Predictors of Potentially Burdensome Transitions of Care for Hospitalized Patients With Advanced Cancer

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Abstract:

Background: Patients with advanced cancer experience frequent hospitalizations and potentially burdensome transitions of care post-discharge that could negatively impact the quality of their end-of-life care. We examined predictors of discharge location for patients with advanced cancer, including patient-reported physical and psychological symptoms, and assessed the relationship between discharge location and survival.

Methods: We prospectively enrolled patients with advanced cancer who experienced an unplanned hospitalization at the Massachusetts General Hospital from September 2014 to March 2016. Upon admission, we assessed patients’ physical symptoms (Edmonton Symptom Assessment System [ESAS]; 0-10) and psychological distress (Patient Health Questionnaire 4 [PHQ-4]; 0-12). The PHQ-4 includes depression and anxiety subscales. We used logistic regression models to identify predictors of discharge to location other than home, including post-acute care (PAC) [skilled nursing facility or long term acute care hospital] or hospice [any setting]. We used Cox proportional hazards models adjusted for clinical variables to assess the relationship between discharge location and survival.

Results: Out of 932 patients, 726 (77.9%) were discharged home, 118 (12.7%) to PAC and 88 (9.4%) to hospice. Compared with patients discharged home, those discharged to PAC or hospice had higher symptom burden, including dyspnea, constipation, low appetite, drowsiness, low wellbeing, fatigue, depression, and anxiety (all p < 0.05). Using logistic regression, patients not discharged home vs. home were more likely to be older (OR 1.03, p<0.0001), live alone (OR 1.95, 95%CI: 1.25-3.02, p<0.003), have impaired mobility (OR 5.08, 95%CI: 3.46-7.45, p<0.0001), longer hospital length-of-stay (OR 1.15, 95%CI: 1.11-1.20, p<0.0001), higher ESAS physical symptoms (OR 1.02, 95%CI: 1.003-1.032, p<0.017), and higher PHQ-4 depression
symptoms (OR 1.13, 95%CI: 1.01-1.25, p<0.027). Patients discharged to hospice vs. PAC (reference) were more likely to receive palliative care consultation (OR 4.44, 95% CI: 2.12 to 9.29, p < 0.0001) and have shorter length of stay (OR 0.84, 95% CI: 0.77 to 0.91, p < 0.0001).

Compared with patients discharged home, those discharged to PAC had lower survival (HR 1.53, 95% CI 1.22-1.93, p < 0.0001).

Conclusions: Patients with advanced cancer discharged to PAC or hospice have substantial physical and psychological symptom burden and poor physical function, and those discharged to PAC have similar symptom burden and clinical characteristics compared to those discharged to hospice, except for higher rates of palliative care consultation and shorter lengths-of-stay for the hospice group. Patients discharged to PAC also have inferior survival compared with those discharged home. This study has identified a sub-population of patients with advanced cancer discharged to PAC after an unplanned admission, which may benefit from targeted interventions to reduce potentially burdensome care transitions and improve the quality of their end of life care. Future studies should attempt to replicate these findings in a larger, more diverse population, and explore the role of care financing issues and patient preferences in driving post-discharge decision-making at the end of life.
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Glossary of Abbreviations:

PAC – Post-Acute Care
SNF – Skilled Nursing Facility
LTACH – Long-term Acute Care Hospital
MGH – Massachusetts General Hospital
CCI – Charlson Comorbidity Index
ESAS – Edmonton Symptom Assessment System
ESAS-r – Edmonton Symptom Assessment System (Revised)
PHQ-4 – Patient Health Questionnaire-4
SD – Standard Deviation
OR – Odds Ratio
HR – Hazard Ratio
Introduction:
The Institute of Medicine report “Dying in America” underscores the critical need to optimize the quality of end-of-life care for patients in the United States.\(^1\) Studies have demonstrated that burdensome care transitions—particularly multiple hospitalizations or transfers in place of care—increase health care costs and contribute to poor quality care at the end of life.\(^2\) For patients with advanced cancer, in particular, hospitalizations represent the largest share of health care spending at the end of life, with significant variations in hospital use across regions in the United States.\(^6,10\) This population is known to have a high end of life symptom burden on admission,\(^11\) and acute hospitalization itself strongly predicts median survival of less than six months, making them by definition eligible for the Medicare hospice benefit.\(^12\) While studies have focused on potential drivers of hospital use at the end of life, data on post-hospital transitions of care for patients with advanced cancer—particularly discharge to post-acute care (PAC) facilities—and on the relationship between discharge location and downstream outcomes like readmission and survival are lacking.

The Care Continuum—Clinical and Policy Issues
PAC facilities such as skilled nursing facilities (SNF) or long-term acute care hospitals (LTACH) are typically utilized for patients who are no longer acutely ill but require ongoing nursing care, physical therapy, or additional time for recovery.\(^1\) In the fee-for-service Medicare population, researchers have shown that 33% of beneficiaries utilize the post-discharge SNF benefit in the last 6 months of life. Notably, 1 in 11 Medicare beneficiaries die while utilizing the SNF benefit.\(^13\) The increased financial incentives to reduce hospital length-of-stay have contributed

