characteristics between baseline and follow-up was conducted using the t-test for dependent means. To test the relationship the bivariate correlate was used. Linear regression was used to estimate confounding factors. P-values below 0.05 were considered as statistically significant.

# Results

We included 124 consecutive patients (27% were women) with a mean age of 70 years (SD = 11). The major cause of CHF was ischemic heart disease. Patient characteristics are given in Table 2. Most patients were treated with diuretics and beta-blockers (66, and 67%, respectively). A detailed description of the patients' medicines is shown in Table 2. About 70% of the patients were classified as NYHA II or III at baseline (Table 3). Both diastolic blood pressure and pulse decreased significantly from the first to the last visit (Table 3). However, there was no significant change in systolic blood pressure (Table 3).

Table 4 shows the relationship between differences in the self-care and SIMS scores, and differences in blood pressure, pulse and creatinine between baseline and follow-up. An association between self-care and systolic ($p = 0.044$) and diastolic ($p = 0.001$) blood pressure was noted, where an improvement in self-care was related to a decrease in blood pressure. No significant association was found between delta pulse and creatinine and delta self-care and SIMS scores.

The relationships between blood pressure, pulse, creatinine and self-care and SIMS scores at baseline and follow-up are presented in Table 5. There was a significant relationship between systolic and diastolic blood pressure and self-care at both baseline ($p = 0.001$, 0.000) and follow-up ($p = 0.004$, 0.022). More specifically, lower blood pressure was correlated to better self-care. A significant relationship was found between SIMS scores (satisfaction regarding medication, particularly potential problems associated with medical use) and diastolic blood pressure ($p = 0.01$ for TSR and 0.07 for PPM). The only significant association between clinical characteristics and self-care and SIMS scores in the hypertensive group was between "satisfaction about action and usage of medication" and systolic blood pressure ($p = 0.043$) at baseline, where lower systolic blood pressure was associated with higher satisfaction with respect to medical information. At baseline relationships were found in the normotensive group between diastolic blood pressure and self-care ($p = 0.001$), total satisfaction rating ($p = 0.007$) and potential problems associated with taking medication ($p = 0.006$), ie, lower diastolic blood pressure was related to better self-care and higher satisfaction concerning the medical information patients received (Table 6). No significant relationship was observed between blood pressure and SIMS scores in the normotensive group at follow-up, but there was a significant relationship between self-care and

**Table 2** General characteristics of the patients

| Characteristic | | Patients | % |
|---|---|---|---|
| Age (years) | | 70 ± 11 | |
| Gender | Male (n) | 88 | 71 |
| | Female (n) | 33 | 27 |
| Etiology | Ischemic heart disease (n) | 67 | 54 |
| | Hypertension (n) | 25 | 22 |
| | Valvular heart disease (n) | 14 | 11 |
| | Arrhythmia (n) | 13 | 10 |
| | Dilated cardiomyopathy (n) | 11 | 9 |
| | Others (n) | 7 | 6 |
| Concomitant diseases | Diabetes (n) | 23 | 19 |
| | Hypertension (n) | 30 | 27 |
| | Pulmonary disease (n) | 16 | 14 |
| Medication at baseline | Diuretics (n) | 82 | 66 |
| | Beta-receptor blockers (n) | 83 | 67 |
| | Lipid-lowering drugs (n) | 37 | 30 |
| | Spironolactone (n) | 22 | 18 |
| | ASA (n) | 59 | 48 |
| | Calciumantagonist (n) | 5 | 4 |
| | Nitrates (n) | 15 | 12 |
| | Digitalis (n) | 23 | 19 |
| | Anticoagulantia (n) | 27 | 22 |

**Abbreviation:** ASA, acetyl salicylic acid.

**Table 3** Clinical characteristics and medication of the patients

| Characteristic | | Baseline | Follow-up | p |
|---|---|---|---|---|
| Systolic BP (mmHg) | | 130 ± 21 | 128 ± 21 | 0.33 |
| Diastolic BP (mmHg) | | 75 ± 12 | 71 ± 11 | 0.001 |
| Pulse (heart rate/ minute) | | 72 ± 13 | 68 ± 11 | 0.004 |
| Creatinine (μmol/L) | | 114 ± 21 | 117 ± 26 | 0.092 |
| NYHA class, n (%): | I | 20 (16) | 26 (21) | |
| | II | 61 (49) | 49 (40) | |
| | III | 27 (22) | 16 (13) | |
| | IV | 1 (1) | 0 | |
| | Mean | 2 ± 0.7 | 1.9 ± 0.7 | 0.001 |
| Diuretics, n (%) | | 82 (66) | 74 (60) | NS |
| Spironolactone, n (%) | | 22 (18) | 16 (13) | NS |
| Beta receptor blockers, n (%) | | 83 (67) | 82 (66) | 0.083 |

**Note:** Data are mean ± SD if not otherwise stated.
**Abbreviations:** BP, blood pressure; NYHA, New York Heart Association.

systolic (p = 0.021) and diastolic (p = 0.042) blood pressure (Table 6).

