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Improvement in KCCQ-12 Scores after a Self-Care Intervention in Patients with Acute Heart Failure Discharged from the Emergency Department

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Dr. Stubblefield reports no COI.
Dr. Storrow reports no COI.
Dr. Spertus reports that, relevant to this work, he owns the copyright to the Kansas City Cardiomyopathy Questionnaire. He also serves as a consultant for Bayer, AstraZeneca, Myokardia, Merck, Amgen, Novartis, United Healthcare and Janssen; has equity in Health Outcomes Sciences and serves on the Board of Directors for Blue Cross-Blue Shield of Kansas City.
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Abstract

Background: We conducted a secondary analysis of changes in the Kansas City Cardiomyopathy Questionnaire (KCCQ)-12 over 30 days in a randomized trial of self-care coaching versus structured usual care in patients with AHF who were discharged from the ED.

Methods: Patients in 15 EDs completed the KCCQ-12 at ED discharge and at 30 days. We compared change in KCCQ-12 scores between the intervention and usual care arms, adjusted for enrollment KCCQ-12 and demographic characteristics. We used linear regression to describe changes in KCCQ-12 summary scores and logistic regression to characterize clinically meaningful KCCQ-12 subdomain changes at 30 days.

Results: There were 350 patients with both enrollment and 30-day KCCQ summary scores available; 166 allocated to usual care and 184 to the intervention arm. Median age was 64 years (IQR 55 to 70), 37% were female, 63% were African American, median KCCQ-12 summary score at enrollment was 47 (IQR 33 to 64). Self-care coaching resulted in significantly greater improvement in health status compared with structured usual care (5.4-point greater improvement, 95% CI, 1.12 to 9.68; p = 0.01). Improvements in health status in the intervention arm were driven by improvements within the symptom frequency [aOR 1.62, 95% CI, 1.01 to 2.59] and quality of life [aOR 2.39, 95% CI, 1.46 to 3.90] subdomains.

Conclusions: In this secondary analysis, patients with AHF who received a tailored, self-care intervention after ED discharge had clinically significant improvements in health status at 30 days compared with structured usual care largely due to improvements within the symptom frequency and quality of life subdomains of the KCCQ-12.

Registration: ClinicalTrials.gov Identifier: NCT02519283

Keywords

Kansas City Cardiomyopathy Questionnaire; KCCQ; KCCQ-12; GUIDED-HF; heart failure

Introduction

Heart failure (HF) is common with an estimated prevalence of 6 million Americans ≥20 years of age according to 2015 to 2018 data and is projected to increase by 46% from 2012 to 2030, affecting >8 million people ≥18 years of age.[1] As many as 875,000 patients with HF visit the emergency department (ED) annually, with 54% being admitted to the hospital three or more times following diagnosis.[2] Of the patients who present to the ED and are diagnosed with acute heart failure (AHF) as the cause of their symptoms, 84% are hospitalized. The 16% of patients with AHF who are discharged home[3] rely on the ED to assist with the transition to outpatient care, including medication adjustments, education about worsening symptoms, and obtaining provider follow-up.[4] However, ED-based transition initiatives are lacking, and ensuring optimal transitions of care for patients with AHF discharged from the ED is a critical, unmet need.

Patients with HF suffer from functional limitations and impaired quality of life,[5, 6] thus it is important to understand the impact of HF interventions on these outcomes.[7, 8] We conducted a randomized trial (GUIDED-HF) to evaluate if a tailored self-care intervention improves HF outcomes in patients with AHF discharged from the ED compared to structured usual care.[9] The self-care intervention included a home visit within 7 days of discharge and twice monthly telephone-based coaching calls for 3 months performed by the study team, including study coordinators, nurses or paramedics who underwent protocol training. A key component of our outcome assessment was to determine the impact of our intervention on

patient perceived health status. Our primary results suggested that a self-care intervention did not result in sustained improvement in the 90-day composite outcome of death, hospital admission, ED visit and Kansas City Cardiomyopathy Questionnaire (KCCQ-12) scores. However, we observed clinically important differences at 30 days between treatment arms in our primary outcome. A key component of this difference in efficacy was differences in changes in KCCQ scores between the intervention and usual care arms. The goal of this manuscript was to analyze changes in KCCQ-12 scores between enrollment and 30-day follow-up between trial arms.

