Title
Symptom Diary Use and Improved Survival for Patients With Heart Failure

Journal
Circulation Heart Failure, 10(11)

ISSN
1941-3289

Authors
Park, Linda G
Dracup, Kathleen
Whooley, Mary A
et al.

Publication Date
2017-11-01

DOI
10.1161/circheartfailure.117.003874

Peer reviewed

HHS Public Access

Author manuscript

Circ Heart Fail. Author manuscript; available in PMC 2018 November 01.

Published in final edited form as:

Circ Heart Fail. 2017 November ; 10(11): . doi:10.1161/CIRCHEARTFAILURE.117.003874.

Symptom Diary Use and Improved Survival for Heart Failure Patients

Linda G. Park, PhD, FNP-BC[1,2,3], **Kathleen Dracup, PhD, FNP**[1,4], **Mary A. Whooley, MD**[1,3,5,6], **Charles McCulloch, PhD**[1,6], **Chengshi Jin, PhD**[1,6], **Debra K. Moser, PhD, RN**[7], **Robyn A. Clark, PhD, RN**[8], **Michele M. Pelter, PhD, RN**[1,4], **Martha Biddle, PhD, CCNS**[7], and **Jill Howie-Esquivel, PhD, ACNP/FNP-BC**[9]

[1]University of California, San Francisco

[2]Department of Community Health Systems

[3]San Francisco Veterans Affairs Medical Center

[4]Department of Physiological Nursing

[5]Department of Medicine

[6]Department of Epidemiology & Biostatistics

[7]University of Kentucky, School of Nursing

[8]Flinders University, School of Nursing

[9]University of Virginia, School of Nursing

Abstract

Background—Attention to symptoms of weight gain and dyspnea are central tenets of patient education in heart failure (HF). However, it is not known whether diary use improves patient outcomes. The aims of the study were to compare mortality among rural patients with HF who completed versus did not complete a daily diary of weight and symptom self-assessment and to identify predictors of diary use.

Methods and Results—This is a secondary analysis of a 3-arm randomized controlled trial on HF education of self-care with 2 intervention groups versus control who were given diaries for 24 months to track daily weight, HF symptoms, and response to symptom changes. Mean age was 66±13, 58% were male, and 67% completed diaries (N=393). We formed 5 groups (No Use, Low, Medium, High, Very High) based on the first 3 months of diary use and then analyzed time to event (cardiac mortality, all-cause mortality, HF-related readmission) starting at 3 months. Compared with patients with No diary use, High and Very High diary users were less likely to experience all-cause mortality (P=0.02 and P=0.01, respectively). Self-reported sedentary lifestyle

Address for Correspondence: Linda G. Park, PhD, MS, FNP-BC, Assistant Professor, University of California, San Francisco School of Nursing, Department of Community Health Systems, San Francisco Veterans Affairs Medical Center, 2 Koret Way, Room 531A, San Francisco, CA 94143-0610, Office: 415-502-6616/Fax: 415-476-6042, linda.park@ucsf.edu.

Clinical Trial Registration–URL: https://www.clinicaltrials.gov. Unique Identifier: NCT00415545

Disclosures
None

was associated with less diary use in an adjusted model (OR, 0.66; 95% CI, 0.46–0.95; P=0.03). Depression and gender were not significant predictors of diary use in the adjusted model.

Conclusion—In this study of 393 rural patients with HF, we found that greater diary use was associated with longer survival. These findings suggest that greater engagement in self-care behaviors is associated with better HF outcomes.

Keywords

Heart Failure; Symptoms; Diary; Clinical Outcomes; Mortality; Rural

Journal Subject Terms

Heart Failure; Compliance/Adherence; Mortality/Survival; Secondary Prevention

Attention to symptoms of weight gain and dyspnea are central tenets of patient education and self-care in heart failure (HF). A key self-care skill for patients with HF is early detection of subtle changes in symptoms. The ability to learn about self-care over time through formative experiences is important. Patients develop links between self-care and knowledge of HF to form an effective action plan for managing early deterioration.[1] Patients who downplay the severity of their symptoms tend to delay longer in seeking help and will inappropriately attribute symptoms to age or comorbidities.[2–4] There is little evidence that specific lifestyle advice or self-care skills improve quality of life or prognosis, however, providing this information has become a key component of education for HF self-care.[2,5] To date, very few specific interventions have been consistently identified and successfully applied in clinical practice for HF self-care.[2,6] Daily diary use can be one method for patients with HF to acknowledge and attend to their symptoms although it is not known whether diary use tracking of symptoms and weight improves patient outcomes.[2]

Symptom diaries have been commonly used in many health areas from psychiatry to obstetrics and their use is now well established in disease management and cardiology.[6–10] Nurses have incorporated daily diaries in patient education programs, so patients can document their symptoms and identify symptom precipitants, often with the aim of modifying particular health behaviors.[9,10] Advantages of diary use warrant further exploration in HF disease management research to unravel conflicting and insubstantial evidence regarding the feasibility, validity and reliability of information reported in a diary and the associations between patient response and clinical outcomes.[10–12]

Recent European Society of Cardiology (ESC) guidelines for diagnosis and treatment of acute and chronic HF highlighted the importance of monitoring as a key component for management of HF.[11] Authors of the ESC guidelines and HF-ACTION trial reported that there were only three non-pharmacological, non-device/surgical interventions that improved mortality, morbidity or quality of life: monitoring, implementation of care in a multidisciplinary framework, and exercise training.[11,13] Programs involving specialized follow-up by a multidisciplinary team decrease all-cause hospitalizations and mortality; however, improvement in clinical outcomes has not been seen in disease management programs that focus only on self-care activities.[14,15]

This paper describes the weight/symptom diary use component of the REMOTE-HF (Rural Education to iMprove OuTcomEs in Heart Failure) randomized controlled trial.[16] In this study, 602 rural patients with HF (mean age was 66 ± 13 years; 41% were female and 51% diagnosed with HFpEF) were randomized to one of three groups: Control (Usual Care) or two intervention groups, Fluid Watchers LITE or Fluid Watchers PLUS. Both intervention groups included a face-to-face education session delivered by nurses that focused on self-care. The LITE group received two follow-up phone calls, while the PLUS group received an audiotape of the educational session and bi-weekly calls (mean 5.3+3.6, range 1–19) until a nurse judged the patient adequately trained.

