POLST-Discordant Intensive Care Near the End of Life: A Retrospective Cohort Study

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A thesis

submitted in partial fulfillment of the

requirements for the degree of

Master of Science

University of Washington

2019

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Program Authorized to Offer Degree:

Epidemiology

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Abstract

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Importance: Patients with chronic life-limiting illness frequently use the Physician Orders for Life Sustaining Treatment (POLST) to document preferences for limiting intensive care. However, the incidence and predictors of POLST-discordant care near the end of life are not known.

Objective: To describe the incidence, predictors, and intensity of POLST-discordant intensive care among patients hospitalized near the end of life.

Design: Retrospective cohort study over 2010-2015.

Setting: Two teaching hospitals in a large academic healthcare system.

Participants: All POLST users with chronic life-limiting illness hospitalized during the last six months of life who died during 2010-2015.

Exposure(s): Age, days from POLST completion to admission, history of cancer, history of dementia, admitting diagnosis of traumatic injury, and whether the patient signed his/her own POLST.

Main Outcome(s) and Measure(s): POLST-discordant intensive care was defined as admission to the intensive care unit or cardiopulmonary resuscitation (CPR) among patients whose preexisting POLST orders that would ordinarily preclude such care. Among recipients of POLST-discordant intensive care, we also measured life-sustaining treatments (invasive mechanical ventilation, vasoactive infusions, new renal replacement therapies, CPR). All outcomes were measured during the last hospitalization of life.

Results: We identified 1,201 eligible decedents (mean [SD] age, 70.0 [14.6] years; 41% female), of whom 268 had POLST orders for "comfort measures only" (CMO) and 476 had orders for "limited additional interventions" (LAI). Among patients with treatment-limiting POLST orders, the incidence of POLST-discordant intensive care was 36% (95%CI 33-40%) [CMO: 28%, 95%CI 23-34%) ; LAI: 41%, 95%CI 37-46%], and the incidence of POLST-discordant life-sustaining treatment was 16% (95%CI 13-18%). Compared to patients without cancer, patients with cancer were less likely to receive POLST-discordant care (CMO: RR 0.51, 95%CI 0.32-0.80; LAI: RR 0.71, 95%CI 0.55-0.91). In the comfort-only group, patients with dementia were less likely to receive POLST-discordant care than those without dementia (RR 0.44, 95%CI 0.26-0.76), and patients admitted for traumatic injury were more likely to receive POLST-discordant care than those admitted for other diagnoses (RR 1.74, 95%CI 1.13-2.69). Patient age, timing of POLST, and POLST signer (patient vs. surrogate) were not independently associated with POLST-discordant care.

Conclusions and Relevance: In an academic healthcare system, one in three patients with treatment-limiting POLST orders received POLST-discordant intensive care near the end of life. Patients with cancer or dementia were less likely to receive POLST-discordant care than those without these illnesses. Patients hospitalized for traumatic injury were more likely to receive POLST-discordant care. Our findings may guide future improvements in the implementation of the POLST.

Introduction

One in four people in the United States are admitted to an intensive care unit (ICU) near the end of life.[1-4] Patients with chronic, life-limiting illness are at particularly high risk of receiving such care.[3-6] While some patients may desire intensive life-sustaining efforts near the end of life, others prefer an approach that prioritizes symptom relief over life extension in the face of serious illness.[7-9] For those who desire a comfort-focused approach, the delivery of intensive care with the goal of life extension may be inconsistent with the patient's goals of care. Unfortunately, accurate assessment of patients' goals is often challenging in the setting of critical illness.[10]

Advance care planning efforts have sought to improve concordance between patients' goals and their medical care by allowing patients to communicate their treatment preferences in advance, prior to the development of a critical illness.[11,12] One widely implemented approach to documenting treatment preferences is the Physician Orders for Life-Sustaining Treatment (POLST) form, a portable physician order that specifies treatment limitations for emergency care.[13,14] In observational studies, POLST has been associated with less in-hospital death, hospitalization, and unwanted cardiopulmonary resuscitation (CPR);[14-17] additionally, studies of POLST users in nursing homes have reported a low incidence of intensive care.[13,18] However, the effects of POLST on other measures of intensity of care are less clear. Descriptions of care received by POLST users near the end of life vary greatly in both intensity of care and concordance with POLST orders.[16,19] The frequency with which prior treatment-limiting directives are reversed in the setting of acute illness[20,21] raises concern that POLST-discordant intensive care near the end of life may be more common than previously appreciated. However, the incidence of POLST-discordant care in patients hospitalized near the end of life is not known.

The primary aim of this study is to characterize the incidence, predictors, and intensity of POLST-discordant intensive care among adults with chronic life-limiting illness who were hospitalized during the last six months of life. We hypothesize that patients with illnesses that have potentially more predictable trajectories, such as cancer or dementia, are more likely to receive POLST-concordant care than patients without these illnesses.[22,23] Owing to the prevalence of traumatic injury near the end of life and the protocolized care delivery model for trauma, we also hypothesize that patients hospitalized for traumatic injury are more likely to receive POLST-discordant care than those hospitalized for non-traumatic indications.[24,25] Lastly, we hypothesize that patients who signed their own POLST are at lower risk for POLST-discordant care than those whose POLSTs were signed by a decision-making surrogate. To explore the overall effectiveness of POLST orders, we also compared the intensity of care received by patients with treatment-limiting POLST orders to care received by those with full-treatment POLST orders, hypothesizing that patients with treatment-limiting POLST orders would receive lower intensity care.