Methods

KCCQ

The KCCQ-12 is a validated health status measure for patients with HF.[10–12] It contains four subdomains: Physical Limitation, Symptom Frequency, Quality of Life, and Social Limitations. Each subdomain provides an individual score from 0 to 100, with 0 denoting the worst and 100 the best possible health status. The mean of the four subdomain scores are presented as a summary score, with differences of 5 points or greater considered to be clinically important.[13–15]

Design

Detailed study methodology for the GUIDED-HF Trial has been previously reported.[16] In brief, patients ≥ 21 years old with a history of HF deemed by the treating emergency provider to have AHF, and who they planned to discharge after ED-based management (less than 23 hours of AHF care), were eligible for inclusion. Patients were excluded if they were unable to comply with the protocol due to psychiatric disease or distance from the hospital, if they had a systolic blood pressure less than 100 mmHg, evidence of acute coronary syndrome, or were undergoing outpatient inotrope infusion. Patients were enrolled in 15 geographically diverse EDs and randomized at the time of ED discharge to structured, usual care versus a self-care intervention. In keeping with the pragmatic nature of the trial, we designed the structured usual care arm discharge procedures to largely reflect usual practice, although the study team also performed HF medication reconciliation and arranged 7-day outpatient HF provider follow-up in the usual care arm. Patients randomized to the self-care intervention received these two structured usual care procedures, as well as a home visit within 7-days of ED discharge and twice-monthly self-care coaching calls for 3 months. Self-care coaching focused on daily weights, signs of worsening HF, low-salt diet, monitoring fluid intake, and exercise. KCCQ scores were collected shortly prior to ED discharge (enrollment) and again 30 days after ED discharge. Protocols were approved by each site’s Institutional Review Board.

Data Collection

At enrollment, patient demographics, medical history, prior ejection fraction (EF), HF hospitalizations and ED visits in the previous 6 months, ED tests and treatments, and KCCQ-12 scores were prospectively collected and entered into a research electronic data capture (REDCap) platform.[17, 18] Outcome assessors collecting 30-day KCCQ-12 scores by phone were blinded to the treatment arm. Per study protocol, KCCQ-12 scoring at

30 days had to be completed within a 5 day window. If patients were reached after this window, HF readmission and cardiovascular mortality events were still recorded in the primary analysis,[9] however KCCQ-12 scores were not recorded. This timeframe was implemented to ensure comprehensive follow-up for readmission and mortality outcomes, and KCCQ-12 collection was reflective of a 30-day follow-up period. This narrow window led to increased missingness for 30-day KCCQ-12 scoring relative to HF readmission and mortality outcomes.

Statistical Analysis

Enrollment demographic and clinical characteristics were summarized using median (Interquartile Range [IQR]) or count (percentage), as appropriate. Comparisons between trial arms were conducted using Wilcoxon rank-sum tests for continuous variables and Pearson's Chi-squared test for categorical variables. Changes in KCCQ-12 scores from enrollment to 30 days were summarized and analyzed both by summary score and, in each subdomain, as continuous variables. To help facilitate clinical interpretability of the mean differences in scores between groups, we also conducted responder analyses of the KCCQ-12 scores, dichotomizing the change in KCCQ-12 scores using previously established thresholds of clinically important changes consistent with prior investigations.[19, 20] Specifically, we evaluated five separate outcomes using thresholds of clinically important differences, defined as deterioration (≤ −5 point loss), small improvement (>5 points), moderate improvement (>10 points), large improvement (>15 points), and very large improvement (>20 points). All analyses were conducted following the intention to treat principle.

Our primary question of interest was whether the tailored self-care intervention resulted in greater improvement in KCCQ-12 scores compared with structured usual care after adjusting for *a priori* determined covariates. To answer this question, we used multivariable linear regression for continuous 30-day changes in KCCQ-12 scores adjusting for enrollment KCCQ-12 scores, age, sex, race, systolic blood pressure, and estimated glomerular filtration rate, and prior EF. In order to further investigate the clinically meaningful thresholds of change in KCCQ-12 scores as separate outcomes, we also fit multivariable logistic regression models for dichotomized outcomes using the 5 thresholds above. These models adjusted for the same covariates and evaluated the summary score and each of the 4 sub-domains as outcomes. Missing data was handled by multiple imputation. Ten copies of the dataset were created. For each dataset, we replaced missing data with imputed values generated using the predictive mean matching approach. Then we used Rubin's rule to summarize results from regression analysis across the 10 imputed datasets. All statistical analyses were performed using R Statistical Software, Version 3.5.2 (www.R-project.org).[21]