A total of 35% of patients (n=211) experienced cardiac death or hospitalization for HF over two years of follow-up, with no difference among with three groups in combined clinical outcomes (P=0.06).[16] Patients in the LITE group had significantly less cardiac death compared with the control group (7.5% and 17.7%, respectively; P=0.003); there was no significant difference in cardiac mortality between patients in the PLUS and control groups.[16]

The primary aim of this secondary analysis was to compare clinical outcomes such as cardiac and all-cause mortality and HF-related hospital readmission in rural patients with HF who completed versus those who did not complete a daily weight and symptom diary. We hypothesized that patients who completed a diary would have lower mortality rates – both cardiac and all-cause - compared to those who did not. A second aim was to identify patient predictors of diary use. Researchers have shown that patient characteristics may be important predictors of HF and other cardiac disease–related survival and hospitalization.[6]

Methods

Study Design and Sample

Data were collected as part of a multicenter, randomized controlled trial designed to evaluate an educational intervention to improve self-care and clinical outcomes in patients with HF who lived in rural areas (REMOTE-HF).[16] A total of 602 patients were available for analysis of clinical outcomes from 12 clinics or hospitals. Inclusion criteria included patients ≥18 years of age with stable HF, living in a rural area, history of hospitalization for HF within the past 6 months, English fluency and literacy, and living independently with primary decision-making ability. Exclusion criteria included serious comorbidities (i.e., disease or illness predicted to cause death within 12 months), current participation in a HF disease management program, or impaired cognition.

Procedures

Trained research personnel obtained written informed consent from all patients. Sociodemographic data were collected with structured questionnaires and clinical data were abstracted from hospital medical records using a standardized form. Comorbidities were assessed with the Charlson Comorbidity Index.[17] Knowledge about HF was assessed with a 20-item HF Knowledge Scale, which was developed by the REMOTE-HF study investigators.[18] This scale has established content validity and predictive validity from other

research studies with Cronbach alpha 0.83.[18–20] Health literacy was measured with the Short Test of Functional Health Literacy in Adults, which is a 36-item, 7-minute timed test of reading comprehension.[21] Patients also completed the nine-item Patient Health Questionnaire (PHQ-9) depression scale.[22] Sedentary lifestyle was self-reported as yes or no.

In the parent REMOTE-HF study, patients were randomized to one of three groups: Control (Usual Care) or two intervention groups, Fluid Watchers LITE or Fluid Watchers PLUS, after completing baseline testing at each site. Random selection techniques with 1:1:1 fixed allocation randomization were employed using blocks of 5 patients (SPSS 18.0, Chicago). Patients' physicians, research assistants, and investigators were blinded to group assignment.

One component of the REMOTE-HF study was the use of diaries. Patients in the 2 intervention groups were asked to complete daily diaries for 24 months on weight and HF symptoms (i.e., edema, dyspnea, and number of pillows used for sleep). If symptoms were present, patients were asked to write the date and time symptoms began, when help was sought, type of help sought (i.e., phone call, emergency department, other), and sequelae if help was obtained. Patients in the two intervention groups were given a script to use when calling their physicians if they experienced significant HF symptoms or weight changes. Weight scales were distributed for daily patient use. Patients were asked to return diaries monthly in stamped, self-addressed envelopes or were hand delivered at face-to-face follow-up visits during the 24 month study period.

Figure 1 displays the patient flow throughout the study. Data were not used from the Usual Care group of the parent study for this current study. To reduce the possibility of reverse causation, we used the first 3 months of diary use (initial diary use) to classify patients by groups using quartiles: Low (1–50%), Medium (51–70%), High (71–90%), and Very High (91–100%). We then started follow-up time for the survival analyses at three months, dropping any individuals who had events before this initial time period.

Clinical outcomes of cardiac and all-cause mortality as well as HF-related readmissions were determined at each data collection point by questioning patients, contacting physicians or by medical record review. Cause of death was determined by medical record review using a blinded adjudication process and interview of the patient's family member or physician for out-of-hospital deaths.

Statistical Analysis

Data were analyzed with SAS (version 9.4, Cary, NC) and STATA (version 14.0, College Station, TX). Descriptive statistics using chi-square, Kruskal-Wallis, and one-way ANOVA analyses were used to characterize the sample and to assess for differences between the diary groups. Chi-square analyses were used to detect differences in the main outcomes of cardiac and all-cause mortality as well as HF-related hospital readmissions. A Kaplan-Meier analysis was used to provide the estimated probability of survival for each of the diary groups.

In addition, Cox proportional hazards models were employed to test whether the diary groups differed in time to first occurrence of the individual end points of cardiac or all-cause mortality and HF-related hospital readmission. We controlled for variables that differed between groups at baseline (P<0.10) and that were known to be associated with death and hospital readmission.[23–27] We censored observations on all analyses on loss to follow-up. All 2-sided significance levels used were established *a priori* at 0.05 for clinical outcomes. Since the numbers of deaths are low in several diary groups, we reported likelihood ratio tests and likelihood based confidence intervals, which should perform better with small numbers of events.

For the secondary aim of identifying predictors of diary use, baseline characteristics using Kruskal-Wallis and Chi-square tests were utilized to determine which candidate variables would be utilized for the statistical model. Univariate ordinal logistic regression was first employed to determine which variables to enter (P<0.10) in the final, multivariable ordinal regression analysis.

Ethics

Ethics Institutional Review Board approval was obtained at all three participating institutions in California, Kentucky, and Nevada. This investigation conforms with the principles outlined in the Declaration of Helsinki.[28] All patients gave written informed consent to participate in the study. Clinical Trial Registration: www.ClinicalTrials.gov, Identifier: NCT00415545.

Results

Patient Characteristics

Of the 393 patients in the two intervention groups (LITE vs. PLUS) who were asked to keep daily diaries, 264 (67%) were adherent to diary use. Because there was no difference in frequency of diary use between the 2 intervention groups (P=0.17), the intervention patients were combined. We established that death occurred for most patients three months or longer after entering the study from survival curves. There were 5 deaths in the No Diary Use group before 3 months, which were excluded from the analysis.

The mean age of the total sample was 66 ± 13 years, 58% were male, and 90% were White. Seventeen percent had less than a high school degree. Literacy was inadequate for 17%, marginal for 16%, and adequate for 66% of the total sample. Half of the sample (50%) had HFrEF as defined by the medical record.

Table 1 presents the patient characteristics of the 5 groups based on diary use. At a level of P<0.10, there were no significant differences between groups except for gender, sedentary lifestyle, and depression. High and Very High diary users were male, less sedentary, and less depressed. There were no differences in age, race, education, marital status, employment, income, BMI, cause of HF, health literacy, or HF knowledge. In addition, there were no overall group differences in clinical characteristics such as NYHA functional class ejection fraction, BNP, creatinine, and comorbidity index.