Methods

Design, Setting, and Participants

We conducted a retrospective cohort study of decedents with preexisting POLSTs who were hospitalized near the end of life. The study was conducted at the University of Washington Medical Center, a quaternary-care academic medical center, and Harborview Medical Center, a

tertiary care and level I trauma center. Both hospitals share an electronic health record (EHR) within UW Medicine, a large academic healthcare system.

Participants included all individuals who died in Washington State between 2010-2015, had chronic life-limiting illness, were hospitalized during the last six months of life at a study hospital, and had a POLST on file in the EHR completed prior to the patient's last hospitalization. Chronic life-limiting illness was defined as having any of nine chronic conditions within the last two years of life: cancers with poor prognosis (primary malignancies with poor prognoses, leukemias, and metastatic disease), chronic lung disease, coronary artery disease, congestive heart failure, peripheral vascular disease, chronic renal failure, severe chronic liver disease, diabetes with end-organ damage, and dementia. These conditions are used by the Dartmouth Atlas to study end-of-life care in the United States, and are associated with 90% of deaths in the Medicare population.[3,26] We excluded patients under 18 years of age at death, patients whose last hospitalization at a study hospital was an inpatient admission for elective surgery, patients whose only POLST on file was completed during or after their last hospitalization. The study was approved by the University of Washington Institutional Review Board (STUDY00002590).

Data Collection

Decedents in the study period were identified using Washington State death certificate data, then linked using multiple identifiers to EHR records. Chronic life-limiting illness diagnoses were abstracted from the EHR using diagnosis codes.[3,27] Structured EHR data, including dates and times of hospital and ICU admissions, presence of advance care planning documents such as POLST, and delivery of life-sustaining treatments were electronically abstracted by investigators using validated queries of structured documentation and claims data. Unstructured data, including POLST forms (a paper document in Washington State that is scanned into the EHR), POLST signer and date signed, and admitting diagnosis were manually abstracted by investigators. To maximize accuracy, 5% of records were co-abstracted. All POLSTs on file in the EHR were abstracted; however, only the last POLST preceding the last hospitalization was considered in the analysis. Because POLST is not used by the study hospitals to document real-time changes in inpatients' treatment preferences, we elected not to consider POLSTs completed during the study hospitalization itself. POLST data were abstracted separately from other EHR data to minimize abstractor bias.

Outcomes

In evaluating risk factors for POLST-discordant care, the primary outcome was POLST-discordant intensive care during the last hospitalization of life at the study hospitals. For patients with POLST orders for "comfort measures only," POLST-discordant intensive care was defined as any admission to the ICU or receipt of CPR. For patients with POLST orders for "limited additional interventions," POLST-discordant intensive care was defined as any ICU admission apart from those solely for delivery of non-invasive ventilation without additional life-sustaining treatments, or receipt of CPR; this definition was agreed upon pursuant to the language of the Washington State POLST, versions 4-6 (in use over 2008-2017).[28] We also describe the secondary outcome of receiving POLST-discordant life-sustaining treatment, defined as receipt of any of the following: invasive mechanical ventilation, vasoactive infusions, new dialysis or continuous renal replacement therapy (CRRT), and CPR. To measure potentially POLST-

concordant ICU admissions for intensive symptom management, we examined provider initiation of a standardized comfort-care order set used for patients receiving comfort measures only in the hospital and also manually reviewed clinician documentation for indications for ICU admission in cases where comfort orders were initiated within 24 hours of ICU admission without prior administration of life-sustaining treatments. In evaluating intensity of care by POLST order, our outcomes were ICU admission and life-sustaining treatments.

Covariates

Age at admission, date and location of death were abstracted from death certificates. Chronic life-limiting illnesses were measured using outpatient and inpatient billing codes from across all UW Medicine facilities over the last two years of life, and categorized using an ICD-based classification system developed by the Dartmouth Atlas Project to define chronic illness.[3,27] Hospitalizations and ICU admissions were obtained from hospital registration data. Receipt of vasoactive infusions (defined as any continuous infusion of dobutamine, dopamine, epinephrine, isoproterenol, milrinone, norepinephrine, phenylephrine, or vasopressin) was obtained from the electronic medication administration record.

To determine the timing of POLST completion, the handwritten date accompanying the patient or surrogate's signature was abstracted as the POLST date. If the patient or surrogate did not complete this field, we used the earliest date on the POLST (typically the date of the provider's signature). POLSTs without legible dates were estimated to have been signed on the date of upload to the EHR. Whether the POLST was signed by the patient or by a surrogate was determined by comparing the handwritten signer's printed name or, if absent, the signature itself, to the patient's name.

Statistical Analyses

To evaluate potential risk factors for POLST-discordant care, we used modified Poisson regression with robust error variance[29] with *a priori* exposures of age at admission, log-transformed days from POLST completion to admission, history of dementia, history of cancer with poor prognosis, admitting diagnosis of traumatic injury, and POLST signer. To reduce latent confounding by POLST orders, we performed separate analyses by POLST order for medical interventions ("comfort measures only" vs. "limited additional interventions"). Participants with full-treatment POLST orders were not included in this analysis. We also performed an *a priori* sensitivity analysis of participants who died during the study hospitalization, as well as complete case analyses and analyses with imputation of best- and worst-case scenarios for missing values.