\(^1\) It is important to distinguish between post-acute care (colloquially termed “rehab”) within a SNF under the Medicare SNF Benefit, which is intended to be for patients with potential for recovery or rehabilitation from acute illness over less than 90 days, and long-term care use of a SNF, which is primarily for assistance with activities of daily living over long periods of time. Medicare does not cover long-term care, though patients on the Medicare SNF Benefit do get assistance with activities of daily living while on the benefit. While both types of patients may be cared for in the same facility, in this study, we will be referring to those in PAC facilities (including SNFs) on the rehabilitation benefit, not to those in long-term care. For more on this distinction, see Ackerly and Grabowski, 2014.
substantially to pressure on hospitals to discharge patients to PAC facilities like SNFs.\textsuperscript{14}

However, discharges to PAC facilities may represent a burdensome transition at the end of life for patients with advanced cancer,\textsuperscript{15} and these PAC facilities generally do not have expertise in palliative care and symptom management comparable to hospice providers.\textsuperscript{16,17} Therefore, studies are needed to examine the clinical characteristics of patients with advanced cancer discharged to PAC facilities and predictors of PAC facility utilization, in order to design supportive care interventions and alternative care delivery models to improve the quality of these patients’ end of life care.\textsuperscript{6}

The policy importance of PAC stems from the finding in 2013 by the Institute of Medicine that PAC is the chief driver of regional variation in health care costs,\textsuperscript{18} and cost growth,\textsuperscript{19} suggesting potential waste, overuse, and potential for interventions to reduce unnecessary or burdensome care, particularly for patients at the end of life. Overall, approximately 40% of Medicare beneficiaries discharged from an acute hospital use some sort of PAC services, including SNF and home health.\textsuperscript{20} ii In 2014, Medicare spent $60 billion on PAC services, just under 10% of all Medicare expenditures; this number includes $29 billion in SNFs and $5 billion in LTACHs.\textsuperscript{21} Of community-dwelling older adults who specifically used the SNF benefit, 42.5% died in a nursing home (whether on the Medicare SNF benefit or in long-term care) versus 5.3% of those who did not.\textsuperscript{13}

One care delivery alternative to PAC facility discharge for patients hospitalized with advanced cancer near the end of life is hospice. The Medicare hospice benefit provides symptom management services in the home, along with a suite of social and spiritual support, for patients with a prognosis of less than six months; however, the benefit is only fully funded by Medicare.

\textsuperscript{ii} While home health care is often grouped under the term PAC, in this study, PAC will be used to mean facility-based care, not home health care. In other words, patients discharged home with home health care will be treated in the same manner as patients discharged home without home health care.
when provided in patients’ homes.\textsuperscript{22} This regulation requires the patients to have a primary
caregiver in the home that is able to care for them, something that is difficult for older patients
with few social supports and/or severe functional decline (e.g. bedridden or severe impairment in
activities of daily living). Long-term residents of nursing homes (which include SNFs) can have
hospice coverage through Medicare, but they must fund their facility fees covering lodging, food,
and help with activities of daily living through Medicaid—the health insurance program for the
poor—or through private funds. For patients near the end of life desiring facility-based care,
inpatient hospice facilities or SNFs can provide short-term hospice care funded through
Medicare, but they still typically require payment of steep facility fees (much like long-term care
settings), meaning that this option is out of reach for many patients without adequate financial
resources. For this population of older patients facing serious illness, functional decline, and lack
of social supports at the end of life, PAC facilities often become the only viable discharge options
after acute hospitalization that are fully funded by Medicare.\textsuperscript{22}

Finally, it is important to note that hospice care—which is a care financing mechanism—is
distinct from palliative care—a medical specialty focused on caring for patients with serious
illness. The current standard of care in the United States is that palliative care should be
integrated from diagnosis of serious illness through imminent death, as it has been shown to have
benefits for patients in terms of symptom control and quality of end of life care.\textsuperscript{23,24} As
previously mentioned, PAC facilities typically have very little expertise in palliative care, and this
lack of comfort with managing seriously ill patients at the end of life likely leads to increased
readmissions and also increased burdensome transitions at the end of life.\textsuperscript{17,25}

\textbf{State of the Field}
Overall, despite the policy importance of PAC use to Medicare spending, and its potential
association with poorer quality end of life care, there are few studies on the predictors of PAC use
for patients near the end of life or analyzing PAC utilization as a marker for downstream
outcomes for patients at the end of life, including readmissions and survival. Further, there is little
research on the relationship between end of life symptom burden, both physical and
psychological, and sites of post-discharge care.

_Predictors of Post-Acute Care Use_
Previous studies have found several predictors of discharge to SNF in the general population.

Burke et al., in what is likely the most rigorous study of predictors of discharge to PAC facilities,
including 2.99 million discharges from 1996 to 2010 using the National Hospital Discharge
Survey, found that older age, unplanned admission, and increased length of stay were associated
with an increased likelihood of discharge to PAC facility.26 Interestingly, Burke et al. also found
that those who were married—a marker of potentially increased social support—had a lower
likelihood of discharged to a PAC facility. A study of 15,000 heart failure patients admitted to the
hospital found that 24.1% of patients overall were discharged to SNF, and that those discharged
to SNF were more likely to be female, and have longer lengths of stay.27 Other, smaller studies
looking at the general population have similarly found that older age, functional decline, living
alone, and increased length of stay all predicted increased PAC use.26,28-37

In cancer, two studies have looked at issues related to PAC use. Laine et al. studied HSCT
transplant patients, and while they did not look specifically at predictors of PAC use, they
analyzed predictors of inpatient physical therapy needs, finding that patients who were older and
had a lower performance status, unsurprisingly, had higher inpatient physical therapy needs
before discharge. Since inpatient physical therapy needs are a predictor of PAC facility use,38 this
study provides some basis for the role of functional status in predicting discharge destination in
patients hospitalized with cancer. Locher et al found that, in the post-discharge period, 29% of
patients with cancer used home health services and 10.7% used hospice services, but did not
specifically study use of PAC facilities.39 Importantly, while one study has shown that inpatient
physical and psychological symptom burden relate to length of stay and risk for readmission for
patients with advanced cancer,\textsuperscript{11} no studies identified on a literature review analyze the relation between end of life symptom burden and discharge to PAC facility, though as already mentioned, it is known that many patients at the end of life use PAC facilities.