Clinical Outcomes

Table 2 includes the incidence of cardiac and all-cause mortality as well as hospital readmission at 24 months of follow-up. Over the study period of 24 months, there were 73 deaths among the 393 participants (19%). Of these deaths, there were 38 (10%) cardiac deaths. There was a statistically significant difference between groups for all-cause mortality (P=0.02) with the greatest difference between 27% in the No diary group compared to 10% in the Very High diary group. In addition, 116 hospital readmissions (30%) occurred during the 24 month follow-up (Table 2).

Cardiac Mortality

Patients with Very High diary use were 39% less likely to experience cardiac mortality compared with patients with No diary use, controlling for gender, sedentary lifestyle, and depression; however, this was not statistically significant [hazard ratio (HR) 0.61, 95% CI 0.20, 1.87; p=0.38; Table 3]. In the Cox model, males tended to have fewer cardiac deaths than women (HR 0.48, 95% CI 0.24, 0.99; p=0.05). Depressive symptoms were entered into the multivariable model as a continuous (not a dichotomous) variable and although not statistically significant, each SD increase in depressive symptoms was associated with a 17% greater risk of cardiac mortality (HR 1.17, 95% CI, 0.85–1.61). Sedentary lifestyle and depression were not associated with cardiac mortality. Survival curves by group are displayed in Figure 2. There was a non-significant group difference in survival from cardiac death (P=0.67).

All-Cause Mortality

While controlling for gender, sedentary lifestyle, and depression, Cox regression analysis showed that patients in the High and Very High diary use group were less likely to experience all-cause mortality compared to patients with No diary use (HR 0.51, 95% CI 0.30, 0.89; P=0.02; and HR 0.32, 95% CI 0.14, 0.77; P=0.01, respectively). Sedentary lifestyle was associated with all-cause mortality; but gender and depression were not. Although not statistically significant, each SD increase in depressive symptoms was associated with an 18% greater risk of all-cause mortality (HR 1.18, 95% CI 0.94–1.47; P=0.15). There were significant group differences in survival from all-cause mortality (P=0.03) as reflected in the survival curves by group.

Hospital Readmission

There were no overall or between-group differences in hospital readmission. However, there was a trend toward lower hospital admission rates in the Low diary users compared to the other groups of diary users.

Predictors of Diary Use—After controlling for gender, depression, and death in the multivariable logistic ordinal regression model, for every unit increase in self-reported sedentary behavior, the odds of diary use decreased by 34%, controlling for all other variables in the model (OR, 0.66; 95% CI, 0.46–0.95; P=0.03; Table 4). Although depression was a significant predictor of diary use in the univariate model and was non-significant in

the adjusted multivariable model, it had a strong, positive trend suggesting an association with diary use with other variables in the model.

Discussion

To date, this has been the largest trial to examine daily diary use in almost 400 rural patients with HF. Uniquely, diary use spanned over a lengthy 24 month period. Rural patients with HF had high BMI, sedentary lifestyle, low health literacy, and complex psychosocial factors (i.e., depression). We found that greater diary use was associated with longer *all-cause* survival among rural patients with HF. These results suggest that patients who follow instructions from health care providers and are engaged in self-care (with diary use as a surrogate) may have better outcomes than those who are less engaged in self-care. Although our results do not demonstrate any causal connection between diary use and mortality, they do imply that healthier behaviors and adherence to HF self-care recommendations may be protective.

We found that sedentary lifestyle was significantly associated with all-cause mortality and less diary use. The association between depression and diary use was not statistically significant; however, we were likely underpowered to detect this relationship. It is well known that physical inactivity is closely linked with depressive symptoms. Health behaviors, such as physical activity, medication adherence, smoking cessation, and healthy eating are associated with each other,[6] and depression is strongly predictive of poor health behaviors.[29] To the extent that diary use is like any other health behavior, it would make sense for depressive symptoms to lead to both low diary use and sedentary lifestyle. Depressive symptoms tend to reduce motivation and energy,[30] which may in turn reduce both physical activity and diary use. Therefore, sedentary lifestyle may require further consideration in determining diary use and outcomes. Perhaps an exercise intervention might improve both sedentary behavior and attention to self-care behavior. We believe it is unlikely that diary use reduced sedentary behavior because the patients with HF were instructed to use the diary only for symptom and weight monitoring, and not for activity tracking or exercise.

Another surprising finding was that depression was not associated with mortality in this study since it is known to be a strong, independent predictor of death and cardiac events in patients with HF.[24–26] However, depressive symptoms were associated with a 17% and 18% greater risk of cardiac and all-cause mortality, respectively. We did not have enough power to detect a statistically significant association between depressive symptoms and mortality, but the point estimates are consistent with prior literature on the association between depressive symptoms and mortality.

Clinical implications of diary use may be significant in this vulnerable population of patients with HF. Symptoms can be a predictor of adverse clinical events in a dose-dependent fashion (all-cause mortality, hospital admission, emergency department visit, ventricular assist device implantation, and heart transplantation),[31,32] thus attention to symptoms is critical to avoid complications. In one study, patients with HF with moderate symptom burden were 82% more likely than those with low symptom burden to have an adverse clinical event within a year, and patients with severe burden were more than twice as likely.[33] The current

study provided action plans to respond to increased symptoms or weight including a script to call physicians and a separate diary to record response to treatment. All intervention patients who were asked to complete daily diaries received the same HF education, thus education alone did not impact clinical outcomes. The differentiating factor was the range of diary entries at the first 3 months from No Diary Use, Low (1–50%), Medium (51–70%), High (71–90%) and Very High (91–100%) that influenced patient self-efficacy to identify and take action on symptoms.