In linear regression models adjusted for age, sex and NYHA-class, no statistically significant confounding factors were found interfering with the change in systolic blood pressure.

## Discussion

Our initial hypothesis was that by initiating treatment and up-titrating ACE-inhibitors, the blood pressure decreased to such an extent that the circulation of the brain is influenced and therefore the perception and self-care is changed. But on the contrary, in this study two interesting findings are illustrated: the association between patients improved self-care and decreasing blood pressure and patient satisfaction with information about medicines (SIMS) with decreasing diastolic blood pressure.

One reasonable interpretation of these results is that because the medicines (up-titrated ACE-inhibitors) are blood-pressure-lowering drugs, the association between decreasing diastolic blood pressure (delta BP) and improved self-care is associated with higher adherence to medication, the consequence of which is decreasing blood pressure. But, already at baseline (Table 5), ie, before the introduction of an ACE-inhibitor, we found that the lower the blood pressure, the better the self-care and the lower the diastolic blood pressure the better the SIMS. These relations probably occur because other medicines used in the treatment of CHF (eg, diuretics and beta-blockers) also decrease blood pressure when patients adhere to all medicines. Lower systolic and diastolic blood pressure and renal dysfunction are associated with higher mortality.[17,18] Consequently, one might speculate whether the associations between lower blood pressure and better self-care and higher satisfaction

**Table 4** Relationships between change in clinical characteristics and change in self-care scores and total satisfaction rating

| | | Δ Self-care | Δ delta TSR |
|---|---|---|---|
| Δ systolic BP | Pearson correlation, r | 0.224 | –0.116 |
| | p | 0.044 | 0.297 |
| Δ diastolic BP | Pearson correlation, r | 0.361 | –0.216 |
| | p | 0.001 | 0.05 |
| Δ Pulse | Pearson correlation, r | –0.043 | –0.037 |
| | p | 0.705 | 0.741 |
| Δ Creatinine | Pearson correlation, r | 0.011 | –0.066 |
| | p | 0.926 | 0.552 |

**Abbreviations:** BP, blood pressure; TSR, total satisfaction rating.

**Table 5** Relationships between blood pressure and self-care and total satisfaction rating during baseline and follow-up

| | | | Self-care | TSR | PPM |
|---|---|---|---|---|---|
| Baseline | Systolic BP | Pearson correlation, r | 0.324 | –0.096 | –0.131 |
| | | p | 0.001 | 0.328 | 0.182 |
| | Diastolic BP | Pearson correlation, r | 0.398 | –0.250 | –0.263 |
| | | p | 0.000 | 0.010 | 0.007 |
| Follow-up | Systolic BP | Pearson correlation, r | 0.317 | –0.007 | –0.036 |
| | | p | 0.004 | 0.950 | 0.747 |
| | Diastolic BP | Pearson correlation, r | 0.253 | –0.048 | –0.097 |
| | | p | 0.022 | 0.661 | 0.384 |

**Notes:** BP, blood pressure; TSR, total satisfaction rating; PPM, potential problems of medication.

with medical information indicate that patients might have been more motivated to assimilate and follow prescribed treatment the more serious and advanced the stage of their disease. One must therefore consider that the associations observed in this study might be that the nurses were more or less fervent in their education of the patient, depending on the clinical signs observed.

A study from 2003 that sheds light on the management of heart failure in primary care shows that general practitioners have worries about using blood pressure lowering drugs in patients with CHF who often are elderly and frail.[19] However, the results of our study, might suggest that these worries are needless.