Results

A total of 491 patients were randomized. Twelve patients withdrew consent after randomization leaving 479 patients in the overall cohort. There were 350 with both KCCQ summary scores available at enrollment and at 30 (+4) days after enrollment; 166 allocated

to usual care and 184 allocated to the intervention arm. Patients were excluded due to incomplete data including two deaths within 30 days, one in each study arm, three withdrawals after ED discharge but before the 30-day follow up, 10 with missing baseline KCCQ summary scores, and 114 had missing 30-day KCCQ scores because follow-up occurred after day 34 (sFig 1). There was no detectable difference in enrollment data between the two arms. Further, there were no differences in baseline KCCQ-12 scores between: 1) the 350 patients with complete enrollment and follow-up KCCQ available and 2) the 129 patients who had either died, withdrew or had missing enrollment and/or follow-up KCCQ scores (n=129) (sTable 1). In the 350 patients that formed the study cohort, the median age was 64 years (IQR 55 to 70), 37% were female, 63% were African American, and 42% had a left ventricular EF >50%. The median KCCQ-12 summary score at enrollment was 47 (IQR 33 to 64). Patients in the intervention arm were more likely to be taking beta-blockers and less likely to be taking ACE inhibitors, otherwise there were no significant difference between study arms in enrollment characteristics or enrollment KCCQ-12 overall summary scores (Table 1).

Patients in the intervention arm experienced an adjusted 5.4-point improvement (95% CI, 1.12–9.68; P=0.01) in KCCQ-12 summary scores at 30 days compared with the usual care arm. The symptom frequency and quality of life sub-domains demonstrated similar improvements in the intervention arm (symptom frequency Beta = 5.62, 95% CI, 0.21–11.03, p = 0.04; quality of life Beta = 7.42, 95% CI, 1.71– 13.13, p = 0.01) (Fig 1).

In unadjusted analyses, relative to the usual care arm, we observed a greater proportion of patients in the intervention arm with improvements in KCCQ-12 summary scores [small (>5 point) 61% vs 53% p=0.11, moderate (>10 point) 49% vs 39% p =0.05, large (>15 point) 39% vs 29% p = 0.04, very large (>20 point) 30% vs 23% p = 0.11]. Additionally, relative to structured usual care, fewer patients in the intervention arm (20% vs 30%, p = 0.04) experienced a deterioration in KCCQ-12 overall summary scores (≤−5 points) at 30 days (Fig 2A). This yielded numbers needed to treat (NNT) of 12, 10, 10, and 14 respectively for small, moderate, large, and very large improvements in KCCQ-12 overall summary scores. Adjusted regression models suggested patients in the intervention arm had increased odds of improvement in KCCQ-12 overall summary scores compared to the usual care arm at 30 days for small (>5 points, aOR 1.48, 95% CI, 0.95–2.33; p = 0.09), moderate (>10 points, aOR 1.66, 95% CI, 1.05–2.26; p = 0.03;), large (> 15 points, aOR 1.66, 95% CI, 1.05–2.62; p = 0.03), and very large (>20 points, aOR 1.64, 95% CI, 0.98–2.74; p = 0.06) improvements, and a decreased odds of deterioration (≤ −5 points, aOR 0.56, 95% CI, 0.34–0.95; p = 0.03) (Fig 2B). In our adjusted regression models, none of the included covariates were significant predictors of change in KCCQ-12 summary scores at 30 days with the exception of baseline KCCQ-12 summary scores for deterioration, small, moderate, large, and very large improvements; prior EF for large improvement; and ED systolic blood pressure for large and very large improvements (sTable II). Patients within the intervention arm had increased odds of improvement in the symptom frequency and quality of life subdomains at 30 days for all improvement threshold levels (Fig 3, D and F). There was no observed association for improvement in the physical limitations and social limitations subdomains (Fig 3, B and H). In an exploratory analysis, we removed the quality of life subdomain to yield the KCCQ clinical summary score.[22] The differences between study

arms remained significant even after the removal of quality of life with a 4.96-point (0.58–9.33, p=0.03) difference between intervention and usual care arms at 30 days.

Discussion

Patients with chronic HF frequently present to the ED with AHF and, when not hospitalized, their successful transition to the outpatient setting relies largely on the emergency care system and its providers. Our analysis of 350 patients included in our randomized trial of transitional care suggests patients in the intervention arm had significantly greater improvements in their health status at 30 days, as measured by the KCCQ-12 overall summary score. An estimated 12 patients were needed to treat to achieve a clinically important improvement (>5 points) in health status, primarily driven by improvements in their HF symptoms and quality of life. Importantly, no individual covariate (age, sex, race, systolic blood pressure, and estimated glomerular filtration rate, and prior EF) with the exception of enrollment KCCQ-12 score remained consistently significant in the adjusted logistic regression models used to predict meaningful clinical changes in KCCQ-12 summary score in the intervention arm. Our findings add to the current literature describing both the impact of self-care interventions on health status, and the changes in KCCQ-12 in patients 30 days after discharge from an ED visit for AHF without hospitalization.