Health care utilization among patients with HF was disproportionate between higher hospital admissions and emergency department visits compared to outpatient clinic visits and phone calls. Utilization of the former services may reveal the acuity of HF exacerbation and need for urgent care. Given the rural setting, it is unclear if access to care was a major barrier to outpatient evaluation due to distance, transportation issues, cost of care, or limited availability of health care providers. Symptoms experienced by patients with HF have been previously linked with greater resource utilization[34]; therefore, improving symptom management and self-care of patients with HF is a major strategy to reduce increasing costs for healthcare systems.[2]

Our study findings provide practical implications for health care providers and systems. Patients with HF can use daily diaries to record their symptoms and weight to detect subtle changes over time. In particular, providers should encourage new patients with HF to use diaries in order to emphasize self-care skills. Data from diaries would be helpful for providers as patient recall can be poor between office visits. Health care providers also need to evaluate health disparities such as patient literacy when recommending the use of a symptom diary. Sedentary lifestyle and depression are risk factors for lack of engagement in self-care and symptom assessment.[23,29,35] Since depression has been shown to be directly related to poor quality of life and increased mortality in patients with HF,[24–26,36] it is essential for clinicians to address this modifiable condition. Other barriers may be cognitive impairment in older patients with advanced HF that weakens their ability to interpret or follow up on their symptoms.[1,3,37] Referral to a HF nurse or clinic may be needed to provide additional support in recognizing and documenting symptoms.[38]

This study was specific for rural patients with HF who face unique challenges. Along with lower health literacy, patients living in rural areas lack access to primary and acute care facilities and have lower income[16,39], less health insurance coverage[40], and less education.[41] The challenges accumulate, placing rural patients with HF at higher risk for health-related complications.[16] Although this study was conducted in multiple rural settings, we believe these data may have implications for all patients with HF, regardless of setting. There may be significant disparities in access to health care; however, patients with advanced HF generally face high symptom burden and require daily monitoring of symptoms. Diary use has been shown to be associated with improved clinical outcomes in urban settings in other chronically ill populations.[10]

Limitations

We recognize the possibility that healthy participants may have been more compliant with diary use and that this may have confounded the association of diary use and mortality.

However, we standardized the diary use period for all participants and did not find significant differences between groups other than depression and sedentary lifestyle, which were included in the multivariable model. We assumed that diary use behavior remained consistent in the groups beyond 3 months. This study used a multifaceted approach to improve HF self-care that makes it less clear which intervention component was most effective in improving clinical outcomes. Those who used diaries were non-randomized, thus we cannot determine causality. Diary use may have been associated with other "healthy user" characteristics. Finally, we may not be able to generalize beyond rural patients.

Despite the availability of costly invasive procedures and other guideline-driven therapy, diary use should be considered as a simple, cost-effective means to improve health behavior in patients with HF. Higher diary use was associated with lower all-cause mortality and was likely related to more adherent patients who were very conscientious about changes in their health. Future work may compare different methods to record symptoms digitally. Additional studies are needed to confirm which patients with HF are more likely to use and benefit from diaries. As more life-prolonging treatments become available, our evidence base for HF symptom assessment and management must increase so that we can improve morbidity and mortality as well as symptom burden and quality of life in this challenging patient population.[31]

Acknowledgments

We would like to thank the REMOTE-HF investigators and participants. We appreciate the statistical support of Steve Paul, PhD, John Boscardin, PhD, and Bruce Cooper, PhD.

Funding Sources: Funding for the REMOTE-HF study came from the National Heart, Lung, and Blood Institute and the National Institute of Nursing Research of the National Institutes of Health (NIH; 5R01HL83176-5). Dr. Park is supported by the National Center for Advancing Translational Sciences of the NIH under Award Number KL2TR001870. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH. We appreciate the support of the University of California, San Francisco Clinical & Translational Science Institute (grant #UL1 TR000004). Dr. Clark is supported by the Australian Heart Foundation Future Leader Fellowship (2015 FLF 100847).

References

1. Bennett SJ, Cordes DK, Westmoreland G, Castro R, Donnelly E. Self-care strategies for symptom management in patients with chronic heart failure. Nurs Res. 2000; 49:139–145. [PubMed: 10882318]
2. Clark AM, Spaling M, Harkness K, Spiers J, Strachan PH, Thompson DR, Currie K. Determinants of effective heart failure self-care: A systematic review of patients' and caregivers' perceptions. Heart. 2014; 100:716–721. DOI: 10.1136/heartjnl-2013-304852 [PubMed: 24548920]
3. Friedman MM. Older adults' symptoms and their duration before hospitalization for heart failure. Heart Lung. 1997; 26:169–176. DOI: 10.1016/S0147-9563(97)90053-4 [PubMed: 9176684]
4. Jurgens CY, Hoke L, Byrnes J. Why do elders delay responding to heart failure symptoms? Nurs Res. 2009; 58:274–282. DOI: 10.1097/NNR.0b013e3181ac1581 [PubMed: 19609179]
5. McAlister FA, Lawson FME, Teo KK, Armstrong PW. A systematic review of randomized trials of disease management programs in heart failure. Am J Med. 2001; 110:378–384. DOI: 10.1016/S0002-9343(00)00743-9 [PubMed: 11286953]
6. Lorig KR, Sobel DS, Stewart AL, Brown BW Jr, Bandura A, Ritter P, Gonzalez VM, Laurent DD, Holman HR. Evidence suggesting that a chronic disease self-management program can improve health status while reducing hospitalization: A randomized trial. Med Care. 1999; 37:5–14. [PubMed: 10413387]

