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The Impact of Patient Education on Rehospitalization Rate and Quality of Life in Heart Failure Patients

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Abstract

Background and Aim: Heart failure (HF) with reduced ejection fraction (HFrEF) significantly impairs quality of life (QoL), leading to frequent hospitalizations, high mortality and high healthcare costs. This study sought to investigate whether education of patients could enhance QoL and reduce rehospitalization rates in patients with HFrEF.

Materials and Methods: A randomized, follow-up trial was conducted in our center including 64 patients diagnosed with HFrEF, all of whom were receiving guideline-directed medical therapy. Participants were randomly assigned to two groups: the nurse-led education group (n=32), which received structured education on HF management from trained nurses, and the routine care group (n=32), who received standard medical care without additional educational support. QoL was assessed using a validated questionnaire and clinical evaluations after 3 months, focusing on the performance of everyday activities (various aspects of daily life and depression), as well as the rehospitalization rate.

Results: Educated group demonstrated significantly improved QoL. Additionally, none of the educated patients had rehospitalizations, while 34% of the non-educated group did.

Conclusion: Education of patients has a positive impact on both the physical and psychological well-being of patients with HFrEF, thereby improving their QoL, reducing rehospitalizations and lowering healthcare costs.

Keywords: Heart failure, education, quality of life, rehospitalizations

INTRODUCTION

Heart failure (HF) is a major global public health problem. The mortality rate is still high, as well as the rate of rehospitalizations despite current therapeutic options.

Advanced HF is a condition with a poor prognosis, with a prognosis worse than many metastatic cancers. We have novel, potent medications helping us in managing patients with HF, especially in HF with reduced ejection fraction (HFrEF). But

there are unmet needs. Obstacles and challenges lurk around the corner. Could we do better?

Are we able to help our patients (and their caregivers) not just to survive but to have better quality of life (QoL)? HF can significantly affect the patient's physical, emotional, and social well-being. The limitations due to fatigue, shortness of breath, and frequent hospitalizations can lead to feelings of frustration, helplessness, and isolation having strong impact on QoL.

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HF guidelines stressed the importance of patient education regarding treatment adherence, lifestyle changes, symptom monitoring, and response to possible deterioration.^[1]

Are our patients well educated? Are we listening to them, their needs, their complaints, their QoL wishes? Are we explaining to them simple but potentially life-changing hacks, such as regarding water and salt intake or nutrition tips?

Could better education of patients make a significant change for HF patients? Utopia or reality?

We hypothesized that **patient education** plays a crucial role in managing HF, as it empowers individuals to understand their condition, make informed decisions, and take active steps in their care and impact on QoL.

HF can significantly affect the patient's physical, emotional, and social well-being. The limitations due to fatigue, shortness of breath, and frequent hospitalizations can lead to feelings of frustration, helplessness, and isolation. Education that supports self-management, promotes adherence to treatment, and encourages a healthy lifestyle can improve both physical and psychological outcomes, ultimately enhancing QoL. For patients with HF, the level of knowledge about the disease process is positively correlated with recognizing and managing symptoms and improving QoL.^[1,2] Nurse-led HF inpatient hospital education (covering disease management, medication adherence, lifestyle changes, symptom monitoring and when to seek medical help) has been demonstrated to improve knowledge, self-care behaviours and readmissions.^[3,4]

METHODS

This study involved two groups of patients with chronic HFrEF receiving optimized guideline-directed therapy. Group 1 (32 patients) received structured education from a trained nurse, covering disease management, medication adherence, lifestyle changes, symptom monitoring, and when to seek medical help. Group 2 (32 patients) received standard routine care without additional detailed education.

Key aspects of nurse-led patient education in HF:

1. Understanding HF

- What is HF? HF means that the heart does not pump effectively and is unable to meet the body's needs.
- Causes: Discuss the underlying causes like coronary artery disease, hypertension, diabetes, and valve disorders.
- Symptoms: Help patients recognize symptoms of worsening HF, such as shortness of breath, fatigue, weight gain, and swelling.

2. Medication adherence

- Importance of medications: Emphasize the need to take prescribed medications regularly to manage symptoms, improve survival and prevent hospitalizations.
- Side effects: Teach patients to recognize common side effects and know how to handle them.