Patient education with its impact on adherence is probably an important factor in management and outcome of CHF.[7] However, many patients with CHF do not seem to be aware of the importance of following prescribed treatment, as well as recognizing signs and symptoms of deterioration of their condition.[8,11] As recently shown by Granger and colleauges, patients' need for information is still high even when the specialist nurses feel that the information given is sufficient.[20] Hence, there must be factors contributing to this need for

**Table 6** Relationships between blood pressure and self-care/total satisfaction rating in the normotensive and hypertensive groups at baseline and follow-up

| | | | Self-care | TSR | AUM | PPM |
|---|---|---|---|---|---|---|
| Baseline: | | | | | | |
| BP < 140/90 mmHg | SBP | Pearson corr, r | 0.085 | –0.113 | –0.042 | –0.147 |
| | | p | 0.452 | 0.316 | 0.708 | 0.189 |
| | DBP | Pearson corr, r | 0.318 | –0.269 | –0.188 | –0.274 |
| | | p | 0.001 | 0.007 | 0.064 | 0.006 |
| BP > 140/90 mmHg | SBP | Pearson corr, r | 0.121 | –0.384 | –0.416 | –0.322 |
| | | p | 0.573 | 0.064 | 0.043 | 0.124 |
| | DBP | Pearson corr, r | 0.415 | –0.080 | 0.007 | –0.172 |
| | | p | 0.306 | 0.864 | 0.988 | 0.713 |
| Follow-up: | | | | | | |
| BP < 140/90 mmHg | SBP | Pearson corr, r | 0.284 | 0.004 | –0.052 | 0.009 |
| | | p | 0.021 | 0.974 | 0.673 | 0.941 |
| | DBP | Pearson corr, r | 0.229 | –0.090 | –0.088 | –0.112 |
| | | p | 0.042 | 0.423 | 0.430 | 0.326 |
| BP > 140/90 mmHg | SBP | Pearson corr, r | –0.016 | 0.129 | 0.153 | 0.093 |
| | | p | 0.954 | 0.622 | 0.557 | 0.731 |
| | DBP | Pearson corr, r | 0.984 | –0.693 | –0.500 | –0.756 |
| | | p | 0.115 | 0.512 | 0.667 | 0.454 |

**Abbreviations:** BP, blood pressure; SBP, systolic blood pressure; DBP, diastolic blood pressure; Pearson Corr, Pearson correlation; TSR, total satisfaction rating; AUM, action and usage of medication; PPM, potential problems of medication.

more information that we are not aware of. One plausible explanation is that nurses still rely on their perceptions of what they believe patients need to know rather than on what the patients actually feel would be important information. An example of this possibility is the patients wish to know more about how long to take the medication, whereas caregivers probably take it for granted that the patients are aware of the fact that the treatment is lifelong.[20] The World Health Organization (WHO) strongly states in their *Global Report on Innovative Care for Chronic Conditions: Building Blocks for Action (2002)* that noncompliance is "fundamentally a failure of the health care system".[21] Compliance is defined by WHO as "the extent to which a person's behavior- taking medication, following a diet, and/or executing lifestyle changes corresponds with agreed recommendations from a provider".[21] This definition emphasizes the contractual relationship between the caregiver and the patient: by agreeing with a recommendation, the patient enters into an active partnership with the provider in which the patient's autonomous goals, such as the patient's need for control, independence and choice, are acknowledged within the realm of the medical goals.[22] To compensate for the provider-centered image that the term compliance implies, alternative terms (eg, adherence, concordance, motivation to follow a therapy and self-care) have been proposed.[23] To offer patients with CHF an active partnership (ie, concordance with the provider) future studies should focus on discovering those factors affecting communication between the patient and the caregiver in clinical practice. More attention should be paid to the association between clinical characteristics, subjective health and patients' self-care and their perception of information given to them about medication.[24] Nonadherence is often not about patients disobeying or forgetting and thus cannot be solved solely with pharmacological information. Rather, the problem has to be approached by trying to understand the patients' way of thinking and adapt to their way of understanding. New approaches are being evaluated for the care and treatment of patients with CHF: models tailor the intervention from a patient's subjective reports about his or her condition. The latter approach underscores the need of health providers to explore the relationship between a patient's particular expression of distress and physiological disorder.

An important task for future researchers is to evaluate innovative pedagogical strategies based on an equal partnership between patients and caregivers. Such studies may contribute to improvement and development in CHF management.

## Limitations

One limitation of this study is the rather small number of patients (n = 124).

# Conclusion

Patients might be more motivated to assimilate and follow prescribed treatment the more serious and advanced the stage of their disease. More attention should be paid in providing good communication and information sharing to patients with mild to moderate CHF who should be even more actively encouraged to be involved in a partnership concerning the treatment of their condition.

# Disclosure

The authors report no conflict of interest in this work.