Self-care interventions in patients with HF has been shown to prevent re-admission and improve quality of life in several meta analyses.[23–26] Although we did not conduct a cost-effectiveness analysis, prior work has reported significant savings in self-management interventions due to reduced resource utilization.[27, 28] The reduced resource utilization and cost savings in safely avoiding return ED visits and subsequent hospital admissions may offset the small incremental cost of time spent conducting a home visit and self-care coaching. Further, our tailored, self-care intervention was implemented by a variety of healthcare providers (paramedics, nurses, coordinators), and could be delivered by staff already present in the ED, without requiring new training or hiring new types of staff to complete this initiative.

Seventy five percent of our cohort had vulnerable characteristics defined as (1) non-White race/ethnicity, (2) brief health literacy score less than 9,[29] or (3) a national area deprivation index (ADI) score greater than 85.[30] This is of particular significance given that vulnerable patients often use the ED as their main source of health care. As noted in the original trial, vulnerable patients in the intervention arm experienced similar early benefit consistent with the overall population effect.

Our results are similar to those reported in patients with AHF who are hospitalized. A prior AHF study conducted by Sauser, et al. followed patients from the ED through hospital admission to 30 days post discharge. They noted KCCQ summary scores were lowest at presentation to the ED, improved during hospitalization (+11.9 points) and were highest at 30 days (+17.8 points).[12] Our study demonstrates improvements in KCCQ summary scores in the intervention arm at 30 days, but is unique in characterizing patients who are discharged after only ED-based management. These improvements may be even more impactful considering patients discharged from the ED are less ill than those

discharged from the hospital. Considering the cost and resource utilization resulting from a hospitalization, we believe these findings represent important incremental improvements in strategies of care in the subset of patients with HF who are discharged.

Our study suggests significant differences in 30-day health status between patients randomized to the intervention when compared with structured usual care, but these findings should be interpreted in the context of the following potential limitations. First, while we identified improvement in health status at 30 days, our primary analysis suggested this improvement was not sustained at 90 days. The temporal relationship of ED discharge with 30-day outcomes is impactful in the emergency department setting and several AHF tools have been developed predicting 30-day outcomes.[31, 32] This does suggest however, a repeat home visit or additional HF provider follow-up may be needed between 30 and 90 days to sustain the observed early health status benefit. This added cost may also need to be considered in a cost-effectiveness analysis. Second, a slow accrual rate was observed in the primary study. A lower-than-expected ED discharge rate suggests our intervention may be of greatest utility at ED sites where a high proportion of patients are discharged home after ED-based management. Quality improvement efforts to increase the discharge to home rate of HF exacerbations presenting to the ED are ongoing.[33] Third, not all patients approached for the study consented to participate, and patients were excluded if they lived too far away from the enrolling institution for a home visit to be conducted. We did not describe a distance but left it up to the study team to determine. Ultimately, we amended this to include telehealth visits and so distance did not exclude anybody from participation. Telehealth visits were conducted in lieu of home visits for 11% of the intervention arm in the original trial. This adjuvant may serve an unmet need for those patients with geographic limitations. Receptivity to telehealth is likely to have improved as a result of the coronavirus pandemic. Fourth, complete KCCQ-12 overall summary scores at enrollment and 30-day follow-up were available for 350 of the 479 patients (73%) in the GUIDED-HF Trial. The majority of patients were excluded due to our strict data collection time window for 30-day KCCQ scores (26–34 days). Patient death or withdrawal resulted in five patients being excluded, no baseline KCCQ-12 score excluded ten, and inability to contact patient within the strict KCCQ-12 follow-up time window excluded 114 patients (sFig I). While patients could recall and report HF events such as ED revisits and hospital admission at later time points, to minimize missingness on these events, the study team was not able to capture KCCQ-12 scores outside the +/− 4-day window. This may have biased the results and favored those who responded in a timely manner. However, there were no differences in baseline KCCQ-12 scores or enrollment characteristics between those included in the analysis and those unavailable for follow-up at 30 days (sTable I). Finally, these results may not be generalizable to more acutely-ill patients with HF, as these patients were specifically excluded. Thus, patients within our cohort had 0 to 1 hospital admissions for HF in the last 6 months, median systolic blood pressures of 143, and were deemed by emergency physician to be eligible for discharge.