3. Lifestyle modifications

- Dietary changes: Advise limiting sodium and fluid intake, and following a heart-healthy diet rich in fruits, vegetables, and whole grains.
- Exercise: Encourage regular physical activity based on individual tolerance to prevent deconditioning.
- Smoking and alcohol cessation and advices

4. Self-monitoring

- Daily weight monitoring: Teach patients to weigh themselves daily, as sudden weight gain can indicate fluid retention or worsening HF.
- Symptom tracking: Encourage tracking symptoms like shortness of breath or swelling, and reporting changes to healthcare providers.

5. When to seek medical help

- Provide clear guidance on when to contact healthcare providers (via phone or email), such as: rapid weight gain (2-3 pounds in one day), increased swelling or shortness of breath, chest pain or signs of a heart attack, new or worsening fatigue

6. Psychosocial support

- Discuss the emotional challenges of living with HF, including anxiety or depression.
- Encourage participation in support groups or counseling to enhance mental well-being.

7. End-of-life planning (when appropriate)

For advanced HF patients, discuss goals of care and end-of-life wishes, ensuring the patient's preferences are respected

Patients were recruited at our institution, either during hospitalization or in outpatient clinics. Hospitalized patients received education from a nurse, which began during their inpatient treatment (group 1). Patients who came for a check-up in the outpatient clinic and had optimized therapy were evaluated and continue to be monitored through follow-up appointments in the outpatient setting (group 2).

Key inclusion criteria included participants being aged 18-85 and diagnosed with HFrEF (ejection fraction $\leq 40\%$). Exclusion criteria included cognitive impairments and patients' refusal to participate.

Both groups were on optimized, guideline-directed medical therapy (GDMT) for HFrEF according to the current European Society of Cardiology (ESC) guidelines for HFrEF,^[5] which included the maximum tolerable dose of angiotensin receptor-neprilysin inhibitor (sacubitril valsartan), a diuretic, a beta-blocker, magnetic resonance angiography (eplerenone or spironolactone, 25 or 50 mg), and sodium-glucose cotransporter 2 (empagliflozin or dapagliflozin, 10 mg).

Outcome Measures:

- Primary outcomes:

- QoL assessed via a customized questionnaire at baseline and after 3 months, focusing on effort tolerance, daily activities, and mood (anxiety/depression).

- Hospitalizations for HF within the 3-month follow-up.

- Secondary outcomes:

- Medication adherence.

- Patient-reported symptoms and functional status (New York Heart Association class).

- Death.

All patients were followed for 3 months. Data were collected at baseline and at follow-up. The study was approved by the Ethics Committee of University Clinical Center Tuzla Institution before starting the research (approval number: 02-09/2-53/21, date: 08.06.2022), and informed consent was obtained from all participants, ensuring their full adherence to appropriate privacy and confidentiality standards.

After 3 months, QoL was assessed in both groups at follow-up examinations. QoL was assessed with a set of questions, via an interview or survey, modeled on the ESC questionnaire (the

questions were adapted to the demographic characteristics of our population, and the questionnaire is provided as a Supplement 1). We compiled a set of questions concerning the patients responded to which QoL in HF and took into account the degree of tolerance to effort, the ability to perform usual daily and life activities, and the mood of the patients, such as the assessment of possible anxiety or depression. The survey questionnaire is attached as a the Supplement 1.

Statistical Analysis

Comparative analysis used t-tests for continuous variables and chi-square for categorical variables ($P < 0.05$ considered significant). ANOVA was used for data analysis. The visual analogue scale assessed symptom intensity and QoL, with patients marking their subjective experiences, as detailed in the Supplement 1.

RESULTS

The study involved 64 patients with HFrEF (85% male, 15% female), with most participants aged 56-65 years. The t-test showed no significant difference in age ($P < 0.05$) between groups. There was no significant difference among groups regarding the etiology of HFrEF, as shown in Table 1. As aforementioned in the methodology section both groups were on GDMT and there were no differences in medications. There were 4 patients with implantable cardioverter-defibrillator/cardiac resynchronization therapy in the first group versus 5 patients in the second group (no statistically significant difference).