# References


1. Schaufelberger M, Swedberg K, Köster M, Rosén M, Rosengern A. Decreasing one-year mortality and hospitalization rates for heart failure in Sweden. *Eur Heart J*. 2004;25:300–307.
2. Ho KK, Pinsky JL, Kannel WB, Levy D. The epidemiology of heart failure: the Framingham Study. *J Am Coll Cardiol*. 1993;22A:6A–13A.
3. Mejhert M, Persson H, Edner M, Kahan T. Epidemiology of heart failure in Sweden: A national survey. *Eur J Heart Fail*. 2001;3:97–103.
4. Rydén-Bergsten T, Andersson F. The health care costs of heart failure in Sweden. *J Intern Med*. 1999;246:275–284.
5. Alonso J, Ferrer M, Gandek B, Ware JJ, Aronsson N, Mosconi P, Rasmussen NK, Bullinger M, Fukuhara S, Kaasa S, Leplège A. Health-related quality of life associated with chronic conditions in eight countries: results from the International Quality of Life Assessment (IQOLA) Project. *Qual Life Res*. 2004;13:283–298.
6. Michalsen A, König G, Thime W. Preventable causative factors leading to hospital admission with decompensated heart failure. *Heart*. 1998;80:437–441.
7. Brasile J. New strategies for improving heart failure management: A primary care perspective. *South Med J*. 2001;94:166–174.
8. Horan M, Barrett F, Mulqueen M, Maurer B, Quigley P, McDonald KM. The basics of heart failure management: are they being ignored? *Eur J Heart Fail*. 2000;2:101–105.
9. Strömberg A, Mårtensson J, Fridlund B, Levin L-Å, Karlsson J-E, Dahlström U. Nurse-led heart failure clinics improve survival and self-care behaviour in patients with heart failure. Results from a prospective, randomised trial. *Eur Heart J*. 2003;24:1014–1023.
10. Kutzleb J, Reiner D. The impact of nurse-directed patient education on quality of life and functional capacity in people with heart failure. *J Am Acad Nurse Pract*. 2006;18:116–123.
11. Patel H, Shafazand M, Schaufelberger M, Ekman I. Reasons for seeking acute care in chronic heart failure. *Eur J Heart Fail.* 2007;9:702–708.
12. Halling A, Berglund J. Concordance between elderly patients' understanding of and their primary healthcare physician's diagnosis of heart failure. *Scand J Prim Health Care*. 2006;24:110–114.
13. Horne R, Hankins M, Jenkins R. The Satisfaction with Information about Medicines Scale (SIMS): a new measurement tool for audit and research. *Qual Health Care*. 2001;10:135–140.
14. Jaarsma T, Strömberg A, Mårtensson J, Dracup K. Development and testing of the European Heart Failure Self-Care Behaviour Scale. *Eur J Heart Fail*. 2003;5:363–370.
15. Streiner DL, Norman GR. *Health Measurement Scales: A practical guide to their development and use*. 2nd ed. New York: Oxford Medical Publications; 2003.

16. Guidelines Committee. 2003. European Society of Hypertension-European Society of Cardiology guidelines for the management of arterial hypertension. *J Hypertens*. 2003;21:1011–1053.
17. Lee TT, Chen J, Cohen DJ, Tsao L. The association between blood pressure and mortality in patients with heart failure. *Am Heart J*. 2006;151(1):76–83.
18. De Silva R, Rigby AS, Witte KK et al. Anemia, renal dysfunction, and their interaction in patients with chronic heart failure. *Am J Cardiol*. 2006;98(3):391–8.
19. Fuat A, Hungin AP, Murphy JJ. Barriers to accurate diagnosis and effective management of heart failure in primary care: qualitative study. *BMJ*. 2003;326:196.
20. Ekman I, Schaufelberger M, Kjellgren IM, Swedberg K, Granger BB. Standard medication information is not enough: poor concordance of patient and nurse perceptions. *J Adv Nurs*. 2007;60:181–186.
21. WHO. Innovative care for chronic conditions: building blocks for action: global report. Geneva: World Health Organization; 2002.
22. Sabaté E. Adherence to long-term therapies: evidence for action. Geneva: World Health Organization; 2003.
23. Dunbar-Jacob J, Erlen JA, Schlenk EA, Ryan CM, Sereika SM, Doswell WM. Adherence in chronic disease. *Annu Rev Nurs Res*. 2000;18:48–90.
24. Ekman I, Cleland JG, Andersson B, Swedberg K. Exploring symptoms in chronic heart failure. *Eur J Heart Fail*. 2005;7(5):699–703.