To compare intensity of care across patients with different POLST orders for medical interventions, we used modified Poisson regression with robust error variance to measure associations between POLST order (as a nominal exposure with the referent category of full-treatment) with the outcomes of ICU admission and life-sustaining treatments. We adjusted *a priori* for age at admission, log-transformed days from POLST completion to admission, history of cancer with poor prognosis, history of dementia, and POLST signer.

Data were complete for all covariates except for date of POLST completion, which was imputed using the date of POLST upload; and POLST signer (i.e. POLSTs for which we were unable to determine the signer), which was addressed using multiple imputation across 40 replicate data sets using logistic regression over all other model covariates and the primary outcome, stratified by POLST order for medical interventions, with effect estimates combined using Rubin's rules to obtain the final results.[30] All analyses were performed using Stata 15.1 (StataCorp LLC, College Station, TX).

Results

Between 2010 and 2015, there were 22,098 potentially eligible adult decedents in Washington State with chronic life-limiting illness who received their care through UW Medicine and died of non-excluded causes, of whom 10,682 were hospitalized within the last six months of life at a study hospital. Of these, 1,201 (11%) patients had a POLST that preceded the study hospitalization (Figure 1).

Participant characteristics are shown in Table 1. Of 1,201 participants, 457 (38%) had POLST orders for "full treatment"; 476 (40%) had orders for "limited additional interventions," and 268 (22%) had orders for "comfort measures only," yielding a total of 744 (62%) patients with treatment-limiting POLST orders for medical interventions. POLSTs were completed a median of 117 (IQR 29-365) days prior to the date of admission. There were 292 (24%) participants with more than one POLST in the EHR preceding the study hospitalization, for whom the most recent POLST was considered the active POLST at the time of study hospitalization. Washington State allows surrogates to sign the POLST in the patient's stead if the patient is "decisionally incapacitated"; at least 298 (25%) POLSTs were signed by surrogate decision-makers. Additionally, 210 (17%) POLSTs had missing POLST signer (i.e. were signed by individuals who did not print their name and whose signatures were illegible to abstractors). Stratified bivariate analysis demonstrated no associations between missing POLST signer and predictors or outcomes. 19 (1.6%) POLSTs bore no legible signature date, although all were known to precede the study hospitalization based on their upload date; 3 of these had treatment-limiting orders for medical interventions. All other data elements were complete.

The mean age (SD) of study participants was 70.0 (14.6) years; 496 (41%) were female, and 273 (24%) were of non-white race or Hispanic ethnicity. The most prevalent chronic illnesses in the cohort were cancer (39%), chronic lung disease (38%), coronary artery disease (39%), chronic renal failure (38%), and congestive heart failure (40%). Additionally, 23% had been diagnosed with dementia. Most participants had more than one chronic life-limiting illness (median no. diagnoses 2, IQR 1-4). Characteristics of the study hospitalization are shown in Table 2. Among the 744 subjects with treatment-limiting POLST orders for medical interventions, the most common reason for admission was sepsis or infection (n=224, 30%), followed by direct complications of cancer (n=175, 24%) and traumatic injury (n=77, 10%).

Of 1,201 study participants, 556 (46%) were admitted to the ICU during the study hospitalization (Table 3). The incidence of ICU admission and life-sustaining treatments was highest among those with POLST orders for full treatment, and lowest among those with POLST orders for comfort measures only. Compared to participants with full-treatment POLSTs, those with treatment-limiting POLSTs were significantly less likely to receive intensive care or life-sustaining treatments (Table 4).

Among 744 participants with treatment-limiting POLST orders that ordinarily preclude most ICU admissions, 281 (38%) were nevertheless admitted to the ICU (Table 3). Although the Washington State POLST allows delivery of NIV to patients with POLST orders for limited interventions, only 12 (3%) participants in the limited interventions group were admitted to the ICU for NIV without receiving other life-sustaining treatments; additionally, there were no ICU admissions for the sole indication of symptom management. The incidence of POLST-discordant intensive care was 28% (95%CI 23-34%) in the comfort-measures-only group, and 41% (95%CI 37-46%) in the limited-interventions group, for a combined incidence of 36% (95%CI 33-40%) across all 744 participants with treatment-limiting POLST orders for medical interventions. Among those 281 participants admitted to the ICU despite treatment-limiting POLST orders, 116 (41%) received one or more life-sustaining treatments. The most common life-sustaining treatment was invasive mechanical ventilation, followed by vasoactive infusions. The incidence of POLST-discordant life-sustaining treatments was 13% (95%CI 9-17%) in the comfort-measures-only group, and 17% (95%CI 14-21%) in the limited-interventions group, for a combined incidence of 16% (95%CI 13-18%). However, following delivery of conventional intensive care, comfort care orders were initiated within 24 hours of ICU admission in 26/76 (34%) patients with comfort-measures-only POLSTs, and in 24/205 (12%) patients with limited-interventions POLSTs (Table 3).