Significant differences were found between educated and uneducated patients in various aspects of daily life (Figure 1). Educated patients reported fewer problems with usual activities, including walking. About 38% of educated patients had no issues walking, compared to 68% of uneducated patients. Furthermore, 19% of uneducated patients were unable to walk at all (Figure 2), while no educated patient reported this ($P = 0.038$). There was also a significant difference in responses regarding chest pain (Figure 3), with educated patients reporting less pain ($P = 0.0011$).

Diagnosis (etiology of HFrEF)	Group 1 (n=32)	Group 2 (n=32)	P-value
Ischemic post infarction heart disease	17 (53.13%)	15 (46.88%)	0.80
Valvular heart disease	7 (21.88%)	9 (28.13%)	0.77
Dilated CMP	5 (15.63%)	6 (18.75%)	1.00
Other CMP/etiology	3 (9.38%)	2 (6.25%)	1.00
Overall difference between groups			0.86

HFrEF: Heart failure with reduced ejection fraction, CMP: Cardiomyopathy

Regarding anxiety and depression, educated patients showed significantly lower levels, with 54% reporting no anxiety compared to 28% in uneducated patients (Figure 4). Conversely, 72% of uneducated patients experienced moderate or severe anxiety/depression ($P = 0.034$; $P = 0.042$).

Additionally, none of the educated patients had rehospitalizations, while 34% of uneducated patients did, highlighting the positive impact of education in reducing hospitalizations, improving QoL, and lowering healthcare costs.

DISCUSSION

This study highlights several key findings regarding the impact of education on HF patients' QoL, symptom management, and overall well-being. The sample of 64 subjects, predominantly male (85%) and aged 56-65 years, reflects the typical demographic profile for HFrEF. No statistically significant difference in age was found between the educated and uneducated groups ($P > 0.05$), suggesting age did not confound the study results.

A major finding was the significant improvement in the ability to perform daily activities among educated patients. For instance, while 68% of uneducated patients reported walking as a problem, only 19% of educated patients did, with none reporting an inability to walk. Statistically significant differences in walking difficulties were observed ($P = 0.038$ for

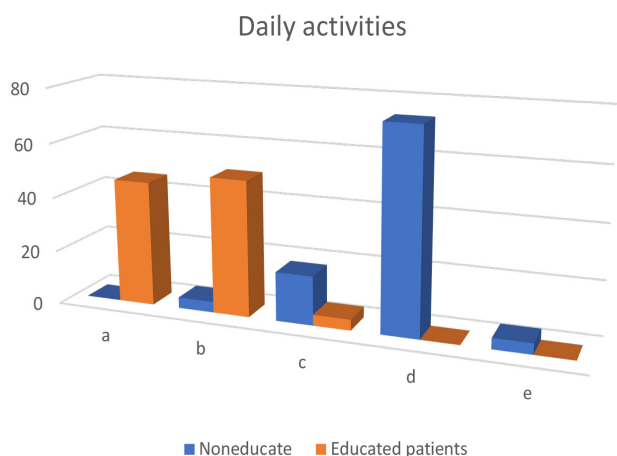


Figure 1: Comparison of results between educated and non-educated group regarding daily activities (a, b, c, d and e on X axis are answers on questions given in Supplement 1, Y axis shows proportions of patients)

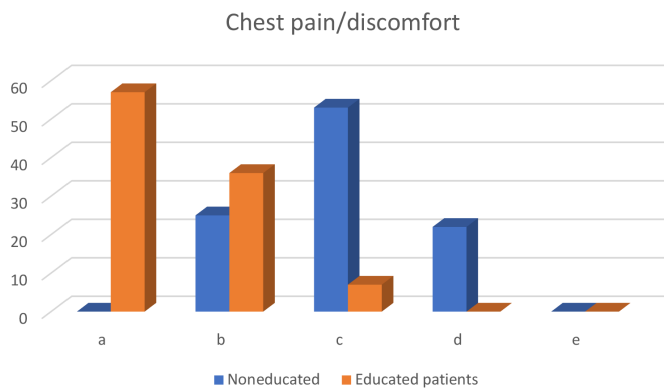


Figure 3: Comparison of results between educated and non-educated group regarding chest pain/discomfort (a, b, c, d and e on X axis are answers on questions given in Supplement 1, Y axis shows proportions of patients)