The lack of knowledge on predictors of PAC use in the advanced cancer population is concerning, particularly given the findings of Brooks et al that “post-acute facility care, home health, and durable medical equipment were confirmed as drivers of regional spending variation [in patients with advanced cancer]. But variation in the use of hospice care demonstrated the opposite association, actually offsetting total spending variation,” leading them to conclude that some regions substitute hospice care for more costly management strategies.\textsuperscript{6}

**Post-Acute Care Use as Predictor of Downstream Outcomes**
The literature on PAC facility use clearly shows that patients discharged to PAC are at higher risk of readmission and increased health care utilization in the post-discharge period. Mor et al. documented that 25\% of Medicare patients admitted to a skilled nursing facility from an acute hospital were readmitted within 30 days, at a total cost of $4.34 billion in 2006.\textsuperscript{20} In a cohort of heart failure patients admitted to the hospital, “all-cause rehospitalization rates were also higher in the patients discharged to SNF in comparison to their non-SNF counterparts: 30-day rehospitalization, 27.0\% versus 23.5\%, and 1-year rehospitalization, 76.1\% versus 72.2\%, respectively; $P<0.0001$.”\textsuperscript{27} Another study of patients undergoing coronary artery bypass surgery found that discharge to SNF was associated with a 1.45 OR of readmission in a multivariable model accounting for demographics and comorbidities.\textsuperscript{40} Hasan et al.’s multicenter prospective cohort study to develop a predictive model for 30-day readmissions using over 10,000 patients, found a strong relationship between previous admissions and odds of readmission.\textsuperscript{31}

Further, in terms of general health care utilization post-discharge, Coleman et al. developed a model for differentiating complicated from uncomplicated care transitions after hospitalization,
finding that previous hospitalizations were strongly predictive of future complicated care transitions. In a 2011 meta-analysis of risk prediction models for hospital readmissions, Kansagara et al. found 26 different readmission risk prediction models, and identified that most have relatively poor predictive ability and called for more attention to social support, access to care, and functional status.

Finally, in most readmissions risk prediction models, patients with malignant solid tumors and/or those discharged from oncology services are often at very high risk for readmission. Dombrowski et al. compared patients discharged to SNF with and without readmission, and found that readmitted patients from SNF were significantly more likely to have malignant solid tumors, with an odds ratio for readmission of 10.10. In the HOSPITAL risk prediction model developed over multiple international sites with over 100,000 patients, discharges from oncology services carry a weight of 2 points, out of thirteen possible points, in predicting readmission. As a reference, having two to five hospital admissions in the previous year also carries a weight of 2 points. Manzano et al. found, as expected, lower rate of readmission in patients discharged to hospice from an oncology inpatient service. In a study of 534 potentially avoidable readmissions, physician reviewers identified end of life conflict as a cause in 15% of cases, and the diagnosis of neoplasm (OR 5.60) or opiate medications at discharge (OR 2.29) were significant predictors of potentially avoidable 30-day readmissions due to end of life conflict. Finally, the surgical oncology literature on readmissions is vast, and some consistent covariates related to readmission after an inpatient cancer-related surgery are discharge to somewhere other than home, length of stay, comorbidities, stage at diagnosis, and longer travel distance (from hospital). Overall, there is adequate evidence to conclude that patients with advanced cancer are at higher risk of readmission and burdensome care transitions, and that this risk is higher for those discharged to PAC facilities.
Purpose of Inquiry

By better understanding the characteristics of patients being discharged to PAC facilities, as well as potential predictors of this transition, we will be able to 1) identify a population at risk for these potentially burdensome transitions of care; and 2) develop interventions and alternate care delivery models to prevent unnecessarily burdensome transitions. Further, by studying downstream outcomes after discharge to PAC facilities, compared to other discharge locations, we will be able to understand how PAC facility discharge can be a marker for poor outcomes. In this study, we first sought to describe the clinical characteristics and symptom burden of patients with advanced cancer discharged to PAC facilities, hospice, or home after an unplanned acute hospital admission. We then explored potential predictors of discharge location for these patients. Lastly, we examined the burden of the care transition by assessing the relationship between patients’ discharge location and their survival as well as risk for hospital readmission. From a methodological perspective, this study will incorporate measures typical of patient-centered outcomes research, particularly end of life physical and psychological symptom burden as well as functional status measures, to study a question that is relevant for the health services research and policy community—namely the utilization of PAC at the end of life.
Methods:

Study Procedures
The Dana Farber Harvard Cancer Center Institutional Review Board approved this study. From 9/2/2014 to 3/31/2016, as part of a larger study to evaluate end of life care symptom burden among patients with advanced cancer, we enrolled 932 patients with advanced cancer who experienced an unplanned hospital admission at Massachusetts General Hospital (MGH). We identified and recruited consecutive patients with their first unplanned hospital admission during the study period by screening the daily inpatient oncology census. Study staff obtained written, informed consent from eligible patients on the first weekday following admission (within 2-5 days of hospitalization). Following consent, participants completed symptom burden questionnaires.