Conclusion

Our findings in this secondary analysis suggest patients with AHF who received a tailored, self-care intervention after ED discharge had clinically significant improvements in health

status at 30 days compared with structured usual care, largely due to improvements within the symptom frequency and quality of life subdomains of the KCCQ-12.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Abbreviations List:

AHF	Acute Heart failure
HF	Heart Failure
ED	Emergency Department
EF	Ejection Fraction
GUIDED-HF	Get with the Guidelines in Emergency Department Patients with Heart Failure
KCCQ	Kansas City Cardiomyopathy Questionnaire

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“What is Known”

- The majority of patients who present to the emergency department (ED) with acute heart failure (AHF) are hospitalized.
- ED-based transition initiatives to assist with the transition to outpatient care, including medication adjustments, education about worsening symptoms, and obtaining provider follow-up is a critical, unmet need.
- The GUIDED-HF trial observed improvement in its composite primary outcome at 30 days as a result of its tailored self-care program

“What the Study Adds”

- This secondary analysis of the GUIDED-HF trial evaluated changes in the Kansas City Cardiomyopathy Questionnaire (KCCQ)-12 over 30 days in patients with AHF who were discharged from the ED.
- Patients with AHF who received the tailored, self-care intervention after ED discharge had clinically significant improvements in health status at 30 days compared with structured usual care, largely due to improvements within the symptom frequency and quality of life subdomains of the KCCQ-12.