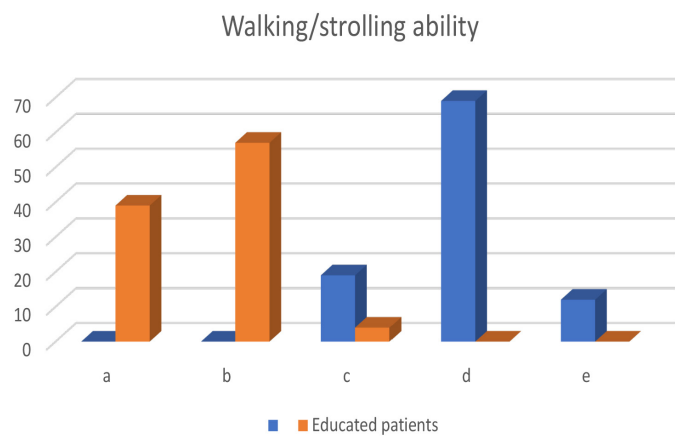


Figure 2: Comparison of results between educated and non-educated group regarding walking disability (a, b, c, d and e on X axis are answers on questions given in Supplement 1, Y axis shows proportions of patients)

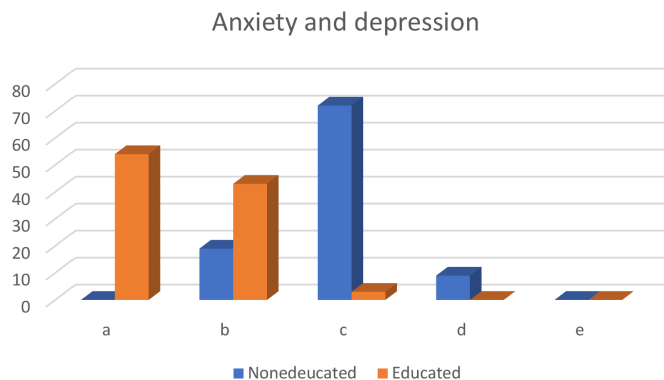


Figure 4: Comparison of results between educated and non-educated group regarding anxiety and depression (a, b, c, d and e on X axis are answers on questions given in Supplement 1, Y axis shows proportions of patients)

“big problem”, $P = 0.044$ for “small problem”), indicating that education positively influences mobility and physical activity.

Regarding chest pain, educated patients reported fewer instances of pain or discomfort. A significant difference was found in the “no chest pain or discomfort” response ($P = 0.0011$) between the groups, though no significant differences were noted for mild, severe, or extreme pain. This suggests education may help alleviate mild to moderate discomfort but might not have a significant impact on more severe pain.

The study also found that educated patients had significantly lower levels of anxiety and depression. Specifically, 54% of educated patients reported no anxiety, compared to 28% in the uneducated group, while 72% of uneducated patients experienced moderate to severe symptoms of anxiety or depression. The statistical significance of these findings ($P = 0.034$ for “not anxious”, $P = 0.042$ for “moderately anxious”) underscores the mental health benefits of patient education.

Finally, a key outcome was the absence of rehospitalizations among educated patients, while 34% of uneducated patients experienced rehospitalizations. This suggests that education is crucial in reducing hospital readmissions, as educated patients are likely more adept at managing symptoms, adhering to treatment, and seeking timely medical care.

Overall, the results suggest that patient education can significantly improve both physical and psychological outcomes for HF patients, while also reducing the need for rehospitalizations.

This not only improves the patients’ QoL but also has important implications for reducing healthcare costs, as rehospitalizations are a significant financial burden.^[4] For instance, Saito et al.^[6] conducted a meta-analysis and concluded that patients with HF, particularly those with comorbidities, poor physical condition, a history of readmissions, or inconsistent medication adherence, are at a higher risk of readmission. These patients could benefit significantly from the additional support provided by nurse-led interventions, which often include home visits and personalized education. Feltner et al.^[7] and Takeda et al.^[8], further corroborated the positive impact of home visits on both readmissions and mortality rates. In contrast, other studies comparing the effectiveness of home visits with telephone calls or telemonitoring found that remote interventions were less effective than face-to-face consultations.^[9-11] These findings underscore the value of in-person interactions in improving patient outcomes, particularly for high-risk populations like those with HF.