7. Thiele C, Laireiter A, Baumann U. Diaries in clinical psychology and psychotherapy: a selective review. Clin Psychol Psychother. 2002; 9:1.doi: 10.1002/cpp.302
8. Tincello DG, Williams K, Joshi M, Assassa RP, Abrams K. Urinary diaries: a comparison of data collected for three days versus seven days. Obstet Gynecol. 2007; 109:277–280. DOI: 10.1097/01.AOG.0000252832.21986.c8 [PubMed: 17267824]
9. Richardson A. The health diary: An examination of its use as a data collection method. J Adv Nurs. 1994; 19:782–791. DOI: 10.1111/j.1365-2648.1994.tb01151.x [PubMed: 8021401]
10. Eastwood CA, Travis L, Morgenstern T, Donaho E. Weight and symptom diary for self-monitoring in heart failure clinic patients. J Cardiovasc Nurs. 2007; 22:382–389. DOI: 10.1097/01.JCN.0000287027.49628.a7 [PubMed: 17724420]
11. Ponikowski P, Voors AA, Anker SD, Bueno H, Cleland JG, Coats AJ, Falk V, González-Juanatey JR, Harjola VP, Jankowska EA, Jessup M, Linde C, Nihoyannopoulos P, Parissis JT, Pieske B, Riley JP, Rosano GM, Ruilope LM, Ruschitzka F, Rutten FH, Meer P van der, Authors/Task Force Members. 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure: The task force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology (ESC). Developed with the special contribution of the Heart Failure Association (HFA) of the ESC. Eur J Heart Fail. 2016; 18:891–975. DOI: 10.1093/eurheartj/ehw128 [PubMed: 27207191]
12. Yancy CW, Jessup M, Bozkurt B, Butler J, Casey DE, Drazner MH, Fonarow GC, Geraci SA, Horwich T, Januzzi JL, Johnson MR, Kasper EK, Levy WC, Masoudi FA, McBride PE, McMurray JJV, Mitchell JE, Peterson PN, Riegel B, Sam F, Stevenson LW, Tang WHW, Tsai EJ, Wilkoff BL. 2013 ACCF/AHA guideline for the management of heart failure: A report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. Circulation. 2013; 128:e240–e327. DOI: 10.1161/CIR.0b013e31829e8776 [PubMed: 23741058]
13. O'Connor CM, Whellan DJ, Lee KL, Keteyian SJ, Cooper LS, Ellis SJ, Leifer ES, Kraus WE, Kitzman DW, Blumenthal JA, Rendall DS, Miller NH, Fleg JL, Schulman KA, McKelvie RS, Zannad F, Piña IL, HF-ACTION Investigators. Efficacy and safety of exercise training in patients with chronic heart failure: HF-ACTION randomized controlled trial. JAMA. 2009; 301:1439–1450. DOI: 10.1001/jama.2009.454 [PubMed: 19351941]
14. Powell LH, Calvin JE Jr, Richardson D, Janssen I, Mendes de Leon CF, Flynn KJ, Grady KL, Rucker-Whitaker CS, Eaton C, Avery E. Self-management counseling in patients with heart failure: The heart failure adherence and retention randomized behavioral trial. JAMA. 2010; 304:1331–1338. DOI: 10.1001/jama.2010.1362 [PubMed: 20858878]
15. Wright SP, Walsh H, Ingley KM, Muncaster SA, Gamble GD, Pearl A, Whalley GA, Sharpe N, Doughty RN. Uptake of self-management strategies in a heart failure management programme. Eur J Heart Fail. 2003; 5:371–380. DOI: 10.1016/S1388-9842(03)00039-4 [PubMed: 12798837]
16. Dracup K, Moser DK, Pelter MM, Nesbitt TS, Southard J, Paul SM, Robinson S, Cooper LS. A randomized controlled trial to improve self-care in patients with heart failure living in rural areas. Circulation. 2014; 130:256–264. DOI: 10.1161/CIRCULATIONAHA.113.003542 [PubMed: 24815499]
17. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: Development and validation. J Chronic Dis. 1987; 40:373–383. DOI: 10.1016/0021-9681(87)90171-8 [PubMed: 3558716]
18. Dracup K, Moser DK, Pelter MM, Nesbitt T, Southard J, Paul SM, Robinson S, Hemsey JZ, Cooper L. Rural patients' knowledge about heart failure. J Cardiovasc Nurs. 2014; 29:423–428. DOI: 10.1097/JCN.0b013e31829cbcf3 [PubMed: 23839575]
19. Caldwell MA, Peters KJ, Dracup KA. A simplified education program improves knowledge, self-care behavior, and disease severity in heart failure patients in rural settings. Am Heart J. 2005; 150:983. doi.org/10.1016/j.ahj.2005.08.005.
20. Howie J, Banks A, Caldwell MA, Dracup K. A pilot educational intervention improves patient knowledge of symptoms of heart failure. Am J Crit Care. 2003; 12:278–279.
21. Baker DW, Williams MV, Parker RM, Gazmararian JA, Nurss J. Development of a brief test to measure functional health literacy. Patient Educ Couns. 1999; 38:33–42. DOI: 10.1016/S0738-3991(98)00116-5 [PubMed: 14528569]

22. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: Validity of a brief depression severity measure. J Gen Intern Med. 2001; 16:606–613. DOI: 10.1046/j.1525-1497.2001.016009606.x [PubMed: 11556941]
23. Koster A, Caserotti P, Patel KV, Matthews CE, Berrigan D, Van Domelen DR, Brychta RJ, Chen KY, Harris TB. Association of sedentary time with mortality independent of moderate to vigorous physical activity. PLoS One. 2012; 7:e37696.doi: 10.1371/journal.pone.0037696 [PubMed: 22719846]
24. Sherwood A, Blumenthal JA, Trivedi R, Johnson KS, O'Connor CM, Adams KF Jr, Dupree CS, Waugh RA, Bensimhon DR, Gaulden L, Christenson RH, Koch GG, Hinderliter AL. Relationship of depression to death or hospitalization in patients with heart failure. Arch Intern Med. 2007; 167:367–373. DOI: 10.1001/archinte.167.4.367 [PubMed: 17325298]
25. Adams J, Kuchibhatla M, Christopher EJ, Alexander JD, Clary GL, Cuffe MS, Califf RM, Krishnan RR, O'Connor CM, Jiang W. Association of depression and survival in patients with chronic heart failure over 12 years. Psychosomatics. 2012; 53:339–346. DOI: 10.1016/j.psym.2011.12.002 [PubMed: 22281436]
26. Sokoreli I, de Vries JJ, Pauws SC, Steyerberg EW. Depression and anxiety as predictors of mortality among heart failure patients: Systematic review and meta-analysis. Heart Fail Rev. 2016; 21:49–63. DOI: 10.1007/s10741-015-9517-4 [PubMed: 26572543]
27. Hwang B, Moser D, Dracup K. Knowledge is insufficient for self-care among heart failure patients with psychological distress. Health Psychol. 2014; 33:588–596. DOI: 10.1037/a0033419 [PubMed: 23815766]
28. Rickham PP. Human experimentation. Code of ethics of the World Medical Association. Declaration Of Helsinki. Br Med J. 1964; 18:177.
29. Kessing D, Denollet J, Widdershoven J, Kupper N. Psychological determinants of heart failure self-care: Systematic review and meta-analysis. Psychosom Med. 2016; 78:412–431. DOI: 10.1097/PSY.0000000000000270. [PubMed: 27082055]
30. Whooley MA, de Jonge P, Vittinghoff E, Otte C, Moos R, Carney RM, Ali S, Dowray S, Na B, Feldman MD, Schiller NB, Browner WS. Depressive symptoms, health behaviors, and risk of cardiovascular events in patients with coronary heart disease. JAMA. 2008; 20:2379–2388. DOI: 10.1001/jama.2008.711.
31. Alpert CM, Smith MA, Hummel SL, Hummel EK. Symptom burden in heart failure: Assessment, impact on outcomes, and management. Heart Fail Rev. 2017; 22:25–39. DOI: 10.1007/s10741-016-9581-4 [PubMed: 27592330]
32. Ekman I, Cleland JG, Swedberg K, Charlesworth A, Metra M, Poole-Wilson PA. Symptoms in patients with heart failure are prognostic predictors: Insights from COMET. J Card Fail. 2005; 11:288–292. DOI: 10.1016/j.cardfail.2005.03.007 [PubMed: 15880338]
33. Lee CS, Gelow JM, Denfeld QE, Mudd JO, Burgess D, Green JK, Hiatt SO, Jurgens CY. Physical and psychological symptom profiling and event-free survival in adults with moderate to advanced heart failure. J Cardiovasc Nurs. 2014; 29:315–323. DOI: 10.1097/JCN.0b013e318285968a [PubMed: 23416942]
34. 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. DOI: 10.1016/j.ejheart.2006.11.002 [PubMed: 17188930]
35. Sedlar N, Lainscak M, Martensson J, Stromberg A, Jaarsma T, Farkas J. Factors related to self-care behaviours in heart failure: A systematic review of European Heart Failure Self-Care Behaviour Scale studies. Eur J Cardiov Nurs. 2017; 16:272–282. DOI: 10.1177/1474515117691644
36. Nesbitt T, Doctorvaladan S, Southard JA, Singh S, Fekete A, Marie K, Moser DK, Pelter MM, Robinson S, Wilson MD, Cooper L, Dracup K. Correlates of quality of life in rural patients with heart failure. Circ Heart Fail. 2014; 7:882–887. DOI: 10.1161/circheartfailure.113.000577 [PubMed: 25146960]
37. Rogers A, Addington-Hall JM, McCoy AS, Edmonds PM, Abery AJ, Coats AJ, Gibbs JS. A qualitative study of chronic heart failure patients' understanding of their symptoms and drug therapy. Eur J Heart Fail. 2002; 4:283–287. DOI: 10.1016/S1388-9842(01)00213-6 [PubMed: 12034153]