Participants
Patients were eligible for participation if they were age 18 or older and admitted to MGH with known diagnosis of advanced cancer between 9/2/2014 and 3/31/2016. We defined patients with advanced cancer as those not being treated with curative intent, identified based on chemotherapy order entry treatment intent designation or clinical documentation. We excluded patients not able to respond to study questionnaires in English, as well as patients experiencing elective or planned hospital admission (including hospitalization for chemotherapy, planned surgeries, or chemotherapy desensitization). We also excluded patients who did not survive to hospital discharge, or those missing initial nursing assessment data of mobility and functional status.

Study Measures
Sociodemographic, Clinical, and Functional Factors
We conducted a medical record review to collect demographic information, including participants’ date of birth, sex, and race. We reviewed patients’ oncology clinic notes to determine Charlson Comorbidity Index (CCI), date of diagnosis with advanced cancer, and cancer type. We reviewed a standardized questionnaire completed with assistance by nurses
within one day of admission as part of ordinary care to assess whether the patient lived alone, used a mobility assistive device, and ambulated independently at baseline. Self-reported functional status measures have been shown to be comparable to validated functional status measures in predicting discharge location.\textsuperscript{37} We reviewed inpatient hospitalization record to determine length-of-stay and whether the patient had a palliative care consultation at any point during their hospitalization.

**Patient-Reported Symptom Burden**

We used the self-administered revised Edmonton Symptom Assessment System (ESAS-r) to assess patients’ physical symptoms, including nausea, dyspnea, lack of appetite, pain, drowsiness, well-being, and fatigue.\textsuperscript{42,43} We also included constipation, as this is a highly prevalent symptom in patients with advanced cancer.\textsuperscript{44} For the ESAS, patients rate their symptoms on a scale with 0 reflecting absence of the symptom and 10 reflecting the worst possible symptom. We defined severe symptoms as ESAS scores from 7 to 10.\textsuperscript{45} We computed composite ESAS physical scores including pain, fatigue, drowsiness, nausea, appetite, dyspnea, and constipation. The ESAS-physical scores are well validated and have been utilized previously in the oncology setting.\textsuperscript{46}

To assess patients’ psychological symptoms, we used the Patient Health Questionnaire-4 (PHQ-4).\textsuperscript{47,48} The PHQ-4 is a 4-item tool that contains two 2-item subscales assessing depression and anxiety. Both subscales and the composite PHQ-4 can also be evaluated continuously, with higher scores indicating worse psychological distress.\textsuperscript{47} We added the PHQ-4 to the study questionnaires on 11/15/2014 to have a more validated measure for psychological distress than the single depression and anxiety items of the ESAS-r.

**Discharge Location**

We obtained discharge location from patients’ medical records using discharge summary documentation. We categorized discharge location as home, PAC facility (SNF or LTACH),
hospice (whether provided at home, hospice facility, or general inpatient hospice), or other. Due to the small sample size (n=1), we excluded patients in the “other” category.

**Survival and Readmission**
We calculated survival time from the date of discharge to the date of death using the Kaplan–Meier method. We censored data from patients who were alive at the last follow-up date (9/9/2016). We also assessed time to readmission within 90 days and the composite outcome of time to readmission or death within 90 days. To account for mortality, as patients who die after their index hospitalization have less time at risk for readmission, we used time to first unplanned admission within 90 days of hospital discharge as an outcome measure, censoring patients without a readmission at 90-days and censoring those who died within 90-days at their death date. In addition, we created a composite dichotomous outcome categorizing patients as dead and/or readmitted within 90-days (yes vs. no) vs. those alive and with no readmission within 90-days to further account for early mortality.

**Statistical Analysis**
We used descriptive statistics to evaluate the frequencies, means, and standard deviations (SDs) for participants’ characteristics and symptom burden, by discharge location. We compared symptom burden across discharge locations using Chi-squared tests. To explore predictors of discharge location, we used logistic regression models incorporating the following variables: age, sex, CCI, cancer type (dichotomized to gastrointestinal and thoracic cancers vs. all others), months since advanced diagnosis, living alone, impaired mobility, hospital length-of-stay, palliative care consultation, and physical and psychological symptoms during hospitalization. We chose these variables a priori based on a review of the literature on predictors of post-discharge location of care.\(^{26,28-37}\) We first determined predictors of discharge to locations other than home, using logistic regression models dichotomizing our outcome to discharge home (reference) vs. other site (includes PAC facility or hospice). We then used similar logistic regression models to determine predictors of discharge to PAC facilities versus hospice. Given collinearity between
physical and psychological symptoms, we created separate models to assess the relationship between physical symptoms (ESAS), depression (PHQ-4 depression), and anxiety (PHQ-4 anxiety) and discharge location.