The impact of education programs on patients with HF has been a topic of ongoing investigation, and recent meta-analytic findings continue to confirm its importance in reducing HF-

related readmissions, as well as all-cause readmissions and mortality. A pooled analysis confirmed that interventions, such as nurse-led education programs, had a meaningful effect on reducing HF-related readmission rates and improving survival outcomes. Notably, interventions that included home visits appeared more effective than those without this component. These findings align with previous research suggesting that home visits can be an essential factor in improving patient outcomes post-discharge.^[4]

However, some studies have questioned the broader efficacy of nurse-led HF self-care education. Son et al.^[3] found that nurse-led education, specifically on self-care, did not lead to significant improvements in QoL or HF knowledge, raising concerns about the generalizability of nurse-led education programs. They argued that while many studies highlight the positive outcomes of such interventions, the evidence supporting the effectiveness of the nurse-led approach remains limited. This point raises an important consideration regarding the methodology used in many trials, which often focuses only on positive health outcomes without addressing potential methodological flaws.

In contrast, the present meta-analysis addressed this gap by including a comprehensive set of interventions. All randomized controlled trials (RCT) included in the meta-analysis incorporated education on managing comorbidities and medications, such as diabetes, hypertension, and obesity-factors that can significantly affect cardiac outcomes. Additionally, three of the studies included mandatory exercise as part of the intervention. These findings suggest that education programs, when tailored to a patient’s broader health management needs, may be more effective in improving HF outcomes.

Despite the overall positive findings regarding nurse-led interventions, it is essential to consider the methodological issues identified in previous studies. Ditewig et al.^[11] highlighted that self-management interventions often suffered from various methodological shortcomings, such as non-RCT designs, which could explain why some studies failed to show any significant impact on readmission rates or mortality. In contrast, the current meta-analysis demonstrated a positive effect on HF-related readmission and the composite outcome of all-cause readmission/death, though no significant effect was observed for all-cause readmissions or all-cause death, alone. These nuanced results are consistent with the broader literature, which suggests that improving patients’ knowledge about HF could help reduce exacerbations and prevent readmissions.^[12-14]

Moreover, Van Spall et al.^[15] examined post-discharge programs for HF patients and found that nurse-led home visits were the most effective in reducing all-cause mortality, followed by

disease management clinics. When it comes to readmissions, home visits proved once again to be the most effective. However, the data did not support a reduction in all-cause readmissions. These discrepancies could stem from differences in the study designs, patient populations, or outcome measures.

In conclusion, while nurse-led education programs—particularly those including home visits—show promise in improving HF-related readmissions and patient survival, there are still questions about the broader impact on all-cause readmissions and mortality. The evidence suggests that tailored, comprehensive interventions that address both disease management and comorbidities, alongside active patient engagement through home visits, are likely to be the most effective strategies for reducing readmission rates and improving outcomes in HF patients.

It is well known that patient education plays an important role in patients with HF, especially when it comes to improving the QoL of educated patients. However, there is not enough research that discusses to what extent education affects patients who are on modern, and optimized therapy according to the latest ESC guidelines for the treatment of HF. Additionally, insufficient implementation of patient and family education in everyday clinical practice is one of the main reasons for the unsatisfactory statistics regarding HF (in terms of mortality, morbidity, and QoL). Due to the insufficient number of healthcare workers (doctors and nurses) per capita in our country, as well as in many other countries, there is often not enough time dedicated to patient education. However, we believe that this research, even though it has a small sample size, emphasizes the importance of education and not just therapy optimization. In the long run, this ultimately saves time and resources by reducing the number of emergency doctor visits, hospitalizations, and improved QoL.

Study Limitations

While the study provides valuable insights into the effects of education on HF patients, there are some limitations. The sample size of 64 patients is relatively small, and the study was cross-sectional in nature, limiting the ability to draw precise conclusions about causality. Furthermore, the study did not assess the specific content or format of the educational interventions, which could vary in effectiveness depending on delivery methods. Future studies with larger, more diverse populations and longitudinal designs are needed to confirm these findings and explore the long-term effects of education on HF patients. Additionally, investigating the specific components of educational programs that contribute to improvements in physical activity, mental health, and hospitalization rates could further enhance the understanding of effective interventions

for HF management. QoL was assessed with a set of questions, via an interview or survey, modeled on the questionnaire of the ESC. We adapted the questions to the demographic characteristics of our population; hence, we did not obtain accreditation.

