Published in final edited form as:

Home Healthc Now. 2020 ; 38(1): 24–30. doi:10.1097/NHH.0000000000000830.

Identifying targets to improve heart failure outcomes for patients receiving home health care services: the relationship of functional status and pain

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Abstract

Heart failure (HF) is one of the leading causes of rehospitalization in the United States. Due to the complex nature of HF, the provision of Medicare-certified home healthcare services has increased. Medicare-certified home healthcare agencies measure and report patients' outcomes such as functional status, activities of daily living (ADL) and instrumental activities of daily living to the Centers for Medicare and Medicaid Services. These metrics are assessed using the Outcome Assessment Information Set (OASIS). As a large data set, OASIS has been used to advance care quality in multiple ways including identifying risk factors for negative patient outcomes. However, there is a lack of OASIS analyses to assess the relationship between functional status and the role of other factors, such as pain, in impeding recovery after hospitalization among HF patients. Therefore, the purpose of this study is to identify the relationship between functional status and pain using the OASIS database. Among 489 HF patients admitted to home healthcare, 83% were White, 57% were female, and the median age was 80. Patients who reported daily but not constant activity-interfering pain at discharge demonstrated the least improvement in functional performance as measured by ADLs, while patients without activity-interfering pain demonstrated the greatest improvement in ADL performance (p-value=0.0284). Tracking individual patient

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The authors declare no conflicts of interest:

Suggested callouts:

Several studies have demonstrated that the presence of pain was one of the risk factors for rehospitalization among patients with heart failure.

Thus, progress in improving functional performance of home healthcare heart failure patients can be accelerated with improved attention to pain.

Our study demonstrated the value of improving pain that interferes with heart failure patients' daily activity as important to improving functional performance overall.

ADL scores, particularly the frequency of activity-interfering pain, could be a key indicator for clinical focus for patients with HF in the home healthcare setting.

Introduction

Heart failure (HF) is a complex chronic condition and is one of the leading causes of rehospitalization in the United States (Formiga et al., 2017). Due to the complex nature of HF, home healthcare referrals have increased (Kang et al., 2016; Xiao et al., 2018). Medicare-certified home healthcare services are commonly offered to Medicare beneficiaries following an inpatient hospitalization or skilled nursing facility stay (Mroz et al., 2018). As the Centers for Medicare and Medicaid Services (CMS) has been financially penalizing health systems for 30-day rehospitalization for six chronic diseases including HF, home healthcare services after hospitalization can be beneficial in reducing rehospitalization and improving overall outcomes (Gupta & Fonarow, 2018; McClintock et al., 2014; Wang et al., 2017).

Home healthcare services are available to Medicare beneficiaries who are homebound and require intermittent skilled care from a registered nurse, or a physical, occupational or speech therapist (Mroz et al., 2018; Wang et al., 2017). To be eligible for home healthcare coverage under Medicare, patients need to be home-bound status i.e. need the help of another person or special equipment such as a cane or wheelchair to leave the home and do not leave home often due to the disease status (Arundel et al., 2018). The duration of home healthcare services is up to 60 days, but patients can get recertified if they still need care and remain home-bound (Kang et al., 2016; Riggs, Madigan, & Fortinsky, 2011). Home healthcare agencies that receive payment for services through Medicare and/or Medicaid are mandated to use the Outcome Assessment Information Set (OASIS) to collect patient data and report this performance data to CMS (Scharpf & Madigan, 2010). OASIS reported data is used for reimbursement, quality improvement, public reporting, and Medicare survey as well as research (Morgan & Madigan, 2018).

