Statistical Analysis Plan

Study: Supporting patients' adaption process in liver cirrhosis

Trial registration number: ISRCTN10842381

Maria Hjorth

2026-04-10

Introduction and study aim

The aim with the present study is to describe:

1) changes in patient-perceived disability and self-efficacy for disease management after receiving a digital eHealth tool, hereinafter, named *the Care plan liver cirrhosis*,

2) patients and RNs acceptability and usability of carrying out activities in the Care plan liver cirrhosis, and,

3) explore associations and correlations between self-efficacy for disease management and patient-perceived disability before and after receiving Care plan liver cirrhosis.

4) explore changes in patient-perceiver health-related quality of life after receiving the Care plan liver cirrhosis.

This study uses a pragmatic, prospective, and single-arm experimental design with repeated measurements at baseline and 3-month follow-up. All analyses are descriptive, exploratory and hypothesis-generating. Outcomes focus on patients perceived usability of the Care Plan Liver Cirrhosis, and within-patient changes in perceived disability, self-efficacy for disease management and health-related quality of life.

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Study end points

Primary Outcomes

Self-efficacy for disease management, measured by use of the Swedish version of the *Self-Efficacy for Managing Chronic Disease* questionnaire [1, 2]. Six items are rated from 1 (not at all confident) to 10 (totally confident). Mean score (range 1–10) will be calculated for each participant. Higher scores indicate higher self-efficacy.

Secondary Outcomes

Patient-perceived disability, measured by use of a modified disability index [3, 4] comprising seven items covering occupational, home/family, recreational, social, sexual, life-support, and daily activities. Each item is scored from 0 (no disability) to 10 (complete disability), yielding a total score ranging from 0 to 70. Higher scores indicate greater disability.

Usability of the Care Plan Liver Cirrhosis, assessed at the 3 months follow-up visit using a 12-item questionnaire. The questions are inspired by the System usability scale [5] and the Interface Usability Instrument [6]. The questionnaire primarily consists of categorical items (yes / no / partly or sometimes; selected items include “I don’t know”) and one open-ended question.

Health-related quality of life, measured with Swedish version of the generic EQ5D-5L questionnaire [7] comprising five areas of health dimensions: mobility, self-care, usual activities, pain/discomfort and anxiety/depression. Each item is scored from 1 (no problems) to 3 (severe problems). In a visual analogue scale general health is rated ranging from 0 (worst health) to 100 (best imaginable health).

For each item of the two questionnaires *Self-Efficacy for Managing Chronic Disease* and *modified disability*, two questions are asked to calculate content validity. The questions read: On a scale from 1(very relevant) to 4 (not a relevant question), how relevant is this question to you?

Sample size determination

The intervention Care plan liver cirrhosis will be evaluated for feasibility and usability in this project. In absence of prior intervention data in this population, effect sizes will be interpreted in relation to distribution-based estimates (inter-quartile range) and clinical interpretability.

Sample size calculation

The study has an exploratory single-arm intervention study design [8]. This design enables active treatment for all participants, which is important from an ethical perspective since liver cirrhosis is a severe disease with high risk for disease progression and for some patients imply a short life expectancy [8, 9]. Therefore, the short intervention time and the single-arm design may reduce the amount of missing data as experienced in a previous randomized controlled study [10]. The intervention was designed and based on patients' needs and wishes for an improved understanding of their disease [11, 12]. An exploratory design will be undertaken based on the intention to study feasibility of the intervention regarding: acceptability, practicality, adaptation, and integration [13]. Consequently, no formal sample size calculation has been performed. A cohort of 70 participants is considered sufficient to study content validity and reliability for the self-efficacy for managing chronic disease questionnaire and the modified disability questionnaire for a population with liver cirrhosis, which corresponds to seven participants per item [14, 15].

Analysis populations

Analyses will be conducted according to the intention-to-treat principle, including all participants who complete baseline assessment irrespectively of the actual treatment.

General analysis methods

Multiplicity aspects

Since the study has a pragmatic design and is an example of clinical research in a real-world setting, no formal adjustment for multiple testing will be applied. Missing data will reflect the clinical outcomes of this patient population. Results will be interpreted cautiously, with emphasis on consistency, clinical relevance, and plausibility rather than isolated statistically significant findings.

Visit window

Self-efficacy for disease management and Patient-perceived disability are recorded at baseline and after Month 3. Usability is recorded month 3 only.

Handling of missing data

Analyses of change over time are based on complete cases with available baseline and follow-up data. The extent of missing data is described for each outcome. No imputation is performed due to the exploratory nature of the study and limited sample size.

Primary and secondary analyses

Primary analysis

Due to the ordinal nature of the *self-efficacy scale*, within-patient changes from baseline to 3-month follow-up will be analysed using the Wilcoxon signed-rank test. A non-normal distribution of data is expected. If data is normal distributed, instead t-test will be used. Self-efficacy outcomes are reported as mean scores (1–10). Effect estimates are presented as median change with interquartile range. A two-sided significance level of 0.05 is used.

Secondary analyses

For *disability outcomes*, within-patient changes from baseline to 3-month follow-up will be analysed using the Wilcoxon signed-rank test, due to the ordinal nature of the scales and anticipated non-normal distributions. Disability outcomes will be reported as total scores (0–70). Effect estimates are presented as median change with interquartile range. A two-sided significance level of 0.05 is used.

Usability outcomes will be analysed descriptively. Categorical responses are summarised as proportions, and responses to the open-ended item will be analysed qualitatively and summarised narratively when relevant.

Associations between disability and self-efficacy scores will be explored using Spearman's rank correlation coefficient at baseline and follow-up. Correlation coefficients will be interpreted descriptively, with emphasis on direction and magnitude rather than statistical significance alone.

For *health-related quality of life* outcomes, within-patient changes from baseline to 3-month follow-up will be analysed using the Wilcoxon signed-rank test, due to the ordinal nature of the scales and anticipated non-normal distributions. Effect estimates will be presented as median change with interquartile range. A two-sided significance level of 0.05 is used.

Item-Content validity index (I-CVI) will be used to validate of the *self-efficacy for managing chronic disease questionnaire* and the *modified disability questionnaire*. Per item the four response alternatives will be dichotomised as follows: response 3 or 4 will be considered valid, and response 1 or 2 not valid. The numbers of experts rating the item as valid will be divided by the total numbers of responders. I-CVI values >0.8 will be considered valid [16].

Internal consistency will be calculated for reliability of the two questionnaires *Self-Efficacy for Managing Chronic Disease* and *modified disability,* by use of Chonbach alpha. Per questionnaire, a value of 0.7 will confirm consistency for the scale in this population [14].

Statistical Considerations

Statistical analyses focus on within-group comparisons and descriptive associations. All analyses are hypothesis-generating and intended to inform future controlled studies. A two-sided significance level of 5% is applied without adjustment for multiplicity. Findings will be interpreted in conjunction with effect sizes, variability, and clinical relevance rather than statistical significance alone. Analyses will not be adjusted for outliers.

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