CONCLUSION

In conclusion, the findings from this study underscore the significant benefits of education for patients with HF. Educated patients reported fewer problems with daily activities, less chest pain and discomfort, lower levels of anxiety and depression, and a reduction in rehospitalizations. These results suggest that incorporating educational interventions into the management of HF could lead to improved patient outcomes, enhanced QoL, and reduced healthcare costs. A comprehensive educational program for HF patients, which emphasizes self-care, symptom monitoring, and lifestyle changes, can significantly improve outcomes. By helping patients understand their condition and actively participate in their treatment plan, we can enhance their overall QoL and reduce hospital admissions and complications.

Future research should further investigate the impact of different educational approaches and explore their long-term benefits for HF patients.

Ethics

Ethics Committee Approval: Approval was obtained from the Ethics Committee of University Clinical Center Tuzla Institution before starting the research (approval number: 02-09/2-53/21, date: 08.06.2022).

Informed Consent: Informed consent was obtained from all participants, ensuring their full adherence to appropriate privacy and confidentiality standards.

Footnotes

Authorship Contributions

Surgical and Medical Practices: L.D.H., E.H., S.B., I.H., Z.S., Concept: L.D.H., S.B., D.L., N.A.J., I.H., Z.S., Design: L.D.H., E.H., S.B., D.L., N.A.J., I.H., Z.S., Data Collection or Processing: L.D.H., E.H., D.L., N.A.J., Analysis or Interpretation: L.D.H., E.H., N.A.J., A.M.I., Literature Search: L.D.H., E.H., N.A.J., A.M.I., Writing: L.D.H., A.M.I., Z.S.

Conflict of Interest: No conflict of interest was declared by the authors.

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Supplement 1-Addendum: Appendix (Questionnaire)**General section****1. Gender**

- a) Male
- b) Female

2. Age

- a) 18-25 years
- b) 26-35 years
- c) 36-45 years
- d) 46-55 years
- e) 56-65 years
- f) 66-75 years
- g) 76 years and older

Part I - Usual activities

- 3. a) I have no problems performing everyday activities.
 - b) I have minor problems performing everyday activities.
 - c) Performing everyday activities is a moderate problem for me.
 - d) Performing everyday activities is a major problem for me.
 - e) I am unable to perform everyday activities.

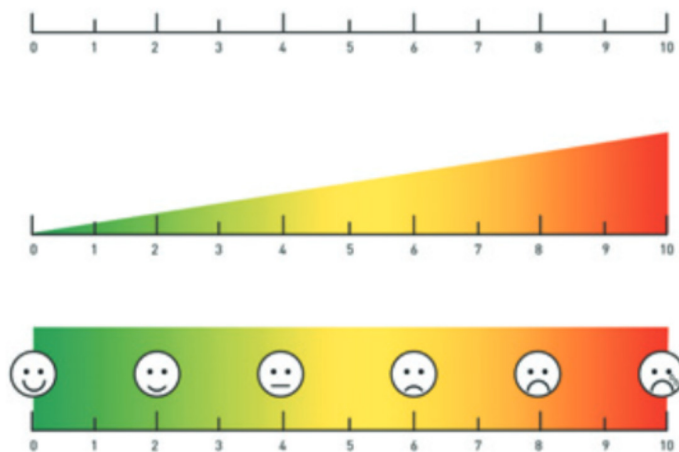
- 4. a) I have no problems walking or strolling.
 - b) Walking or strolling is a minor problem for me.
 - c) Walking or strolling is a moderate problem for me.
 - d) Walking or strolling is a major problem for me.
 - e) I am unable to walk.

Part II - Pain/discomfort

- 5. a) I have no pain or discomfort in my chest.
- b) I have mild chest pain or discomfort.
- c) I have moderate pain or discomfort in the chest.
- d) I have severe pain or discomfort in the chest.
- e) I have very severe pain in my chest.

Part III - Anxiety and Depression

- 6. a) I am not anxious or depressed.
- b) I am mildly anxious or depressed.
- c) I am moderately anxious or depressed.
- d) I am severely anxious or depressed
- e) I am very severely anxious or depressed



VAS scale The VAS scale is used to assess the intensity of symptoms and the QoL of patients. Patients mark their subjective experience on a 10 cm long line, where the endpoints represent the extreme values of the symptoms.