OASIS functions as the primary database for home healthcare and provides the structure for their electronic health records (EHR) (Kang et al., 2016; Madigan et al., 2012a). The OASIS database includes comprehensive clinical assessments that contain nearly 100 metrics and several domains: demographic information, living situation, clinical information based on physical assessment such as pain and functional status including activities of daily living (ADL) and instrumental activities of daily living (IADL) (Kang et al., 2016; Madigan et al., 2012a). OASIS data collection occurs at admission, discharge, and at least every 60 days during home healthcare services (recertification). It is also completed upon resumption of care following a hospital stay and when a patient is transferred to the hospital (Morgan & Madigan, 2018). Generally, a registered nurse or physical therapist collects OASIS admission data within 48 hours of a home healthcare referral (Brown et al., 2004). While these data are readily available for clinical use, it is unclear how well OASIS data guides care throughout the home healthcare episode. Several studies using OASIS data have provided informative findings for clinicians (Kang et al., 2016; Madigan et al., 2012a; Madigan, 2012b; Riggs et al., 2011; Scharpf & Madigan, 2010).

Studies have been performed using OASIS, for the purpose of identifying risk factors for negative patient outcomes, particularly for patients with complex diagnoses including HF (Kang et al., 2016; Madigan et al., 2012b; Riggs et al., 2011; Scharpf & Madigan, 2010). Several studies have demonstrated that the presence of pain was one of the risk factors for rehospitalization among patients with HF (Kang et al., 2016; Madigan et al., 2012a). A number of studies have examined functional status among patients with HF during home healthcare as it is known to be associated with HF however none have explored the link between symptoms and functional status (Fergenbaum et al., 2015; Madigan et al., 2012b; McClintock et al., 2014; Middleton et al., 2019; Sezgin et al., 2017). Moreover, there is an absence of studies using OASIS data that have examined the relationship between pain and functional status among HF patients. Thus, the purpose of this study was to assess changes in functional status measured by ADLs and IADLs from admission to discharge and the relationship between pain and ADL and IADL performance.

Methods

Study design and Data source

This study is a secondary data analysis of a retrospective cross-sectional study using the OASIS C version that was collected from January 1, 2011 to August 31, 2013 among patients with HF, during up to 60 days of home healthcare. The dataset was obtained from a large Medicare-certified home healthcare agency located in Georgia that provided the de-identified OASIS-C version data collected on HF patients.

Sample

The sample was drawn to include all patients admitted with a diagnosis of HF, according to the International Classification of Disease, Ninth Revision (ICD-9) coding; had a discharge from an in-patient facility, including acute hospitals, long-term care facilities or in-patient rehabilitation unit.

Outcome Assessment and Information Set

Reliability and Validity.—Few studies have evaluated the reliability and validity of the items from previous versions of the OASIS dataset (Hittle et al., 2003; Kinatukara, Rosati, & Huang, 2005; Madigan & Fortinsky, 2004). However, studies have demonstrated that inter-rater reliability of many OASIS items is excellent ($\kappa > 0.8$), and that most items have substantial inter-rater reliabilities ($\kappa > 0.6$), although some items did have poor inter-reliability scores (Hittle et al., 2003; Kinatukara et al., 2005; Madigan & Fortinsky, 2004). The reliability coefficients (κ) of the following items are greater than 0.6: all ADLs, IADLs, management of oral medications, dyspnea, urinary incontinence, acute care hospitalization, and confusion frequency (Hittle et al., 2003; Madigan & Fortinsky, 2004). Evidence regarding the validity of the OASIS dataset has demonstrated that the items related to functional status have been well-validated (Madigan et al., 2012a).

Target Variables

Our target variables were nine ADL items (grooming, dressing upper body, dressing lower body, bathing, toilet transferring, toilet hygiene, and transferring, ambulating and feeding or

eating), two IADL items (planning and preparing meals, and using the telephone), and the frequency of activity-interfering pain (See Table 1). Each item of ADL and IADL is assessed on a different scale. For example, grooming has three different categories from 0 (independent) to 3 (entirely dependent), whereas bathing has a scale of 0 (independent) – 6 (entirely dependent). Activity-interfering pain has five different categories on a scale of 0 to 4 with 0 (patient has no pain); 1 (patient has pain but does not interfere with activity or movement); 2 (pain interferes less often than daily); 3 (pain interferes daily, but not consistently); and 4 has pain all of the time).