We used Kaplan-Meier curves to assess survival by discharge location and used Cox proportional hazards models adjusted for age, sex, CCI, cancer type, and months since advanced cancer diagnosis to assess the relationship between discharge location and survival. Similarly, we used Cox proportional hazards models to assess the relationship between discharge location and time to readmission within 90-days. We used logistic regression adjusted for the same variables to assess the relationship between discharge location and the composite outcome of readmission or death within 90 days. Less than 1% of patients had missing data for each individual symptom, precluding the need for missing data imputations. All reported P values are two-sided with a P < 0.05 considered statistically significant. We used Stata 14.2 for all statistical analyses.
Results:

Participant Sample
We screened a total of 2,353 patients for eligibility. We approached 1,152 eligible patients and enrolled 1,036 (89.9%) participants. For this analysis, we included 980 eligible patients who experienced their first unplanned admission within the period covering 9/2/2014 to 3/31/2016.iii We excluded 48 patients due to death during admission (n=38), missing nursing assessment data (n=9), and discharge to “other” (n=1) [Figure 1]. Among the 932 eligible patients, 726 participants (77.9%) were discharged home, and 118 (12.7%) and 88 (9.4%) discharged to PAC facilities or hospice, respectively [Table 1]. We observed no differences between the groups in terms of sex, race, cancer type, or months since advanced cancer diagnosis. Patients discharged to PAC facilities, versus those discharged to home or hospice, were more likely to be older (PAC 70.6 years vs. home 62.3 years vs. hospice 63.4 years, p<0.001), have a higher CCI (PAC 1.4 vs. home 0.8 vs. hospice 0.8 p<0.001), and live alone (PAC 33.9% vs. home 15.4% vs. hospice 19.3%, p<0.001). Patients discharged to PAC facilities or hospice were more likely than patients discharged home to have a longer length-of-stay (PAC 8 days vs. hospice 6 days vs. home 4 days, p<.001), impaired mobility (PAC 70.3% and hospice 67.0% vs. home 27.5%, p<0.001), and use a mobility assistive device (PAC 40.7% and hospice 39.8% vs. home 14.3%, p<0.001). Rates of palliative care consultations varied across the three groups (Home 26.7%, PAC facility 33.9%, and Hospice 70.5%, p<0.001).

Patient-Reported Symptom Burden
Figure 2 depicts the proportion of patients experiencing severe symptoms by discharge location. Compared with patients discharged home, those discharged to PAC or hospice had consistently higher symptom burden across most symptom types, including dyspnea (PAC 28.8% vs. home 18.6% vs. hospice 34.1%, p<0.001), constipation (PAC 31.4% vs. home 24.0% vs. hospice

iii After 3/31/2016, a new electronic record system was implemented at MGH, which no longer required nurses to fill out standardized questionnaires assessing whether patients lived alone or had impaired mobility.
36.4%, p<0.017), lack of appetite (PAC 55.6% vs. home 40.5% vs. hospice 60.2%, p<0.001),
drowsiness (PAC 55.1% vs. home 44.6% vs. hospice 58.0%, p<0.011), poor wellbeing (PAC
33.9% vs. home 29.6% vs. hospice 45.5%, p<0.009), fatigue (PAC 70.3% vs. home 59.6% vs.
hospice 71.6%, p<0.013), PHQ-4 depression (PAC 42.1% vs. home 25.1% vs. hospice 48.5%,
p<0.001), and PHQ-4 anxiety (PAC 37.9% vs. home 24.3% vs. hospice 37.9%, p<0.003).
Notably, over half of patients discharged to PAC facilities or hospice reported severe lack of
appetite, pain, drowsiness, and fatigue.

Predictors of Discharge Location
Table 2 depicts predictors of discharge to location other than home (including PAC facility or
hospice). Older age (1.03, 95% CI: 1.02 to 1.05, p<0.0001), living alone (OR 1.95, 95% CI: 1.25
to 3.02, P<0.003), impaired mobility (OR 5.08, 95% CI: 3.46 to 7.45, P<0.0001), and longer
hospital length-of-stay in days (OR 1.15, 95% CI 1.11 to 1.20, P<0.0001) were all significantly
associated with discharge to PAC facility or hospice. Notably, patients’ physical symptoms
[ESAS-physical (OR 2.03, 95% CI: 1.003 to 1.032, P<0.017)] were also significantly associated
with discharge to PAC facility or hospice. In a separate model, depression symptoms were also
associated with a higher likelihood of being discharged to PAC facility or hospice [OR 1.13, 95%
CI: 1.01 to 1.25, P = 0.027]. Anxiety symptoms were not associated with discharge location.

We then explored predictors of discharge to hospice versus PAC facility (reference) using logistic
regression modeling. The only predictors of discharge to hospice vs. PAC facility were younger
age (OR 0.95, 95% CI: 0.91 to 0.98, P<0.001), shorter hospital length-of-stay (OR 0.84, 95% CI:
0.77 to 0.91, P<0.0001), and palliative care consultation during hospitalization (OR 4.44, 95%
CI: 2.12 to 9.29, P<0.0001) [Table 3].

Discharge Location and Survival
Figure 3 depicts the Kaplan-Meier survival curves for patients by discharge location. Patients
discharged to PAC facility and to hospice had lower overall survival compared with those
discharged to home. In Cox regression models, discharge to PAC facility (HR 1.53, 95% CI 1.22 to 1.93, P<0.0001) and to hospice (HR 7.92, 95% CI 6.19 to 10.14, P<0.0001) were both associated with lower overall survival compared with home discharge.