38. Jurgens CY, Shurpin KM, Gumersell KA. Challenges and strategies for heart failure symptom management in older adults. J Gerontol Nurs. 2010; 36:24–33. DOI: 10.3928/00989134-20100930-06 [PubMed: 21544962]

39. Fisher M. Why is U.S poverty higher in nonmetropolitan than metropolitan areas? Growth Change. 2007; 38:56–76. DOI: 10.1111/j.1468-2257.2007.00353.x

40. Eberhardt MS, Pamuk ER. The importance of place of residence: examining health in rural and nonrural areas. Am J Public Health. 2004; 10:1682–1686.

41. Hartley D. Rural health disparities, population health, and rural culture. Am J Public Health. 2004; 94:1675–1678. [PubMed: 15451729]

What is new

- This study highlights the value of routine weight and symptom monitoring in a rural population of patients with HF.
- Patients who were engaged in diary use had better survival.

What are the clinical implications?

- These data suggest that health care providers should encourage patient engagement in self-care activities such as daily weight and symptom monitoring given the relationship with improved survival.
- Sedentary lifestyle was associated with all-cause mortality in this vulnerable population. All patients should be encouraged to engage in physical activity.

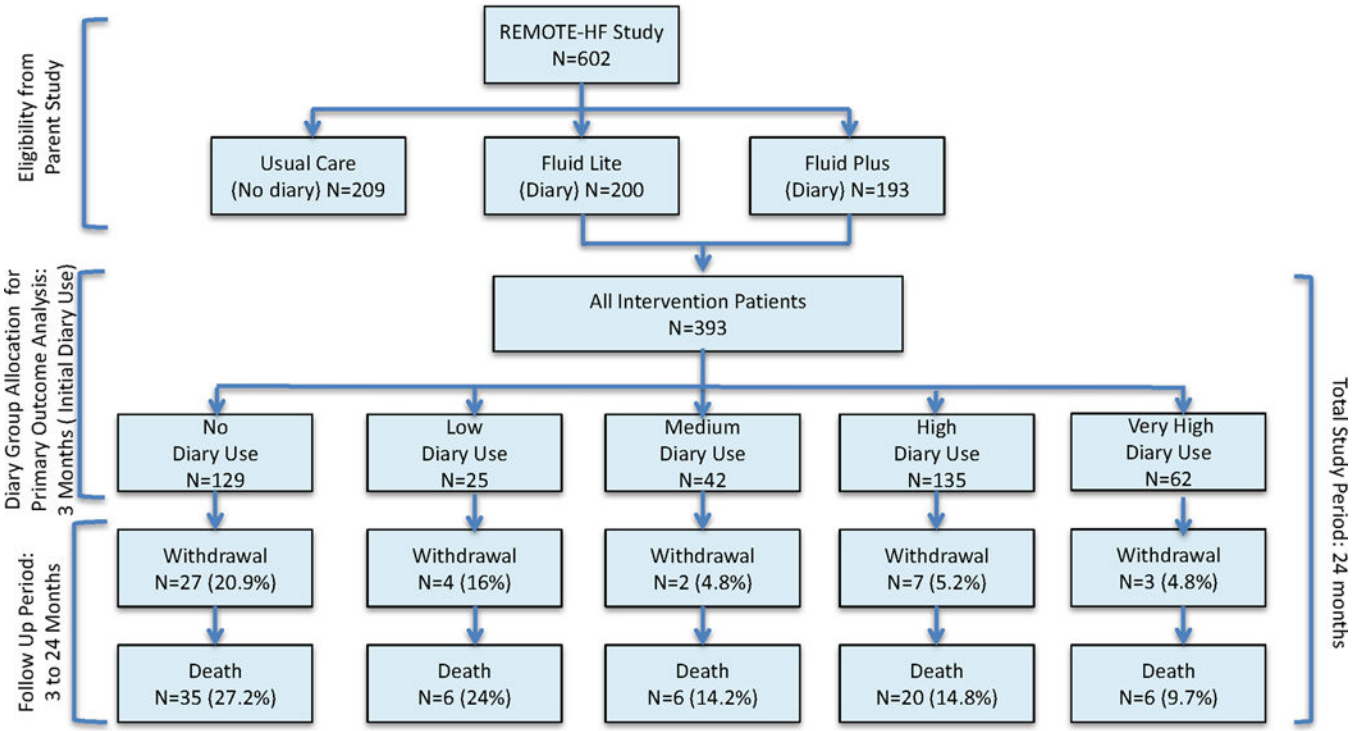
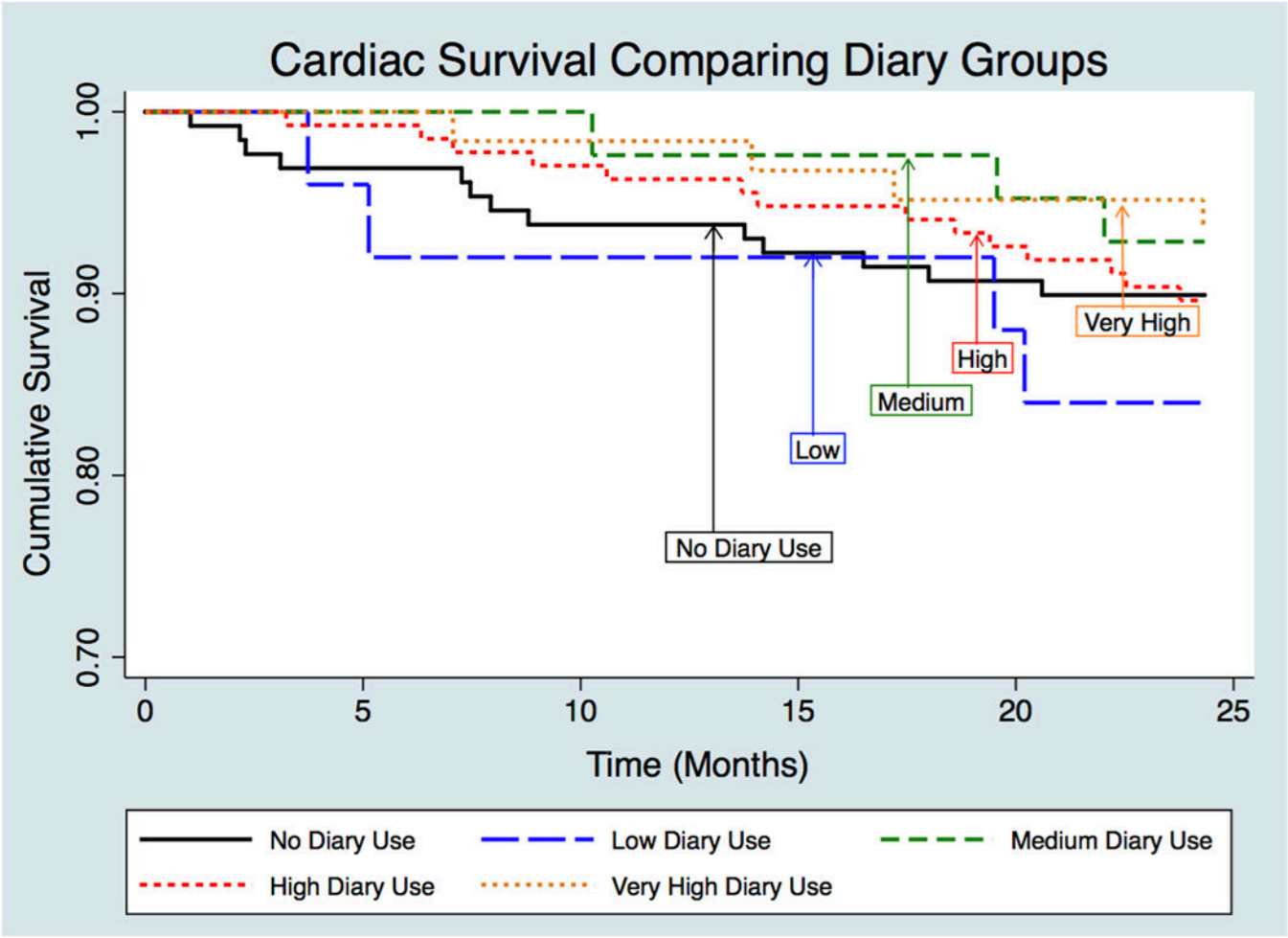