Analysis

Demographic data (N=489) were explored with descriptive statistics. In order to analyze ADL and IADL status, the scores of ADL or IADL were transposed. First, due to differing scales among measured items, all individual ADL and IADL scores were standardized to a 0 – 1 score. These individual ADL and IADL scores were divided by highest score possible within an individual item - for example, grooming scores for all participants were divided by 3, while bathing scores divided by 6. Then, scores were averaged to determine overall ADL and IADL scores. Changes in overall ADL and IADL scores were calculated by subtracting the discharge from the admission score for each. A one-sample t test was used to determine significant differences in overall ADL and IADL change scores.

We conducted univariate analysis of variance (ANOVA) for overall change of ADL and IADL respectively on the following variables: frequency of activity-interfering pain at admission, and frequency of activity-interfering pain at discharge. McNemar test was applied to evaluate the change in the proportion of subjects with pain interference between admission and discharge. Post-hoc pairwise comparison between groups for different frequencies of activity-interfering pain at discharge were performed with Tukey-Kramer's multiple comparison adjustment.

Results

Of the 489 patients analyzed, the majority were White (83%), 57% female (57%), and greater than 65 years old (88%), with a median age of 80 years. About 70% were admitted after an acute hospitalization (see Table 1). The percentage of patients who reported no daily activity-interfering pain at admission was 29.9 %, and 55.6 % reported no daily activity-interfering pain at discharge (see Table 1). There was a statistically significant decrease in patients with activity-interfering pain between admission and discharge (a 25.7% decrease; McNemar test p-value <0.001) (see Table 2).

Improvement in overall ADL and IADL scores from admission to discharge (mean change of ADL -0.19, t test p-value <0.001; mean change of IADL -0.16, t test p-value <0.001 due to non-normal distribution) (see Table 3). Furthermore, there were significant differences in ADL changes among subgroups based on the frequency of activity-interfering pain at discharge (p-value=0.028) (see Table 4). From the Post-hoc pairwise comparison, we found statistically significant differences on ADL change scores (p-value=0.017), between patients without activity-interfering pain and those with daily but not consistent pain interference at discharge. Overall ADL change scores in patients without activity-interfering pain at

discharge showed the highest functional improvement from admission. ADL scores in patients with daily but not consistent pain interference at discharge showed the least functional improvement.

Discussion

In this study, there was significant improvement in both overall ADL and IADL from admission to discharge among home healthcare patients with HF. The degree of overall ADL functional improvement was influenced by degree of activity-interfering pain at discharge. In particular, patients who reported activity-interfering pain daily but not consistently, improved the least in ability to perform ADLs, while patients who reported no activity-interfering pain had the greatest improvement in ADL functional performance.

Although there has been relatively little research on changes in functional status during home healthcare for patients with HF using OASIS data, a few studies have analyzed functional status in this population. Madigan (2012a) demonstrated improvement in functional status over the course of home healthcare service. Riggs (2011) also showed improvement in ADL status potentially associated with nursing intensity among HF patients in home healthcare, but nursing intensity based on change in IADL status did not show improvement. There was an observed association between overall change in ADL status and the frequency of activity-interfering pain. Perhaps a comparison of overall ADL scores with other factors such as a prior hospital stay and frequencies of activity-interfering pain could be a key indicator in assessing functional status of home care patients with HF.

In this current study, overall ADL score was also improved from admission to discharge. However, the subset of patients who reported daily, but not consistent pain interference at discharge demonstrated the lowest functional improvement score. This finding suggests that a key nursing focus for HF patients during home healthcare should be monitoring the frequency of pain that interferes with activity. Those patients who do not demonstrate pain improvement should receive intensified symptom management. Thus, progress in improving functional performance of home healthcare HF patients can be accelerated with improved attention to pain.