In multivariable analysis of potential risk factors for POLST-discordant intensive care (Table 5), patients with a history of cancer were less likely to receive POLST-discordant care in both comfort-only (unadjusted risk 36% vs. 19%; adjusted RR 0.51, 95%CI 0.32-0.80, $p<0.01$) and limited-interventions (unadjusted risk 47% vs. 33%; adjusted RR 0.71, 95%CI 0.55-0.91, $p<0.01$) groups compared to patients without cancer. Additionally, in patients with comfort-only POLSTs, patients with a history of dementia were also less likely to receive POLST-discordant care compared to patients without dementia (unadjusted risk 31% vs. 21%; adjusted RR 0.44, 95%CI 0.26-0.76, $p<0.01$); and, patients admitted for traumatic injury were more likely to receive POLST-discordant care compared to patients admitted for other diagnoses (unadjusted risk 49% vs. 25%; adjusted RR 1.74, 95%CI 1.13-2.69, $p=0.01$); however, these differences were not significant in patients with limited-interventions POLSTs. There was no evidence of association between POLST signer and POLST-discordant care.

Complete case analysis (eTable 1) and analyses with imputation of best- and worst-case scenarios for missing data reached the same conclusions as the primary analysis. An *a priori* sensitivity analysis restricted to participants who died during the study hospitalization found that both dementia and cancer remained associated with decreased risk of POLST-discordant intensive care in the comfort-measures-only group, and cancer remained associated with decreased risk of POLST-discordant intensive care in the limited-interventions group (eTable 2).

Discussion

In this study of POLST users hospitalized for acute illness, we observed a high incidence of POLST-discordant intensive care and POLST-discordant life-sustaining treatments near the end of life. Although treatment-limiting POLST orders were associated with reduced intensity of care compared to full-treatment POLST orders, the observed incidence of potentially inappropriate intensive care near the end of life is cause for concern.

Previous studies of nursing home residents with completed POLST have described a low incidence of POLST-discordant medical treatments.[13,15,18] However, these studies have enrolled mixed cohorts of living and deceased POLST users in nursing homes, and have not specifically examined care received by patients at the end of life. The largest cohort of deceased POLST users studied to date excluded individuals who died in a hospital,[15,18] raising concerns for the systematic exclusion of recipients of POLST-discordant care. Our findings are consistent with a smaller study of 58 POLST users in a comprehensive elder care program, which described a similar incidence of POLST-discordant care near the end of life.[19] Our findings differ from a prior study of 268 deceased POLST users that found a very low occurence of POLST-discordant care.[16] Importantly, this latter study was conducted in a community where POLST had been implemented as one facet of a multicenter interdisciplinary advance care planning initiative. Our contrasting findings may be explained by differences in POLST implementation, and we suspect our study setting more closely resembles POLST implementation in most communities.

We identified three factors that were independently associated with POLST-discordant care. First, a history of dementia was associated with lower risk of POLST-discordant intensive care. Our findings are consistent with prior studies that have found that advance directives are most effective in reducing intensity of end-of-life care among those with cognitive impairments.[31] Second, a history of cancer was associated with lower risk of POLST-discordant intensive care. This is also consistent with the results of prior studies.[32] Although patients who die of cancer complete POLST forms closer to death than those dying of organ failure or dementia,[33] the association we observed was independent of POLST timing. Lastly, we found that patients who were admitted for a traumatic injury near the end of life were more likely to receive POLST-discordant intensive care. To our knowledge, this risk factor has not been previously evaluated, and further study is needed to elucidate the reason for this association. Neither decision-making capacity at the time of POLST completion (as assessed by whether the patient was able to sign his/her own POLST) nor the patient's age were associated with POLST-discordant care. Overall, our findings support the hypothesis that patients with a more predictable prognostic trajectory[22,23] may receive less intense care near the end of life, whereas those with less predictable prognostic trajectories or sudden injuries are more likely to receive intensive care despite treatment-limiting directives.

Our study has several important limitations. First, as we only enrolled POLST users who were hospitalized near the end of life, our findings cannot be applied to POLST users who die without hospitalization during the last six months of life, and also cannot be applied predictively to non-decedents. Although our experience suggests that a substantial proportion of POLST users with comfort-measures-only orders are able to avoid all hospitalization near the end of life, our study identifies a key subpopulation of individuals who are in fact hospitalized and who may receive POLST-discordant intensive care. Second, by enrolling decedents, we are unable to comment on POLST-discordant care delivered to individuals who survive their critical illness. This concern is tempered by the high mortality of critical illness among individuals with chronic disease;[34] additionally, examining decedents allowed us to specifically evaluate care received near the end of life—a critical time period for the intended function of the POLST.[13,35] Third, our primary outcome only captures delivery of care that is more aggressive than preexisting POLST orders. Because it is difficult to understand the reasons for non-delivery of intensive care using EHR data, this study is unable to examine POLST-discordant withdrawal or withholding of desired treatments. Fourth, patients who do not develop an indication for ICU care cannot receive POLST-discordant intensive care. To address this, we enrolled only decedents (who have

universally evolved critical illness prior to their death), and examined the last hospitalization prior to death in order to capture the care delivered for the illness episode most proximal to death. Additionally, an *a priori* sensitivity analysis of those who died during the study hospitalization corroborated most of our findings. Fifth, our study only captures POLSTs on file at, and care delivered at, the study hospitals. We note that the observed uptake of POLST in our cohort (11% of hospitalized individuals) is similar to statewide estimates of POLST uptake among inpatients with chronic disease (13%; J. Martinson MS, Washington State Medical Association, written communication, January 2019). However, other healthcare systems may deliver more or less POLST-discordant care than ours. Lastly, although we are concerned that the delivery of life-sustaining treatments to patients with an expressed preference for comfort-oriented care may often be inappropriate, we acknowledge that POLST-discordant care is not always inappropriate or goal-discordant. Nevertheless, our findings describe a concerning frequency of provision of potentially inappropriate intensive care near the end of life. These findings may guide future improvements in the implementation of the POLST.