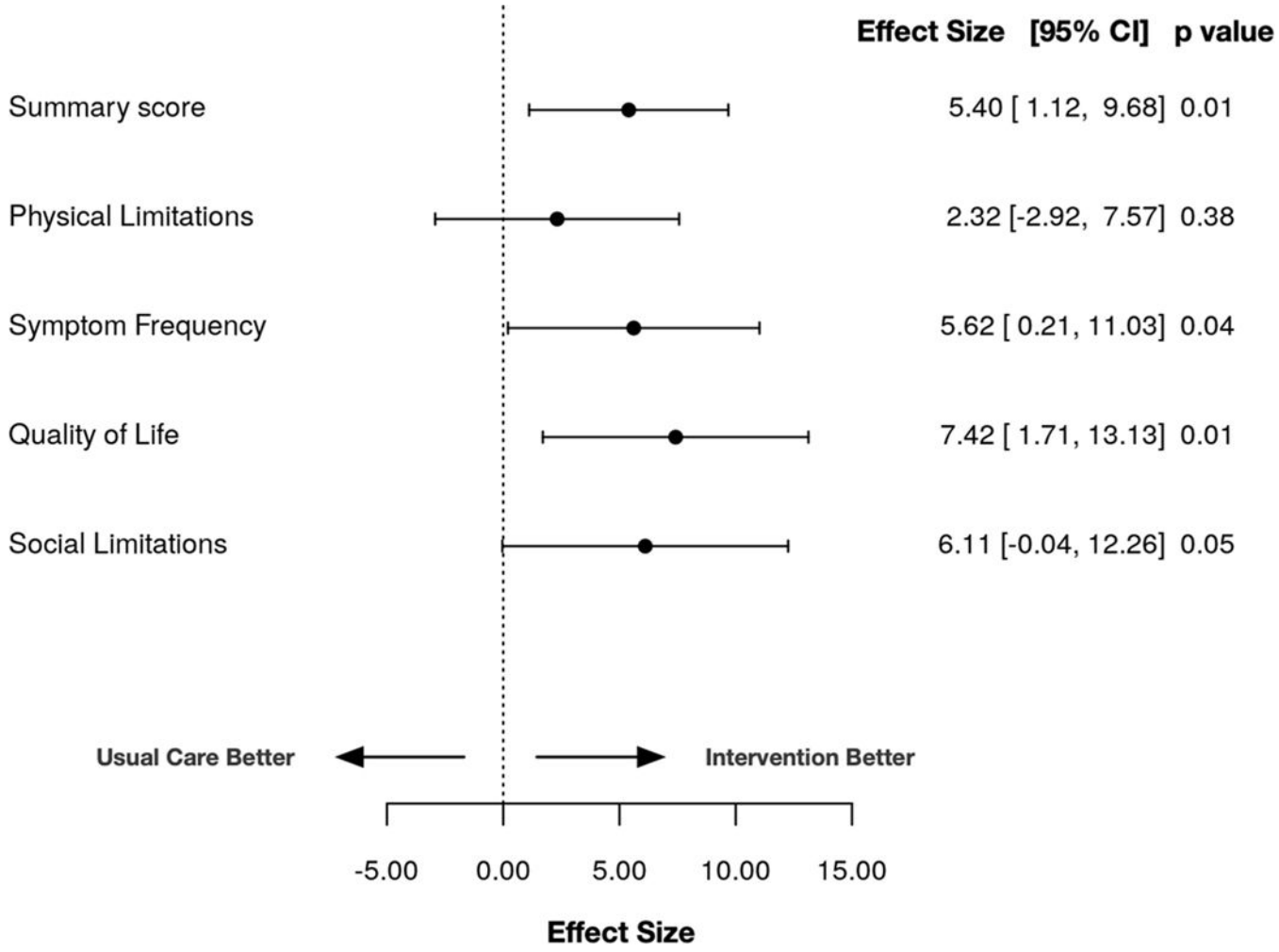

Fig 1. Effect size between intervention and usual care from enrollment to 30 days.

Linear regression analyses show 5.4-point greater improvements in KCCQ-12 summary scores at 30 days and similar associations in the symptom frequency and quality of life sub-domains.

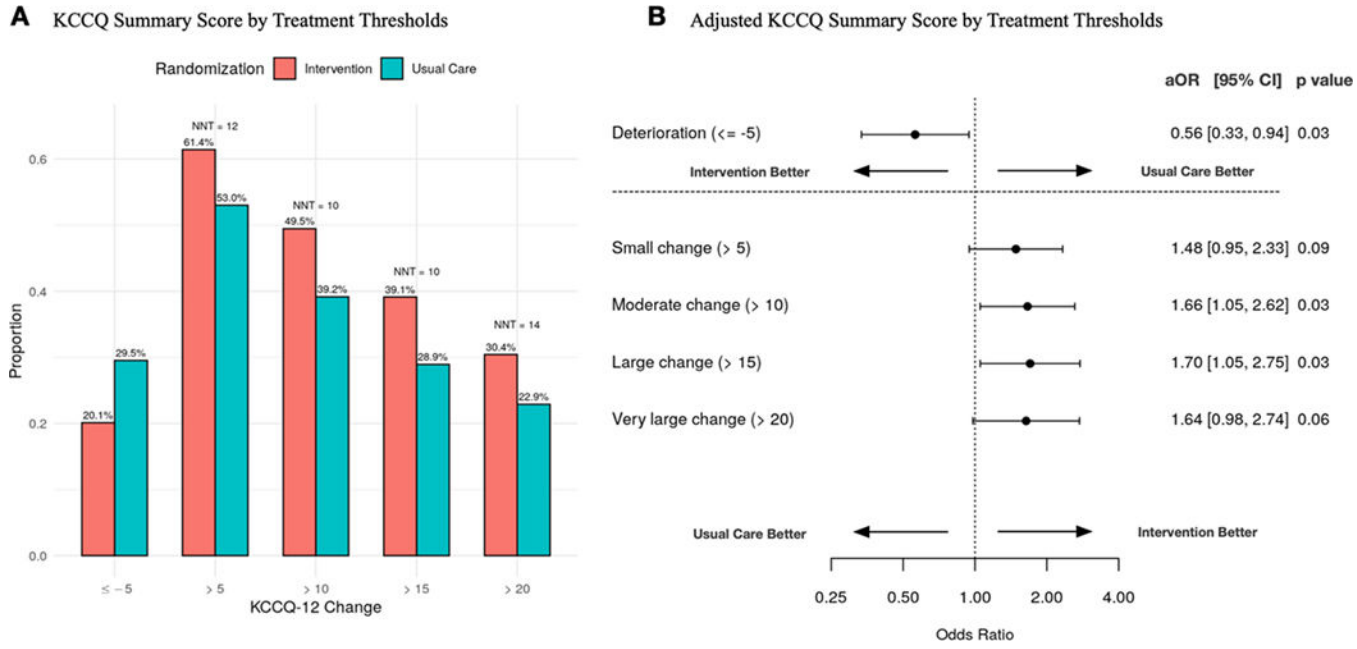

Fig 2. Responder analysis of change in KCCQ-12 summary score at 30 days with self-care intervention versus usual care.