**Discharge Location and Readmission**

In Cox regression models examining time to readmission within 90 days, discharge to hospice (HR 0.21, 95% CI: 0.09 to 0.52, p<0.001) was associated with a lower likelihood of readmission, while there was no association between discharge to PAC facilities and likelihood of readmission within 90 days (HR 1.30, 95% CI: 0.85 to 1.51, P<0.396) [Table 4]. However, discharge to PAC facility (OR 1.96, 95% CI: 1.24 to 3.08, P<0.004) and hospice (OR 8.25, 95% CI: 3.74 to 18.16, P<0.0001) were both associated with a higher likelihood of readmission or death within 90 days.
Conclusion, Discussion, and Suggestions for Future Work:

In this study of patients with advanced cancer and unplanned hospital admission, we demonstrated that patients discharged to PAC facilities have substantial physical and psychological symptoms and impaired mobility, which are all strikingly similar to characteristics of patients discharged to hospice. Despite their immense physical and psychological symptoms, these patients were discharged to PAC facilities which do not provide substantial palliative care services.\textsuperscript{16,17} Notably, similar to hospice patients, patients discharged to PAC facilities have higher lengths-of-stay, lower overall survival and higher likelihood of readmission or death within 90 days compared with those discharged to home, further underscoring that these patients may be better served by a different post-discharge setting of care. Interestingly, palliative care consultation during the index hospitalization emerged as an important predictor of patients’ discharge to hospice vs. PAC facility. These findings contribute to the literature on end of life care transitions for patients with advanced cancer and point toward several implications and potential interventions to improve patient care. This study also highlights the need to integrate methodology and perspectives from both health services research and patient-centered outcomes research in order to understand patient-level predictors of health care utilization beyond data typically available in larger claims datasets.\textsuperscript{49,50}

Discussion

As mentioned previously, few prior studies have addressed the predictors of post-hospital care transitions in patients with advanced cancer at the end of life. Aragon and colleagues found high overall rates of PAC facility use in the last six months of life, with almost one-tenth of Medicare beneficiaries dying while in a PAC facility.\textsuperscript{13} Our findings confirm existing evidence that patients with poor prognoses utilize PAC facilities at high rates near the end of life, and found that some predictors of PAC facility placement in the general medical population also apply to the advanced cancer population, including older age, length-of-stay, and functional status.\textsuperscript{26,30,36} Given previous
findings that patients with cancer\textsuperscript{33} and patients discharged to PAC facilities\textsuperscript{20} have higher readmission rates, our finding that patients discharged to PAC facilities did not have a significantly higher readmission rates is likely due to a lack of power to detect the difference; however, patients discharged to hospice in our study had significantly lower readmission rates, which is notable given that all patients discharged to PAC facilities in our study were hospice eligible (i.e. prognosis of less than six months\textsuperscript{12}).

**Limitations**
This study has several limitations. First, we conducted this study at a single tertiary cancer care center, in a patient sample with limited socioeconomic diversity, which may limit the generalizability of the findings to other, more diverse populations or health care settings in other geographic areas. However, the MGH is likely representative of other large tertiary cancer centers, and patients choosing to receive their care at MGH probably have similar characteristics to patients choosing care at other similar centers. It will be important to conduct a similar study in community settings to study the similarities and differences in these two populations’ utilization of PAC facilities and hospice after hospital discharge.

Second, we examined predictors of discharge location based on available demographic, clinical, and patient-reported outcomes within our study. However, other unmeasured factors could confound the relationship between these predictors and discharge location. Importantly, we did not collect information on patient and caregiver preferences for post-discharge care location as well as their preference for place of death, which may be related to burdensome transitions at the end of life.\textsuperscript{51} Lastly, only a small percentage of our study cohort was discharged to hospice, thereby limiting our ability to conduct more extensive analyses of predictors of discharge to hospice versus PAC facility.
Future studies should replicate our methodology in a larger and more diverse population. The nature of this study, merging concepts from health services research—which typically studies claims and population-level trends—and patient-centered outcomes research—which typically conducts smaller studies collecting patient-reported outcomes longitudinally—makes it difficult to conduct on a large scale and generalize to the full population. However, replication of this study will allow confirmation of patient-level predictors of discharge location and a better understanding of how these may vary among different patient populations.

**Suggestions for Future Work**

**Supportive and Palliative Care Intervention Studies**

First, our findings allow the opportunity for clinicians to identify advanced cancer patients at risk for discharge to PAC facilities early during their hospital course. With the exception of length-of-stay, all factors predicting discharge location in this vulnerable population can be identified on admission. Specifically, older patients with functional decline, impaired mobility, and those living alone were more likely to be discharged to locations other than home (PAC facility or hospice). Since patients ultimately discharged to PAC facilities had high symptom burden similar to patients discharged to hospice, as identified by standardized patients questionnaires on admission, integrating universal symptom screening on admission for patients with advanced cancer may help identify a population at risk for discharge to PAC facilities and may influence their overall plan of care.\(^{52-54}\) Finally, clinical notifications to physicians, nurses, case managers, and physical therapists could identify patients at risk for a potentially burdensome transition to PAC facility and thus facilitate discharge planning and conversations focused on shared-decision-making about desired place of care at the end of life.

Second, patients identified as having high symptom burden and who are at risk for PAC discharge could be targeted for supportive care interventions geared towards improved post-discharge care transitions—that could benefit patients and also benefit health systems, given these
patients’ longer lengths-of-stay and higher risk of readmission or death within 90 days. Early assessment of patients’ functional status may help address their impaired mobility and identify those with more intensive discharge-planning needs. Early palliative care consultation may help address these patients’ substantial physical and psychological symptom burden, as well as enhance goals-of-care conversations to optimize end-of-life care and potentially decrease the number of burdensome transitions at the end of life for this population.