Conclusions

In a large cohort of POLST users with chronic life-limiting illness who were hospitalized near the end of life, patients with treatment-limiting POLST orders for medical care received less intense care than patients with full-treatment POLST orders. However, one in three patients with POLST orders for limited treatments or comfort-oriented care received POLST-discordant intensive care, and nearly one in six received mechanical ventilation, vasoactive infusions, or CPR. Patients with cancer were less likely to receive POLST-discordant care than those without cancer. Among those with POLST orders for comfort measures only, patients without dementia and patients admitted for a traumatic injury were at relatively higher risk of receiving POLST-discordant care.

ACKNOWLEDGEMENTS

Funding/Support: This study was supported by the Cambia Health Foundation and by UW Medicine. Dr. Lee was additionally supported by an F32 award (HL142211) and a palliative care T32 training fellowship (HL125195), both from the National Heart, Lung, and Blood Institute. Additionally, Dr. Sathitratanacheewin was supported by the Prince Mahidol Youth Program Award, Bangkok, Thailand. Infrastructure support was provided by the University of Washington Institute of Translational Health Science, which is funded by the National Center for Advancing Translational Sciences (UL1 TR002319).

Role of the Funder/Support: The funding sources had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

TABLES AND FIGURES

Figure 1. Identification of Eligible Decedents for Cohort of Chronically Ill Patients Hospitalized Near the End of Life with Preceding POLST.

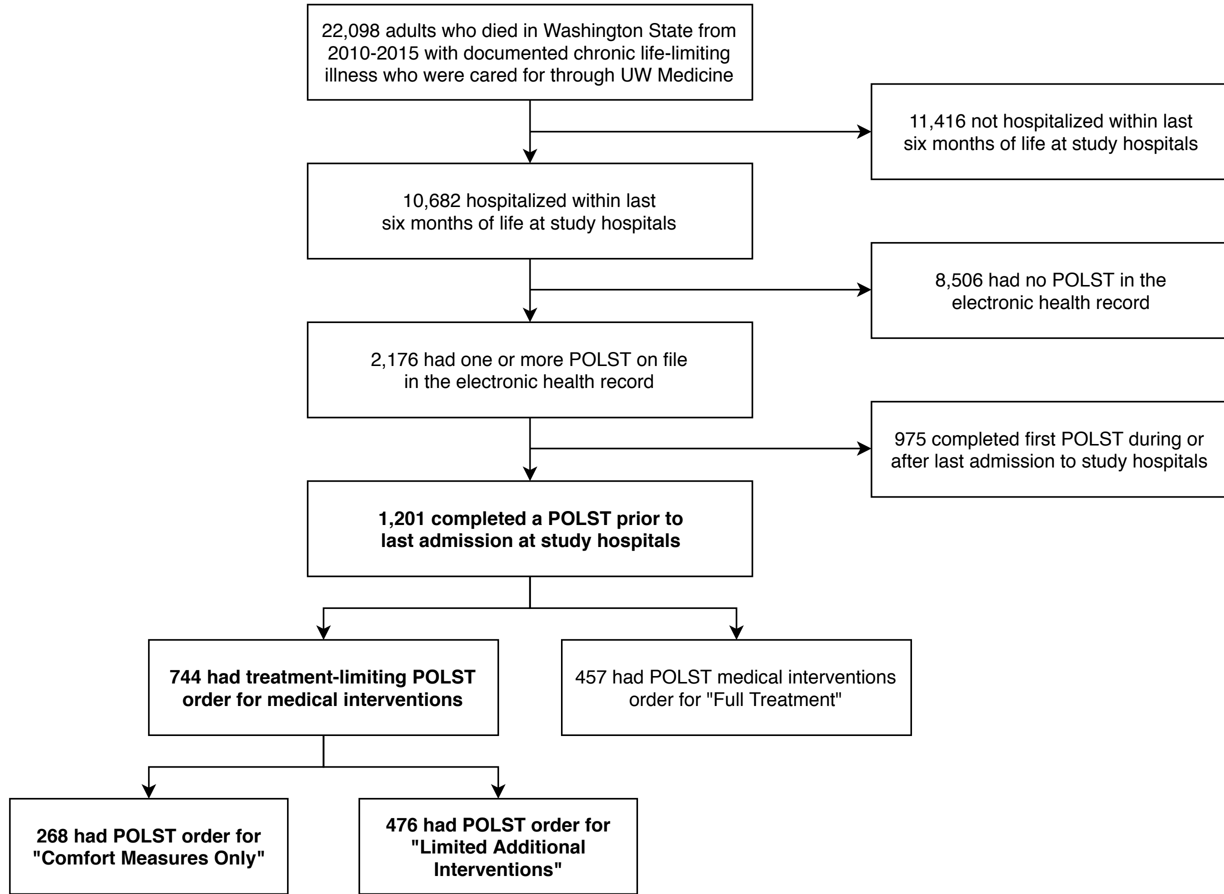

Table 1. Baseline Demographics and Medical Characteristics of POLST Users Hospitalized Near the End of Life.