Figure 1.
Study Flow Diagram



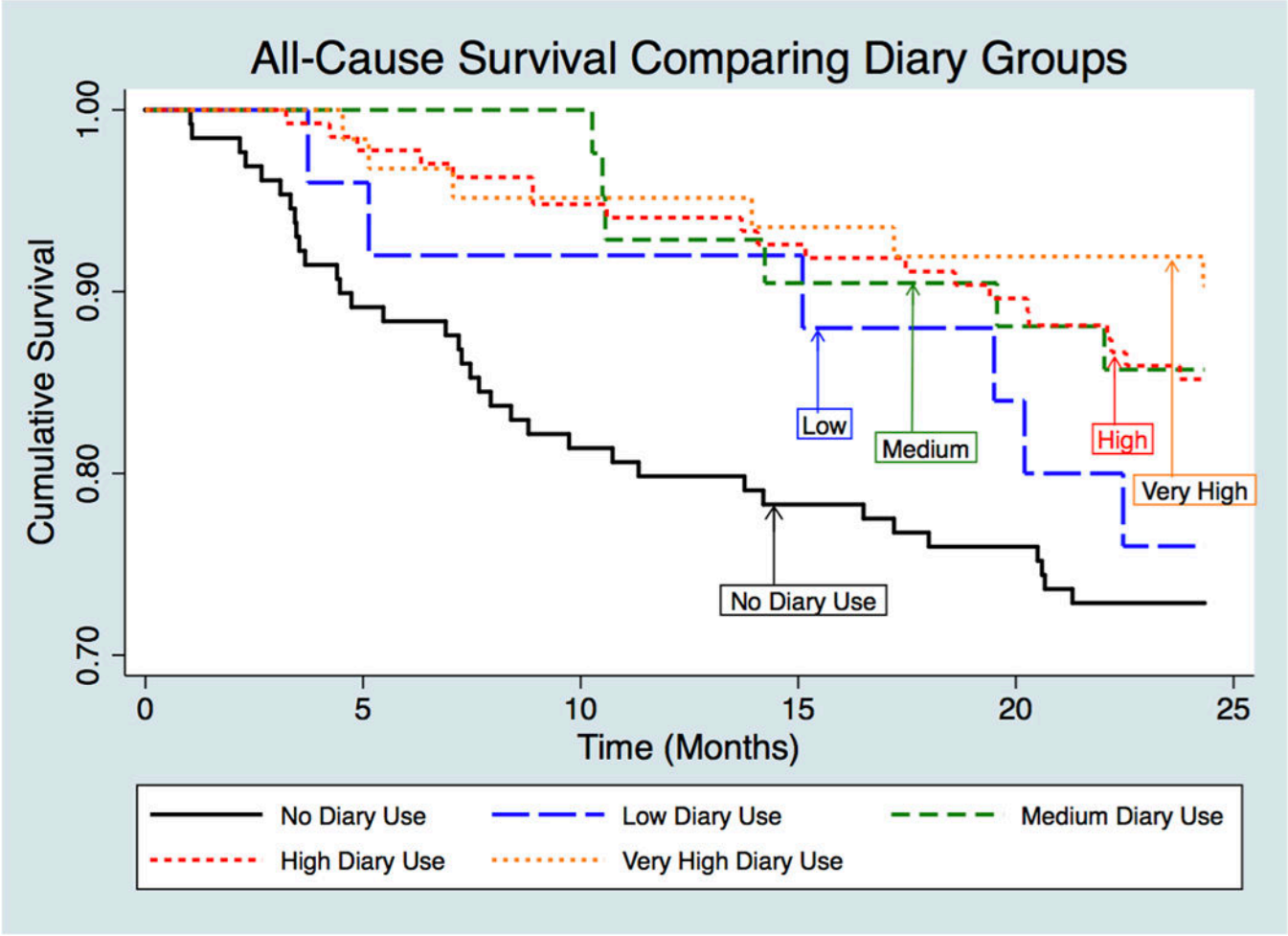


Figure 2.
Survival Graphs of Cardiac and Non-Cardiac Death Comparing Diary Groups