Unadjusted small, moderate, and large changes in KCCQ-12 Summary Scores in self-care intervention versus usual care at 30 days **(A)**. Associated small, moderate, and large changes in KCCQ-12 summary scores using adjusted regression analyses **(B)**. Abbreviations: KCCQ-12, 12 item Kansas City Cardiomyopathy Questionnaire; OR, odds ratio; CI, confidence interval.

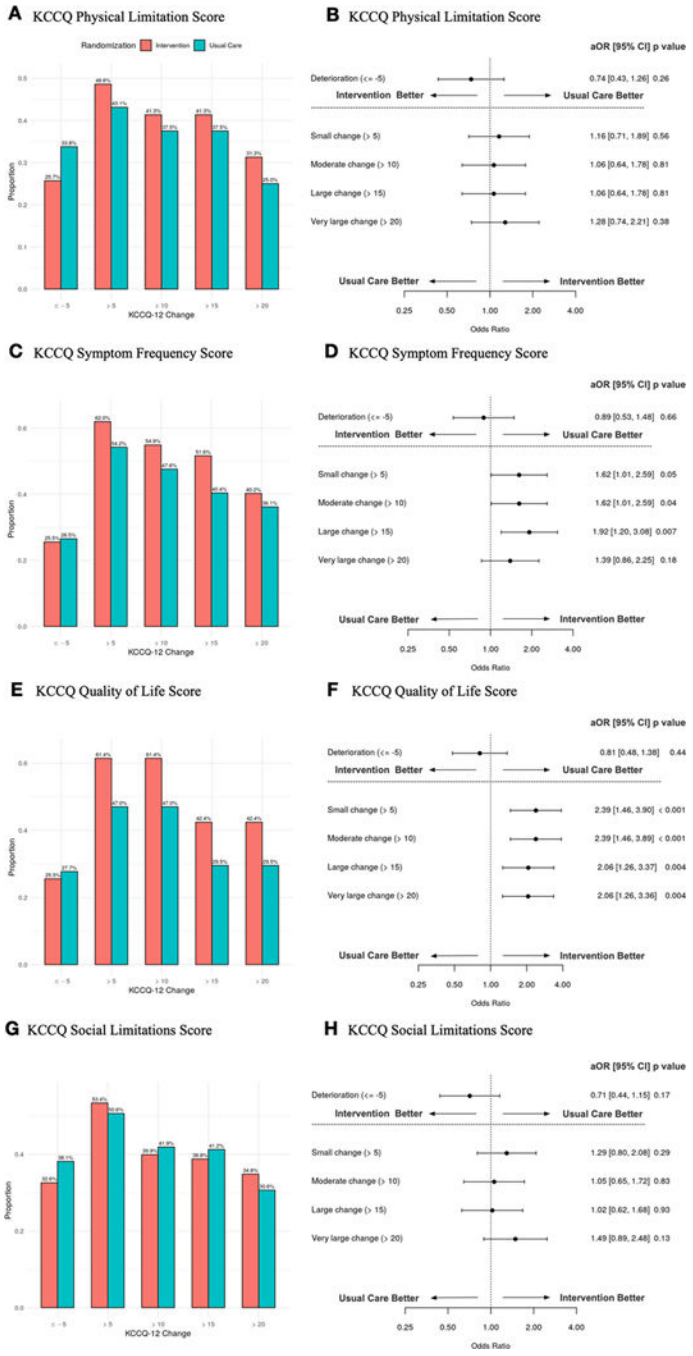

Fig 3. Responder analysis of change in KCCQ-12 subdomain scores at 30 days with self-care intervention versus usual care.

Unadjusted small, moderate, and large changes in KCCQ-12 Physical Limitation Score **(A)**, Symptom Frequency Score **(C)**, Quality of Life Score **(E)**, and Social Limitation Score **(G)** with self-care intervention versus usual care at 30 days. Associated small, moderate, and large changes in KCCQ-12 Physical Limitation Score **(B)**, Symptom Frequency Score **(D)**, Quality of Life Score **(F)**, and Social Limitation Score **(H)** using adjusted regression

analyses. Abbreviations: KCCQ-12, 12 item Kansas City Cardiomyopathy Questionnaire; OR, odds ratio; CI, confidence interval.

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Table 1.