Characteristic	All Participants (N=1201)	POLST Order for Medical Interventions		
		Comfort Measures Only (n=268)	Limited Interventions (n=476)	Full Treatment (n=457) [a]
Participant Characteristics				
Age at admission, years, mean (SD)	70.0 (14.6)	71.5 (14.7)	72.6 (14.5)	66.4 (14.0)
Female sex, n (%)	496 (41)	111 (41)	202 (42)	183 (40)
White and non-Hispanic, n (%) [b]	843 (76)	208 (82)	344 (78)	291 (69)
Number of chronic life-limiting illness diagnoses, n (%)				
1	308 (26)	89 (33)	125 (26)	94 (21)
2	314 (26)	80 (30)	124 (26)	110 (24)
3	236 (20)	52 (19)	93 (20)	91 (20)
4 or more	343 (29)	47 (18)	134 (28)	162 (35)
Chronic Life-Limiting Illnesses				
Cancer with poor prognosis, n (%)	465 (39)	117 (44)	203 (43)	145 (32)
Chronic lung disease, n (%)	457 (38)	87 (32)	170 (36)	200 (44)
Congestive heart failure, n (%)	486 (40)	81 (30)	195 (41)	210 (46)
Chronic renal failure, n (%)	460 (38)	81 (30)	170 (36)	209 (46)
Coronary artery disease, n (%)	467 (39)	78 (29)	192 (40)	197 (43)
Dementia, n (%)	282 (23)	73 (27)	124 (26)	85 (19)
Peripheral vascular disease, n (%)	289 (24)	52 (19)	106 (22)	131 (29)
Diabetes with end-organ damage, n (%)	190 (16)	34 (13)	62 (13)	94 (21)
Severe chronic liver disease, n (%)	172 (14)	26 (10)	61 (13)	85 (19)
POLST Characteristics				
Signer of POLST, n (%) [c]				
Patient signed own POLST	693 (58)	161 (60)	280 (59)	252 (55)
POLST signed by surrogate	298 (25)	69 (26)	112 (24)	117 (26)
Unclear whose signature (missing)	210 (17)	38 (14)	84 (18)	88 (19)
Days from POLST completion to study hospitalization, median (IQR)	117 (29-365)	100 (29-330)	106 (29-360)	128 (29-414)

Abbreviations: POLST, Physician Orders for Life Sustaining Treatment; DNR, do not resuscitate.
[a] Patients with POLST orders for full medical treatments were not included in the analysis of risk factors for POLST-discordant care.
[b] Race and ethnicity data were missing from the death certificate for 85 patients (15 in comfort measures only, 37 in limited interventions, 33 in full treatment).
[c] The Washington State POLST specifies that the POLST should always be signed by the patient, unless the patient is "decisionally incapacitated" in which case a legal surrogate may sign the POLST.

Table 2. Hospital Admissions Among POLST Users Near the End of Life.

Characteristic	POLST Order for Medical Interventions	
	Comfort Measures Only (n=268)	Limited Interventions (n=476)
Characteristics at the Time of Study Hospitalization		
Admitted from a nursing facility, n (%) [a]	85 (32)	193 (41)
Primary admitting diagnosis, n (%)		
Cancer [b]	64 (24)	111 (23)
Traumatic injury	37 (14)	40 (8)
Non-pulmonary sepsis or infection	36 (13)	85 (18)
Pneumonia or respiratory failure [c]	35 (13)	73 (14)
Stroke	16 (6)	41 (9)
CHF exacerbation	9 (3)	26 (5)
Myocardial infarction	8 (3)	11 (2)
COPD exacerbation	7 (3)	7 (1)
Decompensated cirrhosis	7 (3)	12 (3)
Renal failure	7 (3)	9 (2)
Gastrointestinal bleeding [d]	2 (1)	8 (2)
Other [e]	40 (15)	53 (11)
Outcomes Following Study Hospitalization		
Place of death, n (%) [f]		
Died in study hospital, n (%)	87 (34)	154 (34)
Died in a nursing facility	90 (35)	158 (35)
Died at home	53 (21)	87 (19)
Died in a hospice facility	13 (5)	11 (2)
Died in a non-study hospital, n (%) [g]	12 (5)	46 (10)
Time of death		
Died during study hospitalization, n (%)	87 (32)	154 (32)
Died after discharge from study hospitalization, n (%)	181 (68)	322 (68)
Days from discharge to death, median (IQR) [h]	27 (8-68)	29 (10-73)

Abbreviations: POLST, Physician Orders for Life Sustaining Treatment; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease.

[a] Includes nursing homes, skilled nursing facilities, acute rehabilitation, and long-term acute care.

[b] Includes organ dysfunction due to cancer or its treatment. Does not include infectious complications.

[c] Does not include respiratory failure due to CHF, COPD, end-stage renal disease, or end-stage liver disease.

[d] Does not include gastrointestinal bleeding due to cirrhosis.

[e] Includes all primary admitting diagnoses that could not be grouped into categories of ≥2% prevalence within each stratum. Examples: unexplained altered mental status, venous thromboembolic disease, limb ischemia, critical lab abnormalities.

[f] Place of death was missing from the death certificate for 13 participants in the comfort-measures-only group, and 20 participants in the limited-interventions group.