Table 1

Baseline Patient Characteristics of Diary Use in Rural Heart Failure Patients (N=393)

Variable	No Diary Use (N=129)	Low Diary Use (N=25)	Medium Diary Use (N=42)	High Diary Use (N=135)	Very High Diary Use (N=62)	P-Value
Age, Y (Mean ± SD)	67 ± 13	63 ± 17	66 ± 12	66 ± 13	65 ± 12	0.70
Male	72 (56)	14 (56)	17 (41)	83 (62)	41 (66)	0.10
White	117 (91)	25 (100)	35 (83)	118 (87)	57 (92)	0.21
Education, Less than High School	19 (15)	6 (24)	9 (21)	21 (16)	12 (19)	0.59
Employed	18 (14)	4 (16)	7 (17)	26 (19)	8 (13)	0.75
Married/Cohabitating	71 (55)	12 (48)	20 (48)	79 (59)	39 (63)	0.56
Annual Household Income (<20K)	50 (39)	8 (32)	14 (33)	45 (33)	26 (42)	0.88
BMI >25	96 (74)	16 (64)	35 (83)	102 (76)	45 (73)	0.52
Sedentary	69 (54)	13 (52)	24 (57)	53 (39)	23 (37)	0.04
Literacy, Adequate	76 (59)	16 (64)	29 (69)	88 (65)	40 (65)	0.48
NYHA Class III-IV	50 (39)	8 (32)	14 (33)	47 (35)	17 (27)	0.64
Ejection Fraction (Mean ± SD)	40.1 ± 17.3	43.6 ± 15.3	43 ± 16.9	40.3 ± 14.7	37.1 ± 13.6	0.32
BNP (Mean ± SD)	410 ± 575	343 ± 484	386 ± 572	485 ± 1370	306 ± 336	0.73
Creatinine (Mean ± SD)	1.2 ± 0.5	1.1 ± 0.4	1.4 ± 1.0	1.2 ± 0.8	1.2 ± 0.4	0.68
Charlson Comorbidity (Mean ± SD)	3.3 ± 2.0	3.0 ± 1.5	3.6 ± 1.9	3.0 ± 1.5	3.3 ± 1.5	0.28
PHQ-9 Depression Score *	8.1 ± 6.9	8.3 ± 6.5	8.1 ± 6.1	5.9 ± 5.9	7 ± 5.9	0.03
HF Knowledge Score	14.1 ± 2.2	14.4 ± 3.0	14.1 ± 3	13.5 ± 2.6	13.5 ± 3.0	0.20

Results reported as n (%) or mean ± SD (standard deviation)

No Diary Use=0% days diary use; Low=1–50%; Medium=51–70%; High=71–90%; Very High=91–100%

* Higher PHQ-9 score indicates more severe depression

Table 2

Incidence of Clinical Outcomes Compared Among Diary Groups at Two Years Follow-up

Variable	Total N=393	No Diary Use (N=129)	Low Diary Use (N=25)	Medium Diary Use (N=42)	High Diary Use (N=135)	Very High Diary Use (N=62)	P-Value
All-cause Mortality	73 (19)	35 (27)	6 (24)	6 (14)	20 (15)	6 (10)	0.02
Cardiac	38 (10)	13 (10)	4 (16)	3 (7)	14 (10)	4 (7)	0.68
Non-cardiac	35 (9)	22 (17)	2 (8)	3 (7)	6 (5)	2 (3)	0.002
Hospital Readmission	116 (30)	35 (27)	6 (24)	17 (41)	40 (30)	18 (29)	0.53

Results reported as n (%)

No Diary Use=0% days diary use; Low=1–50%; Medium=51–70%; High=71–90%; Very High=91–100%

Table 3

Cardiac and All-Cause Hazard Ratios Compared Among Diary Groups at Two Years Follow-up

	Cardiac Mortality *		All-Cause Mortality **	
Variable	**Hazard Ratio (95% CI)**	**P-Value**	**Hazard Ratio (95% CI)**	**P-Value**
No Diary Use	Reference	---	Reference	---
Low	1.69 (0.55, 5.20)	0.36	0.83 (0.35, 1.97)	0.66
Medium	0.74 (0.21, 2.60)	0.64	0.46 (0.19, 1.09)	0.08
High	1.04 (0.48, 2.20)	0.92	0.51 (0.30, 0.89)	0.02
Very High	0.61 (0.20, 1.87)	0.38	0.32 (0.14, 0.77)	0.01
Male Gender	0.48 (0.24, 0.99)	0.05	0.76 (0.47, 1.23)	0.26
Sedentary	1.30 (0.68, 2.50)	0.43	1.65 (1.02, 2.60)	0.04
Depression (per SD)	1.17 (0.85, 1.61)	0.33	1.18 (0.94, 1.47)	0.15

SD: Standard deviation

* Overall group effect not significant, P=0.67

** Overall group effect significant, P=0.03

Table 4

Predictors of Diary Use with Ordinal Logistic Regression

Variable	Unadjusted OR (95% CI)	P-Value	Adjusted OR (95% CI)	P-Value
Male Gender	0.75 (0.52, 1.07)	0.11	0.82 (0.57, 1.19)	0.30
Sedentary	0.60 (0.42, 0.86)	0.01	0.66 (0.46, 0.95)	0.03
Depression (per SD increase)	0.79 (0.66, 0.95)	0.01	0.84 (0.69, 1.0)	0.06

SD: Standard deviation

Dependent variable: level of diary use at the first 3 months

No Diary Use=0% days diary use; Low=1–50%; Medium=51–70%; High=71–90%; Very High=91–100%