Enrollment Characteristics by Study Arms

Characteristic		Intervention (n=166)	Usual Care (n=184)	Combined (n=350)	p-value
Median Age (interquartile range), years		64 (54, 70)	63 (56, 70)	64 (55, 70)	0.94
Female, n (%)		65 (35)	66 (40)	131 (37)	0.39
Race, n (%)					0.66
	American Indian or Alaskan Native	0	1 (1)	1 (0)	
	Black/African American	121 (66)	100 (60)	221 (63)	
	Native Hawaiian or Pacific Islander	0	1 (1)	1 (0)	
	White non-Hispanic	58 (32)	60 (36)	118 (34)	
	White Hispanic	4 (2)	3 (2)	7 (2)	
	Declined to Disclose	1 (1)	1 (1)	2 (1)	
Vulnerable Population, n (%)		143 (78)	120 (72)	263 (75)	0.24
Brief Health Literacy Score < 9		22 (12)	17 (10)	39 (11)	0.60
Median National ADI Rank (interquartile range)		83 (58, 96)	83 (58, 95)	83 (57, 96)	0.63
Low SES, n (%)		85 (49)	72 (44)	157 (46)	0.42
Mean Body Mass Index (kg/m^2)		33 (28, 41)	36 (30, 43)	34 (29, 42)	0.05
Chronic Medical Conditions, n (%)					
	Myocardial Infarction	54 (29)	52 (31)	106 (30)	0.52
	Hypertension	173 (94)	154 (93)	327 (93)	0.64
	Diabetes Mellitus	105 (57)	89 (54)	194 (55)	0.52
	CKD	54 (29)	41 (25)	95 (27)	0.37
	COPD	70 (38)	53 (32)	123 (35)	0.41
Prior EF, n (%)					0.36
	Normal	63 (37)	74 (47)	137 (42)	
	Moderately reduced	50 (29)	38 (24)	88 (27)	
	Severely reduced	53 (31)	43 (27)	96 (29)	
	Not reported	4 (2)	3 (2)	7 (2)	
NYHA Class, n (%)					0.42
	I	26 (14)	29 (19)	55 (16)	
	II	89 (49)	63 (41)	152 (45)	
	III	54 (30)	50 (32)	104 (31)	
	IV	12 (7)	13 (8)	25 (7)	
Mean number of visits for HF in last 6 months		1 (0, 2)	1 (0, 2)	1 (0, 2)	0.46
Mean number of hospital admissions for HF in last 6 months		0 (0, 1)	0 (0, 1)	0 (0, 1)	0.72
Initial ED testing (interquartile range)					
	Median SBP	143 (126, 164)	142 (125, 164)	143 (126, 164)	0.80
	Calculated eGFR	65 (50, 80)	61 (50, 85)	63 (50, 82)	0.70
	BUN	19 (14, 27)	19 (14, 26)	19 (14, 26)	0.56

Characteristic		Intervention (n=166)	Usual Care (n=184)	Combined (n=350)	p-value
	BNP	603 (263, 1336)	438 (148, 1152)	520 (182, 1256)	0.13
	Troponin I	0.026 (0.012, 0.040)	0.021 (0.012, 0.040)	0.024 (0.012, 0.040)	0.87
	Troponin T	0.010 (0.007, 0.033)	0.030 (0.020, 0.045)	0.030 (0.010, 0.035)	0.27
Guideline Directed Medical Therapy at ED Discharge, n (%)					
	Diuretic *	163 (89)	148 (89)	311 (89)	0.87
	BB	143 (78)	112 (68)	255 (73)	0.04
	ACEi	58 (36)	85 (47)	143 (41)	0.04
	ARB	31 (17)	40 (25)	71(21)	0.09
	Aldosterone Antagonist †	38 (21)	36 (22)	74 (21)	0.74
KCCQ-12 scores at enrollment (interquartile range)					
	Summary	49 (36, 65)	44 (31, 63)	47 (33, 64)	0.10
	Physical limitations	67 (50, 75)	67 (50, 83)	67 (50, 75)	0.60
	Symptom frequency	44 (27, 62)	39 (21, 58)	42 (25, 60)	0.06
	Quality of life	38 (12, 62)	38 (12, 50)	38 (12, 62)	0.23
	Social limitations	50 (25, 75)	42 (25, 75)	50 (25, 75)	0.14

ACEi, Angiotensin-converting enzyme inhibitors; ADI, area deprivation index; ARB, Angiotensin II receptor blocker; BB, beta blocker; BNP, brain natriuretic peptide; BUN, blood urea nitrogen; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; EF, ejection fraction; eGFR, estimated glomerular filtration rate; HF, heart failure; NYHA, New York Heart Association Functional Classification for Heart Failure; SBP, systolic blood pressure; SES, socioeconomic status.

*diuretics included furosemide (Lasix) and bumetanide (Bumex)

†Aldosterone antagonists included: Spironolactone (Aldactone)