[g] Includes individuals who survived the study hospitalization, were subsequently hospitalized at a non-study hospital, and died in the hospital during that hospitalization.

[h] Does not include those who died during the study hospitalization.

Table 3. Intensive Care Delivered to POLST Users Hospitalized Near the End of Life.

Care Outcome	POLST Order for Medical Interventions		
	Comfort Measures Only (n=268)	**Limited Interventions (n=476)**	**Full Treatment (n=457)**
	n (cumulative incidence [%], 95%CI [%])		
Admission to ICU	76 (28, 23-34)	205 (43, 39-48)	275 (60, 56-65)
ICU admission only for NIV [a]	4 (1.5, 0.4-3.8)	12 (3, 1-4)	8 (1.8, 0.8-3.4)
ICU admission only for symptom management	0 (0, 0-1.4)	0 (0, 0-0.8)	0 (0, 0-0.8)
Comfort care within 24 hours of ICU admission	26 (10, 6-14)	24 (5, 3-7)	11 (2, 1-4)
Delivery of Life-Sustaining Treatments	34 (13, 9-17)	82 (17, 14-21) [b]	185 (40, 36-45)
Mechanical ventilation	24 (9, 6-13) [c]	50 (11, 8-14) [c]	157 (34, 30-39)
Vasoactive infusions	20 (7, 5-11)	50 (11, 8-14)	115 (25, 21-29)
New dialysis or CRRT	0 (0, 0-1.4)	1 (2.1, 0.1-1.2)	9 (2.0, 0.9-3.7)
CPR	5 (1.9, 0.6-4.3)	9 (1.9, 0.9-3.6) [b]	19 (4, 3-6)
POLST-discordant intensive care [d]	**76 (28, 23-34)**	**195 (41, 37-46) [b,d]**	–
	Combined: 271 (36, 33-40)		

Abbreviations: POLST, Physician Orders for Life Sustaining Treatment; ICU, intensive care unit; NIV, non-invasive ventilation; CRRT, continuous renal replacement therapy; CPR, cardiopulmonary resuscitation.

[a] Includes participants who were admitted to the ICU and received NIV, but did not receive any mechanical ventilation, vasoactive infusions, new dialysis/CRRT, or CPR.

[b] Two participants with POLST orders for limited interventions and DNR were not admitted to the ICU but received CPR outside of the ICU.

[c] Seven participants with POLST orders for comfort measures only, and seven participants with POLST orders for limited interventions, were intubated by prehospital providers (i.e. emergency medical services).

[d] POLST-discordant intensive care is defined as (1) delivery of CPR or ICU admission for patients with POLST orders for comfort measures only; or, (2) delivery of CPR or ICU admission apart from those indicated solely for delivery of NIV without additional life-sustaining treatments for patients with POLST orders for limited interventions.

Table 4. Associations Between POLST Order for Medical Interventions and Intensive Care Near the End of Life. [a]

	Admission to ICU				Life-sustaining Treatments			
POLST Order for Medical Interventions	**Unadjusted RR (95% conf. int.)**	***P* value**	**Adjusted RR (95% conf. int.) [a]**	***P* value**	**Unadjusted RR (95% conf. int.)**	***P* value**	**Adjusted RR (95% conf. int.) [a]**	***P* value**
Full treatment (n=457)	referent	–	referent	–	referent	–	referent	–
Limited additional interventions (n=476)	0.72 (0.63-0.81)	< 0.01	0.77 (0.67-0.88)	< 0.01	0.43 (0.34-0.53)	< 0.01	0.50 (0.40-0.63)	< 0.01
Comfort measures only (n=268)	0.47 (0.38-0.58)	< 0.01	0.51 (0.42-0.63)	< 0.01	0.31 (0.22-0.44)	< 0.01	0.37 (0.27-0.52)	< 0.01

Abbreviations: POLST, Physician Orders for Life Sustaining Treatment; ICU, intensive care unit.
[a] Adjusted for age at admission, log-transformed days from POLST completion to study admission, history of cancer with poor prognosis, history of dementia, and whether patient signed own POLST.

Table 5. Patient Characteristics Associated with POLST-Discordant Intensive Care.

	POLST Orders for Comfort Measures Only (n=268)				POLST Orders for Limited Interventions (n=476)			
Characteristic	**Unadjusted RR (95% conf. int.)**	***P* value**	**Adjusted RR (95% conf. int.) [a]**	***P* value**	**Unadjusted RR (95% conf. int.)**	***P* value**	**Adjusted RR (95% conf. int.) [a]**	***P* value**
Age at admission, per 10 years	1.07 (0.94-1.22)	0.31	0.99 (0.87-1.13)	0.90	0.99 (0.92-1.06)	0.75	0.93 (0.85-1.00)	0.06
History of cancer with poor prognosis	0.52 (0.34-0.81)	< 0.01	0.51 (0.32-0.80)	< 0.01	0.72 (0.57-0.91)	0.01	0.71 (0.55-0.91)	0.01
History of dementia	0.66 (0.40-1.08)	0.10	0.44 (0.26-0.76)	< 0.01	1.09 (0.86-1.38)	0.49	0.97 (0.74-1.28)	0.84
Admitted for traumatic injury	1.94 (1.30-2.89)	< 0.01	1.74 (1.13-2.69)	0.01	1.39 (1.02-1.88)	0.04	1.36 (0.97-1.89)	0.07
Patient signed own POLST [b]	1.24 (0.77-2.00)	0.38	1.02 (0.62-1.70)	0.93	0.95 (0.74-1.21)	0.67	0.97 (0.74-1.28)	0.85
Log-days from POLST to admission [c]	1.09 (1.01-1.18)	0.03	1.07 (0.98-1.16)	0.15	1.03 (0.99-1.08)	0.16	1.03 (0.98-1.08)	0.26