Home healthcare clinicians should realize the potential to improve patients' outcomes through clinical utilization of the data routinely collected during home healthcare services. The structured data elements of OASIS facilitate the capture of real-time data that clinicians can utilize for the identification of potential targets for improvement in individual patient care (Vaduganathan et al., 2017). Identification of such targets using data captured in EHRs can help clinicians tailor assessment components (Vaduganathan et al.). Thus, the use of OASIS data as a home healthcare EHR system could be helpful for home healthcare clinicians. Although the main purpose of OASIS is for Medicare payment, recording performance data of nearly 100 metrics can provide new insights to target skilled nursing care priorities to improve outcomes for home healthcare patients with HF. Harnessing the benefit of big data analysis approaches not only allows the development of in-hospital outcomes prediction model for acute coronary syndrome patients (Gleason & Dennison

Himmelfarb, 2017), but it is also helpful for developing outcome prediction models but OASIS which can help home healthcare clinicians improve home healthcare services.

Implications for translation to practice/further research

Our study demonstrated the value of improving pain that interferes with HF patients' daily activity as important to improving functional performance overall. While this is likely intuitive, clinicians may not understand the relationship between pain relief, improved ADL function and the potential to decrease rehospitalization. In practice, OASIS is mainly used for the purpose of payment and for reporting performance to the CMS. It is an untapped resource to improve clinical care and guide priorities for individual patient improvement.

In order to develop clinical decision-making tools using OASIS, more home healthcare agencies could collaborate with researchers and policy makers to develop strategies and enhance the utility of OASIS. As current patient assessment tools for HF focus on weight and a few known HF-related symptoms in the home healthcare setting, the creation of a comprehensive tool that incorporates ADL items and pain assessment may better link the direction of intervention tailored to areas needing improvement individualized to the patient. In this study, we saw that most patients improved in ADL performance from admission to discharge and it might be concluded that there was no need for further intervention. However, examining the subset of patients who did not improve ADL performance reveals new targets including better intervention for pain that interferes with daily activity as found in this study. Although CMS made an announcement that it would drop two pain-related home healthcare quality indicators from Home Health Compare in 2017 to assess performance of home healthcare agencies (Wang et al., 2017), frequencies of activity-interfering pain captured in OASIS are still reported. Thus, an overall ADL score may need to be reported with frequencies of activity-interfering pain as part of the performance data.

In previous research, OASIS has been used to assess multiple outcome measures, such as changes in functional status, and many studies used traditional statistical methods (Fortinsky et al., 2014; Madigan et al., 2012a). As OASIS contains nearly 100 items, it can be considered a system of "big data", based on the three Vs: volume, variety, and velocity (Leem, 2016). One previous study that used a similar big data approach to analyze OASIS data was able to identify risk factors for rehospitalization among patients with HF (Kang et al., 2016). Due to the complex nature of HF, future research using this big data approach may be warranted to assess the relationship between functional status and any other factors including pain captured by OASIS. Future studies could also work to identify how these factors contribute to rehospitalization among home-bound patients with HF.

Limitations

One of the limitations was that the data used were not collected for the purpose of research for patients with HF. The OASIS-C dataset did not provide the information of detailed clinical HF characteristics such as New York Heart Association functional class, left ventricular ejection fraction, or laboratory results. Potential confounders were also not included in the OASIS-C dataset, such as dosage of home visits or physical therapy that could be hidden factors of improvement in functional status. The potential for selection bias

might have occurred, and the findings of this study may not be generalizable because the sample was limited to patients with a completed OASIS-C assessment from one home healthcare agency.

Conclusions

The results of this study show that the majority of patients had improvement in functional capacity at the time of discharge from home healthcare services. There were however significant differences in ADL change at discharge among different frequencies of activity-interfering pain. Comparisons of ADL scores with frequencies of activity-interfering pain could be a key indicator in assessing functional status of patients with HF in the home healthcare setting. As current self-assessment tools focus on weight and a few known HF-related symptoms in the home healthcare setting, we recommend the creation of a comprehensive self-assessment tool that incorporates ADL items and pain assessment including pain interference with daily activities into current tools used in home health care agencies.