**Policy Implications**

However, even with the best of supportive care interventions, many patients with advanced cancer and limited social supports experience numerous barriers to a home and/or hospice discharge. Lack of social support at home and high care needs may make it impossible to transition to home with hospice services—the only fully funded means for older adults to receive hospice care through Medicare. Patients ready to transition their care and focus on comfort but without adequate support at home face steep fees for facility-based hospice care. Consequently, the Medicare PAC facility benefit becomes the only financially feasible option for a substantial proportion of patients. Since PAC facilities lack significant palliative and end-of-life care expertise, these patients are thus potentially subject to burdensome transitions of care at the end of life and poor quality care near death. This financing gap leaves a significant subset of advanced cancer patients without adequate options for care at the end of life. Health systems and insurers interested in improving end of life outcomes while reducing readmissions and other measures of overutilization should explore alternative care delivery models to enhance the quality of care for this population. Alternative models including providing more intensive home services or funding care in inpatient hospice facilities post-discharge may facilitate patients receiving adequate assistance in activities of daily living alongside high-quality hospice care. For those patients with no alternatives to a PAC facility, integrating palliative care into PAC facilities or into their outpatient care may enhance the quality of their end-of-life care as well.
Conclusion

In conclusion, patients discharged to PAC facilities or hospice have substantial physical and psychological symptom burden, impaired physical function, and worse survival compared with those discharged home. Notably, the physical and psychological symptom burden of patients discharged to a PAC facility was strikingly similar to that of those discharged to hospice, yet these facilities lack the palliative and supportive care infrastructure to optimize the quality of end-of-life care for this population. Further research should focus on developing targeted palliative care interventions and innovative care models for this population in order to improve the quality of their end-of-life care, as well as replicating these findings in a larger, more diverse patient population, combining methods and questions of health services research and patient-centered outcomes research.
Figures & Tables:

Figure 1: Cohort Development

Patients with Advanced Cancer Assessed for Eligibility
(n = 2,353)
September 2014 – May 2016

Excluded (n = 851)
- Patients admitted electively (n = 341)
- Cannot read/respond in English (n = 207)
- Under age 18 (n = 1)
- Clinical team reports patient is too ill to participate (n = 302)

Eligible Patients
(n = 1,502)

Not Approached (n = 350)
- Not approached prior to hospital discharge (n = 223)
- Admitted and discharged over the weekend (n = 127)

Approached Patients
(n = 1,152)

Refused (n = 116)
- Overwhelmed/Not interested in research (n = 70)
- Too ill to participate (n = 46)

Enrolled Patients (Full Study)
(n = 1,036)

Not Eligible for Transitions of Care Study
- Post 3/31/2016, outside of study window (n=56)
- Death during Admission (n=38)
- Missing Nursing Assessment Data (n=9)
- Discharge to “Other” (n=1)

Enrolled Patients (Transitions of Care Study)
(n = 932)
Table 1: Participant Characteristics: IQR = Inter-Quartile Range; ESAS= Edmonton Symptom Assessment Scale; PHQ-2 = Patient Health Questionnaire-2; GAD= General Anxiety Disorder-2; SD = Standard Deviation.

<table>
<thead>
<tr>
<th></th>
<th>Home (N = 726)</th>
<th>Post-Acute Facility (N = 118)</th>
<th>Hospice (N = 88)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sociodemographic and Clinical Variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean age (SD)</td>
<td>62.3 (13.1)</td>
<td>70.6 (10.5)</td>
<td>63.4 (11.4)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Female gender (%)</td>
<td>359 (49.4%)</td>
<td>59 (50.0%)</td>
<td>45 (51.1%)</td>
<td>0.95</td>
</tr>
<tr>
<td>Race (% White)</td>
<td>672 (92.6%)</td>
<td>108 (91.5%)</td>
<td>82 (93.2%)</td>
<td>0.89</td>
</tr>
<tr>
<td>Charlson Comorbidity Index (SD)</td>
<td>0.8 (1.2)</td>
<td>1.4 (1.4)</td>
<td>0.8 (1.2)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Cancer Type (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gastrointestinal</td>
<td>236 (32.5)</td>
<td>29 (24.6)</td>
<td>31 (35.2)</td>
<td>0.056</td>
</tr>
<tr>
<td>Lung</td>
<td>119 (16.4)</td>
<td>25 (21.2)</td>
<td>24 (27.3)</td>
<td></td>
</tr>
<tr>
<td>Breast/Genitourinary</td>
<td>133 (18.3)</td>
<td>26 (22.0)</td>
<td>11 (12.5)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>238 (32.8)</td>
<td>38 (32.2)</td>
<td>22 (25.0)</td>
<td></td>
</tr>
<tr>
<td>Months since advanced diagnosis (IQR)</td>
<td>8 (2, 24)</td>
<td>7 (2, 16)</td>
<td>7 (3, 19.5)</td>
<td>0.45</td>
</tr>
<tr>
<td>Living alone (%)</td>
<td>112 (15.4)</td>
<td>40 (33.9)</td>
<td>17 (19.3)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Impaired mobility (%)</td>
<td>200 (27.5)</td>
<td>83 (70.3)</td>
<td>59 (67.0)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Use of mobility assistive device (%)</td>
<td>104 (14.3)</td>
<td>48 (40.7)</td>
<td>35 (39.8)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td><strong>Patient-Reported Outcomes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean ESAS-physical symptoms (SD)</td>
<td>31.0 (14.0)</td>
<td>35.5 (13.8)</td>
<td>38.5 (13.0)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Mean PHQ-4 depression symptoms (SD)</td>
<td>1.6 (1.8)</td>
<td>2.2 (2.0)</td>
<td>2.6 (2.0)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Mean PHQ-4 anxiety symptoms (SD)</td>
<td>1.5 (1.8)</td>
<td>2.1 (2.2)</td>
<td>2.0 (2.1)</td>
<td>0.006</td>
</tr>
<tr>
<td><strong>Hospital Admission-Related Variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median hospital length of stay (IQR)</td>
<td>4.0 (3.0, 6.0)</td>
<td>8.0 (6.0, 12.0)</td>
<td>6.0 (4.0, 9.5)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Palliative care consultation (%)</td>
<td>194 (26.7)</td>
<td>40 (33.9)</td>
<td>62 (70.5)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Figure 2: Participants’ Symptom Severity, by Discharge Location