Abbreviations: POLST, Physician Orders for Life Sustaining Treatment.
[a] Adjusted for all exposures presented in the table.
[b] The Washington State POLST specifies that the POLST should always be signed by the patient, unless the patient is "decisionally incapacitated" in which case a legal surrogate may sign the POLST.
[c] Relative risk per doubling of days from POLST signature to date of admission (i.e. log base 2).

eTable 1. Patient Characteristics Associated With POLST-Discordant Intensive Care: Complete Case Analysis.

	POLST Orders for Comfort Measures Only (n=230 of 268 participants)				POLST Orders for Limited Interventions (n=392 of 476 participants)			
Characteristic	**Unadjusted RR (95% conf. int.)**	***P* value**	**Adjusted RR (95% conf. int.) [a]**	***P* value**	**Unadjusted RR (95% conf. int.)**	***P* value**	**Adjusted RR (95% conf. int.) [a]**	***P* value**
Age at admission, per 10 years	1.05 (0.92-1.21)	0.44	0.98 (0.86-1.12)	0.78	1.01 (0.94-1.10)	0.76	0.95 (0.87-1.03)	0.21
History of cancer with poor prognosis	0.54 (0.35-0.83)	< 0.01	0.53 (0.34-0.82)	< 0.01	0.70 (0.54-0.89)	< 0.01	0.71 (0.54-0.93)	0.01
History of dementia	0.65 (0.37-1.12)	0.12	0.44 (0.24-0.78)	< 0.01	1.16 (0.90-1.48)	0.25	1.00 (0.76-1.32)	0.99
Admitted for traumatic injury	1.81 (1.17-2.78)	< 0.01	1.67 (1.05-2.67)	0.03	1.45 (1.06-1.99)	0.02	1.37 (0.98-1.93)	0.07
Patient signed own POLST [b]	1.27 (0.79-2.03)	0.33	1.02 (0.62-1.67)	0.94	0.93 (0.73-1.19)	0.57	1.00 (0.77-1.31)	0.99
Log-days from POLST to admission [c]	1.11 (1.02-1.21)	0.02	1.09 (0.99-1.19)	0.08	1.05 (1.00-1.10)	0.06	1.01 (0.77-1.31)	0.96

Abbreviations: POLST, Physician Orders for Life Sustaining Treatment.

[a] Adjusted for all exposures presented in the table.

[b] The Washington State POLST specifies that the POLST should always be signed by the patient, unless the patient is "decisionally incapacitated" in which case a legal surrogate may sign the POLST.

[c] Relative risk per doubling of days from POLST signature to date of admission (i.e. log base 2).

eTable 2. Patient Characteristics Associated With POLST-Discordant Intensive Care Among Participants who Died During the Study Hospitalization.

	POLST Orders for Comfort Measures Only (n=87 of 268 study participants)				POLST Orders for Limited Interventions (n=154 of 476 study participants)			
Characteristic	**Unadjusted RR (95% conf. int.)**	***P* value**	**Adjusted RR (95% conf. int.) [a]**	***P* value**	**Unadjusted RR (95% conf. int.)**	***P* value**	**Adjusted RR (95% conf. int.) [a]**	***P* value**
Age at admission, per 10 years	0.99 (0.83-1.19)	0.95	1.01 (0.86-1.18)	0.94	0.99 (0.91-1.09)	0.87	0.92 (0.84-1.02)	0.12
History of cancer with poor prognosis	0.56 (0.29-1.06)	0.07	0.48 (0.25-0.90)	0.02	0.64 (0.48-0.85)	< 0.01	0.66 (0.49-0.89)	< 0.01
History of dementia	0.38 (0.15-0.98)	0.05	0.29 (0.10-0.81)	0.02	1.28 (1.00-1.63)	0.05	1.14 (0.83-1.56)	0.42
Admitted for traumatic injury	0.87 (0.27-2.81)	0.82	1.38 (0.37-5.18)	0.63	1.67 (1.46-1.91)	< 0.01	1.64 (1.29-2.08)	< 0.01
Patient signed own POLST [b]	1.89 (0.89-4.02)	0.10	1.20 (0.52-2.79)	0.67	0.89 (0.68-1.17)	0.40	1.06 (0.78-1.45)	0.71
Log-days from POLST to admission [c]	1.09 (0.97-1.24)	0.16	1.07 (0.94-1.22)	0.31	1.05 (0.99-1.10)	0.08	1.04 (0.99-1.09)	0.15

Abbreviations: POLST, Physician Orders for Life Sustaining Treatment.

[a] Adjusted for all exposures presented in the table.

[b] The Washington State POLST specifies that the POLST should always be signed by the patient, unless the patient is “decisionally incapacitated” in which case a legal surrogate may sign the POLST.

[c] Relative risk per doubling of days from POLST signature to date of admission (i.e. log base 2).

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