Acknowledgement:

The parent study was supported by the Ruth L. Kirchenstein National Research Service Training Award for predoctoral students (1F31NR014403), Sigma Theta Tau International Small Grants, Sigma Theta Tau XI chapter, and Frank Morgan Jones Fund at the University of Pennsylvania School of Nursing, Office of Nursing Research.

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Table 1.

Patient characteristics (N=489)

Demographic/clinical characteristics	Median (IQR) or Count (%)
Age (Median (IQR))	79.6 (71.7~85.9)
65 or Under	58 (11.9)
65 to 90	381 (77.9)
90 or Above	50 (10.2)
Gender	
Male	208 (42.5)
Female	281 (57.5)
Race	
White	405 (82.8)
Other	84 (17.2)
Facilities prior to home healthcare services	
Short-stay acute hospital	335 (68.5)
Inpatient rehabilitation hospital or unit	23 (4.7)
Long-term nursing facility	3 (0.6)
Not discharged from an inpatient facility	128 (26.2)
Presence of severe pain	
Yes	69 (14.1)
No	420 (85.9)
Frequency of activity-interfering pain at admission	
No pain	146 (29.9) *
Pain but does not or interfere with activity or movement	46 (9.4)
Less often than daily	70 (14.3)
Daily, but not constantly	193 (39.4)
All of the time	34 (7.0)
Frequency of activity-interfering pain at discharge	
No pain	272 (55.6) *
Pain but does not or interfere with activity or movement	49 (10.0)
Less often than daily	53 (10.9)
Daily, but not constantly	100 (20.4)
All of the time	15 (3.1)

Note: IQR-interquartile range, admission-home health care admission, discharge-home health care discharge.

* McNemar test $p < 0.001$

Table 2.

The relationship between the subgroups with and without activity-interfering pain at admission and at discharge

	Activity-interfering pain at discharge		Total	P-value
Activity-interfering pain at admission	No	Yes		<0.001
No	118 (24.1%)	28 (5.7%)	146 (29.9%)	
Yes	154 (31.5%)	189 (38.7%)	343 (70.1%)	
Total	272 (55.6%)	217 (44.4%)	489	

Table 3.

The status of ADL and IADL

Functional Performance Indicator	Mean (SD)
ADL at admission	0.35 (0.15)
IADL at admission	0.33 (0.26)
ADL at discharge	0.15 (0.18)
IADL at discharge	0.17 (0.26)
ADL change (from admission to discharge)	−0.19 (0.16) *
IADL change (from admission to discharge)	−0.16 (0.25) *

Note: ADL- activities of daily living, IADL- instrumental activities of daily living, admission-home health care admission, discharge-home health care discharge.

*
t-test p-value<0.001

Table 4.

The relationship between ADL changes and the frequency of pain interference

Frequency of activity-interfering pain at admission	ADL change (95% CI)	P-value
No pain	-0.193 (-0.219, -0.166)	0.323
Pain but does not or interfere with activity or movement	-0.145 (-0.192, -0.097)	
Less often than daily	-0.191 (-0.230, -0.153)	
Daily, but not constantly	-0.200 (-0.223, -0.177)	
All of the time	-0.208 (-0.263, -0.153)	
Frequency of activity-interfering pain at discharge		
No pain	-0.207 (-0.226, -0.187)	0.028
Pain but does not or interfere with activity or movement	-0.203 (-0.249, -0.158)	
Less often than daily	-0.199 (-0.243, -0.155)	
Daily, but not constantly	-0.146 (-0.178, -0.114)	
All of the time	-0.168 (-0.250, -0.086)	

Note: ADL- activities of daily living, admission-home health care admission, discharge-home health care discharge, CI-confidence interval