Severe ESAS Physical Symptoms by Discharge Location

* p < 0.001
* p < 0.017
* p < 0.011
* p < 0.009
* p < 0.013
* p < 0.001
* p < 0.003

- Home
- Post-Acute Care
- Hospice
**Table 2: Predictors of Patients’ Discharge Location:** Home (reference group) vs. location other than home (post-acute care facility or hospice). GI = Gastrointestinal; ESAS = Edmonton Symptom Assessment Scale.

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Odds Ratio</th>
<th>95% CI</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1.03</td>
<td>1.02 to 1.05</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Female gender</td>
<td>0.96</td>
<td>0.66 to 1.39</td>
<td>0.811</td>
</tr>
<tr>
<td>Charlson Comorbidity Index</td>
<td>1.00</td>
<td>0.87 to 1.15</td>
<td>0.996</td>
</tr>
<tr>
<td>GI/lung cancer vs. other</td>
<td>1.32</td>
<td>0.91 to 1.91</td>
<td>0.144</td>
</tr>
<tr>
<td>Months since advanced diagnosis</td>
<td>0.99</td>
<td>0.98 to 1.00</td>
<td><strong>0.005</strong></td>
</tr>
<tr>
<td>Living alone</td>
<td>1.95</td>
<td>1.25 to 3.02</td>
<td><strong>0.003</strong></td>
</tr>
<tr>
<td>Impaired mobility</td>
<td>5.08</td>
<td>3.46 to 7.45</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Hospital length of stay (days)</td>
<td>1.15</td>
<td>1.11 to 1.20</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Palliative care consultation</td>
<td>1.91</td>
<td>1.28 to 2.85</td>
<td><strong>0.001</strong></td>
</tr>
<tr>
<td>ESAS- physical symptoms</td>
<td>1.02</td>
<td>1.00 to 1.03</td>
<td><strong>0.017</strong></td>
</tr>
</tbody>
</table>
Table 3: Predictors of Patients’ Discharge Location: Post-Acute Care Facility (reference group) vs. Hospice. GI = Gastrointestinal; ESAS = Edmonton Symptom Assessment Scale.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Odds Ratio</th>
<th>95% CI</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.95</td>
<td>0.91 to 0.98</td>
<td>0.001</td>
</tr>
<tr>
<td>Female gender</td>
<td>0.85</td>
<td>0.43 to 1.72</td>
<td>0.658</td>
</tr>
<tr>
<td>Charlson Comorbidity Index</td>
<td>0.77</td>
<td>0.58 to 1.01</td>
<td>0.064</td>
</tr>
<tr>
<td>GI/lung cancer vs. other</td>
<td>1.78</td>
<td>0.89 to 3.56</td>
<td>0.101</td>
</tr>
<tr>
<td>Months since advanced diagnosis</td>
<td>1.00</td>
<td>0.98 to 1.02</td>
<td>0.805</td>
</tr>
<tr>
<td>Living alone</td>
<td>0.68</td>
<td>0.31 to 1.49</td>
<td>0.337</td>
</tr>
<tr>
<td>Impaired mobility</td>
<td>0.75</td>
<td>0.36 to 1.57</td>
<td>0.434</td>
</tr>
<tr>
<td>Hospital length of stay</td>
<td>0.84</td>
<td>0.77 to 0.91</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Palliative care consultation</td>
<td><strong>4.44</strong></td>
<td>2.12 to 9.29</td>
<td>&lt;0.0001</td>
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<tr>
<td>ESAS- physical symptoms</td>
<td>1.00</td>
<td>0.98 to 1.03</td>
<td>0.754</td>
</tr>
</tbody>
</table>
Note: In Cox Regression models adjusting for age, gender, CCI, cancer type, and days since advanced cancer diagnosis, discharge to post-acute care facility (HR 1.53, 95% CI 1.22 to 1.93, P<0.0001) and to hospice (HR 7.92, 95% CI 6.19 to 10.14, P<0.0001) were associated with lower overall survival compared to home discharge.
Table 4: Relationship between Discharge Location and Readmission: Models controlled for age, sex, Charlson Comorbidity Index, cancer type, and months since advanced cancer diagnosis.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Hazard Ratios</th>
<th>95% CI</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Readmission within 90 days</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-acute care facility</td>
<td>1.30</td>
<td>(0.85 to 1.51)</td>
<td>0.396</td>
</tr>
<tr>
<td>Hospice</td>
<td>0.21</td>
<td>(0.09 to 0.52)</td>
<td>0.001</td>
</tr>
<tr>
<td>Home</td>
<td>Ref</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Readmission or death within 90 days</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-acute care facility</td>
<td>1.96</td>
<td>(1.24 to 3.08)</td>
<td>0.004</td>
</tr>
<tr>
<td>Hospice</td>
<td>8.25</td>
<td>(3.74 to 18.16)</td>
<td>&lt;0.000</td>
</tr>
<tr>
<td>Home</td>
<td>Ref</td>
<td></td>
<td></td>
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</table>
References:


