

**THE PHYSICIAN ORDERS FOR LIFE-SUSTAINING TREATMENT FORM
IN THE SETTING OF TRAUMATIC INJURIES:
A PRELIMINARY STUDY ON PREVALENCE AND EFFECTIVENESS**

By

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ABSTRACT

Background: Traumatic injuries among older (≥ 65 years) adults are increasing annually in the United States. There is a growing need for decision-making tools that guide acute interventions based on patient preferences, particularly when the patient may not be able to participate in their own care. The Physician Orders for Life-Sustaining Treatment (POLST) program was created in an effort to help people, especially older adults, direct their care in the event of an emergency. Multiple studies have found to the POLST program to be effective in nursing homes, hospices and in out of hospital cardiac arrest field decision-making. However, to date, no studies have examined the role of the POLST program in the setting of traumatic injuries.

Methods & Results: This is a multi-method study involving retrospective data from the OHSU Trauma Registry and individual chart review for patients ≥ 65 years arriving at OHSU for trauma care from March 2007 – December 2013 ($n=1622$). 180 patients (11.1%) were found to have a POLST form on file upon arrival. Patients with a POLST form were less likely to be intubated ($p=0.011$) during their hospital stay and had significantly different ED dispositions ($p=0.023$) than those without a POLST form. POLST patients who had selected “*Comfort Measures*” or “*Limited Interventions*” had significantly shorter total hospital and ICU length of stays ($p=0.0098$ and $p=0.0242$, respectively) compared to those patients who had selected “*Full Treatment*”. Chart review of those patients with a POLST on file revealed ways in which care providers are using the POLST form in their medical decision-making for complex trauma patients.

Conclusions: The POLST form is a useful decision-making tool in the setting of traumatic injuries that allows for a variety of patient preferences to be met, particularly related to ED disposition, intubation and diagnostic work-up. This study adds to the growing body of evidence supporting the utility of the POLST form in a multitude of medical environments, however, further research is needed to better understand the way in which health care providers and patients understand and interpret the POLST form, particularly in emergency situations.

INTRODUCTION

Every year millions of older (≥ 65 years) adults suffer traumatic injuries, falls in particular.¹ In the trauma setting, decisions about care are made quickly and can involve complex interventions, such as admission to the Intensive Care Unit (ICU), intubation and/or emergency surgery. If an injured person is unable to participate in their care, due to level of consciousness or a very severe injury, they may end up receiving undesired interventions.

In 1995, Oregon created the Physician Orders for Life-Sustaining Treatment (POLST) form in an effort to help people, particularly older adults and those living with serious illness, to direct the interventions they may receive in an emergency, including, but not limited to, cardiopulmonary resuscitation (CPR), intubation and hospital disposition. Currently, 45 out of 50 U.S. states have or are in the process of developing state-specific POLST programs.²

Multiple studies have looked at the effectiveness of the POLST form in advanced care settings, such as nursing homes and hospices, and a limited number have examined the POLST form in the setting of emergency medical services (EMS) field decision-making, particularly related to out-of-hospital cardiac arrest.^{3,4,5,6,7,8} However, to date, no studies have examined the role of the POLST form in the setting of traumatic injuries.

Through retrospective chart and database review, this study explores the prevalence and role of the POLST form in traumatically injured older (≥ 65 years) adults presenting for care at Oregon Health & Science University (OHSU), a Level 1 trauma center in Portland, Oregon, from 2007 through 2013. We hypothesized that having a POLST form would

result in fewer and less aggressive interventions and, for those with fatal injuries, a shorter duration of care.

BACKGROUND

The Physician Orders for Life-Sustaining Treatment (POLST) form was created in Oregon in 1995 in an effort to provide a decision-making tool that improves end-of-life care in all settings.² Similar to a traditional advance directive, the POLST is a way for patients to state their preferences for care in the event they become unable to do so in the future.

However, unlike the advance directive, which is a document created with a lawyer, the POLST is completed with a health care provider and serves as an actual medical order during a medical crisis or emergency, focusing on resuscitation, intubation, hospital transfer and use of artificial nutrition and, in some states, antibiotics.

In Oregon, the mandatory statewide Oregon POLST Registry makes POLST forms accessible to emergency and hospital personnel when needed, unlike an advance directive, which must be provided by a patient and/or their family and, in an emergency, may surface after certain interventions have already taken place.^{2,9} Figure 1 outlines the differences and similarities between the POLST form and traditional advance directives.²

Figure 1. Differences and similarities between POLST and Advance Directive

POLST Form	Advance Directive
Completed with health care provider Provides medical orders for current treatment Used by EMS, when available Used by inpatient providers, when available Accessible via statewide registry**	Completed with lawyer Informs about wishes for future treatment Appoints a Health Care Representative Does not provide any direction to EMS Used by inpatient providers, when available Must be provided by patient/family

**In Oregon, registry status in other states is pending

The current Oregon POLST form allows a person to designate choices at three main branch points of care (See Appendix A for full form). Section A allows a decision regarding resuscitation in the event of cardiopulmonary arrest, that is, if the person is found unresponsive, without a pulse and not breathing. Section B deals with medical interventions in the event that the person has a pulse and is breathing. Section C deals with artificially administered nutrition. Some previous versions, which are still valid, included a section regarding antibiotic use. The form also includes space for specific instructions, for example, “attempt treatment for 72 hours only”.

This study focuses on patient preferences in regards to resuscitation, Section A, and medical interventions, Section B. In Section A, patients are able to designate if emergency and health care personnel should attempt cardiopulmonary resuscitation (CPR) or allow natural death, commonly referred to as “Do Not Resuscitate” (DNR).

Section B specifies three levels of possible treatment – *Full Treatment*, *Limited Treatment* and *Comfort Measures Only*. *Full Treatment* includes “life support measures in the intensive care unit”, while *Limited Treatment* aims to “generally avoid the intensive care unit” and specifies no intubation. *Comfort Measures Only* aims to “maximize comfort through symptom management,” with hospitalization being necessary only when comfort needs cannot be met in a different, lower acuity location. Figure 2 shows the exact wording of Section B.

Figure 2. Section B of current Oregon POLST form

B Check One	MEDICAL INTERVENTIONS: <i>If patient has pulse and is breathing.</i>
	<input type="checkbox"/> Comfort Measures Only. Provide treatments to relieve pain and suffering through the use of any medication by any route, positioning, wound care and other measures. Use oxygen, suction and manual treatment of airway obstruction as needed for comfort. <i>Patient prefers no transfer to hospital for life-sustaining treatments. Transfer if comfort needs cannot be met in current location.</i> <u>Treatment Plan:</u> Provide treatments for comfort through symptom management.
	<input type="checkbox"/> Limited Treatment. In addition to care described in Comfort Measures Only, use medical treatment, antibiotics, IV fluids and cardiac monitor as indicated. No intubation, advanced airway interventions, or mechanical ventilation. May consider less invasive airway support (e.g. CPAP, BiPAP). <i>Transfer to hospital if indicated. Generally avoid the intensive care unit.</i> <u>Treatment Plan:</u> Provide basic medical treatments.
	<input type="checkbox"/> Full Treatment. In addition to care described in Comfort Measures Only and Limited Treatment, use intubation, advanced airway interventions, and mechanical ventilation as indicated. <i>Transfer to hospital and/or intensive care unit if indicated.</i> <u>Treatment Plan:</u> All treatments including breathing machine.
	<u>Additional Orders:</u> _____

Although all sections of the POLST are considered together, the fact that independent choices can be made in each section mean that a wide variety of patient preferences can be accommodated. A 2012 review of the Oregon POLST Registry found that the three most common combinations were DNR/Comfort Measures Only (34.4%), DNR/Limited Interventions (29.7%) and Attempt Resuscitation/Full Treatment (23.9%).¹⁰

Although the POLST form was originally created for use by seriously ill and/or frail persons who could reasonably be expected to die within a year,² the form is gaining popularity among relatively healthy elders, especially in Oregon. In 2010, 85.9% of the 25,142 POLST forms on file in the Oregon POLST Registry were for people aged ≥ 65 years, which represents 3.5% of all Oregonians aged ≥ 65 years.^{11,12}

A 2012 analysis of the Oregon POLST Registry found a 24.3% increase in the number of forms on file compared to 2010 (n = 31,294), with an average registrant age of 76.7 years,¹⁰ thus allowing the conclusion that the majority of new forms are most likely being completed by older adults.

A growing number of studies have evaluated the effectiveness of the POLST in advanced care settings, such as nursing and hospice facilities, as well as in the setting of

pre-hospital care provided by emergency personnel. The main findings indicate that there is high concordance between patient preference and actual course of treatment.^{3,4,5,6,7,8}

However, to date, no studies have examined the role of the POLST form in the setting of traumatic injuries, both in terms of epidemiology and the ways in which POLST preferences may affect care decisions. While a few recent studies have examined the role of decisions to withdraw life-sustaining care once a traumatically injured patient has been admitted to the ICU, none have examined a decision-making tool like the POLST, which aims to provide input on patient preference *prior* to interventions being made.^{13,14}

Oregon Health & Science University (OHSU) is one of only two Level 1 Trauma Centers in the state of Oregon and, as such, treats a large number of patients each year. In 2012, OHSU provided treatment to 2,618 traumatically injured patients, of which 477, or 18.2%, were adults aged ≥ 65 years. Older adults represent an increasing proportion of trauma patients at OHSU and the overwhelming majority of injuries are caused by falls, 74% in 2012 (compared to 37.1% for trauma patients of all ages).¹⁵ In 2012, 82% of older trauma patients arriving at OHSU for care were admitted to the hospital and 9.2% died.¹⁵

Similar trends exist on a national level. In 2013, an estimated 2.5 million older (≥ 65 years) adults were treated for falls in emergency departments, 29% of whom required hospital admission.¹ Falls continue to be the leading cause of fatal and nonfatal injuries among older adults.^{1,15,16,17}

It is known that mortality among older trauma patients is twice that of younger patients and that, due to minimal reserves and/or preexisting health issues, older patients are more at risk for prolonged hospital stays, complications and, often, the need for lengthy rehabilitation and long-term assistance.^{18,19}

Thus, there is currently a great deal of interest and incentive for shared decision-making tools like the POLST that serve not only as a foundation for discussions about care preferences when a patient is still in relatively good health, but also as actual medical orders in the case of an emergency or health crisis.

Traditionally, in the event a critically ill patient is unable to participate in their care, family members or friends are called upon to make care decisions on their behalf. While advance directives are sometimes used to guide discussions, their utility is often minimal due to the fact that are often not discovered or made available until days after the admission.^{9,20,21}

In addition to the financial costs of ICU-level care, providing treatment for and making decisions on behalf of gravely injured patients has a high mental and emotional cost, among family members and care providers alike.^{9,13,18,21} It is known that structured communication between families and care providers can result in earlier agreement regarding goals of care for seriously injured trauma patients, as well as help to relieve some of the existential distress family members feel about making decisions on behalf of their loved ones and that care teams feel about providing what they see as futile interventions.^{9,18}

Thus the POLST, which often either travels with a patient to the hospital or, in Oregon, can be accessed electronically by any health provider via the Oregon POLST Registry, has become one of the quickest, most reliable methods for determining what interventions a patient may have preferred.^{6,7,10}

Given the stresses and costs associated with decision-making in the setting of trauma, particularly relating to interventions for older patients, we believe that the

POLST is an effective, timely and important decision-making tool, and, as such, formal evaluation of its effectiveness was needed.

This study provides insight into the epidemiology of the POLST form in traumatically injured older adults in Oregon, as well as the ways in which providers are using the POLST form to make care decisions. Specifically, we hypothesized that having a POLST on file changes the care received by traumatically injured patients and, specifically, that it results in fewer and less aggressive interventions and, for those with fatal injuries, a shorter duration of care.

METHODS

This is a retrospective study that uses data from the OHSU Trauma Registry and individual electronic health record (EHR) review from 2007 through 2013. People aged ≥ 65 years who were entered into the trauma system and arrived at OHSU for care after any injury type were identified in the registry and associated information was extracted from registry data (n=1622). Individual EHR review was then done for all patients listed in the registry as having a POLST form on file at their time of arrival (n=180).

The institutional review board at OHSU approved this study (Protocol ID# IRB00010678) and the waiver of informed consent.

OHSU TRAUMA REGISTRY

The OHSU Trauma Registry has been functional for over 20 years and tracks a wide variety of information, including demographics, injury type, vitals on admission and final outcome, which is then shared with county, state and federal sources as part of the Oregon Trauma System.

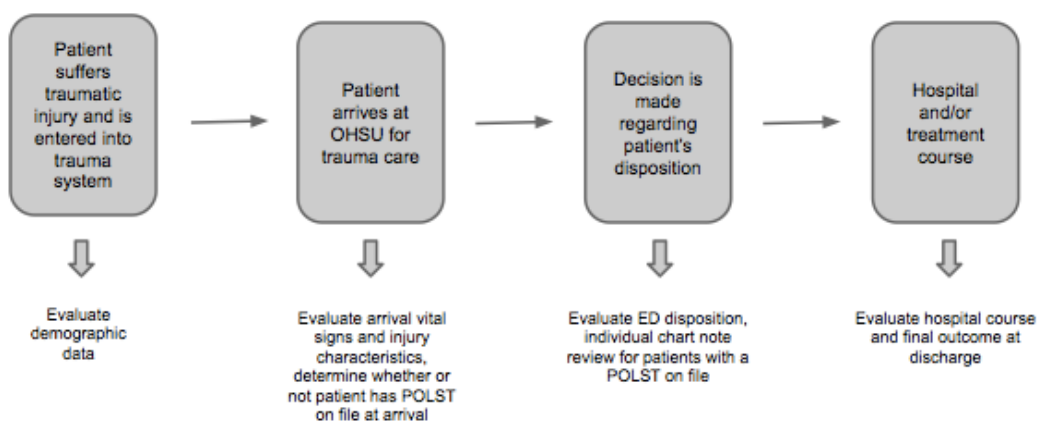
The Oregon Trauma System is a government-mandated statewide system that is based upon pre-hospital care providers identifying seriously injured patients who meet triage criteria and, as such, are required by trauma system guidelines to be transported to trauma centers. An example of triage criteria is a sustained loss of consciousness after a blow to the head. Many elders involved in ground-level falls sustain a blow to the head and have a low Glasgow Coma Score (GCS), indicating to emergency medical personnel responding to the scene that patients should be entered into the trauma system.

Thus, the criteria for inclusion in the OHSU Trauma Registry includes having a traumatic injury of any kind, for which EMS was called, and at their discretion decided that the injuries warranted transport to a hospital that could provide trauma-level care. Once the trauma system is activated, the patient is tracked and data collected for the duration of their hospital stay. Figure 3 outlines the steps trauma patients move through as they receive care, as well as the areas examined by this study. Data was evaluated for the study population as a whole, as well as comparisons between those patients with a POLST form on file upon arrival and those without.

Inclusion criteria included arriving at OHSU for trauma care from March 2007, when OHSU began using an EHR, through December 2013, and being aged ≥ 65 years.

Exclusion criteria for this study included patients who were transferred from a referring facility, patients who were dead on arrival (DOA) or re-entry into the trauma system within 30 days of initial visit.

Figure 3. Study and population flow



Trauma registry variables assessed included information on demographics, injury type, vitals on admission, hospital course and final outcome, as well as whether or not a

patient had a POLST form on file at the time of arrival. The registry tracks only the presence of a POLST form, not the particular preferences that are stated within. The majority of variables were used in the format they were collected in, but a few were transformed for the purpose of analysis and/or to address issues within the dataset itself.

In an effort to address the fact that it is not possible to obtain a GCS for those patients who arrived intubated,²² GCS was transformed into a categorical variable of mild (GCS 13-15), moderate (GCS 9-12) and severe (GCS 3-8) and it was assumed that those patients intubated on arrival had a severe level GCS prior to intubation.²³

In an effort to provide more meaningful overall data, systolic blood pressure (SBP) on arrival was transformed into a categorical variable (≤ 80 , 81-110, 111-140, >140), based on literature relating to risk stratification and hypotension in the elderly trauma patient.^{24,25}

Total hospital length of stay and ICU length of stay are calculated based on the hour of arrival and are listed in the registry as exact numbers. Days of mechanical ventilation, on the other hand, are listed as whole numbers, meaning that if a person was on a ventilator for even a small portion of one day this counted as a day of mechanical ventilation.

The registry reflects mechanical ventilation and intubation received in the ICU setting only. That is, if a person received a surgery requiring intubation and mechanical ventilation but otherwise did not require respiratory assistance during their stay, they would be listed as having zero days of mechanical ventilation and as not having been intubated.

The registry does not have a specific variable tracking whether or not a patient received cardiopulmonary resuscitation (CPR) during their stay. However, in the event that CPR took place, it is documented as a procedure using the ICD9 code 99.60, “cardiopulmonary resuscitation, not otherwise specified.” Registry data was queried for

this ICD9 code in order to identify those patients receiving CPR during their stay and a new binary (yes/no) variable was created to reflect this.

Registry data for mechanism of injury is incredibly specific, often capturing the specific environmental details involved, such as what caused a person to fall or on what type of roadway a motor vehicle crash took place. Mechanism of injury was reviewed for all patients and categorized more broadly into falls, motor vehicle crash (car and motorcycle), pedestrian struck by car, bicycle accident (including bicycle struck by car), assault, suicide attempt and “other.”

Registry chart abstractors do attempt to gather information on patient comorbidities, however, upon review of the collection method it was felt that this variable was unreliable and it was not used in the final analysis. Abstractors include only those formally diagnosed comorbidities listed in the chart at the time of arrival, which may under represent the true comorbidities of an individual patient or the patient population as a whole. This issue is further aggravated by the fact that patients presenting to OHSU for their trauma care may receive their general healthcare elsewhere and, as such, their OHSU record on arrival would not have listed any comorbidities for inclusion in the registry.

In an effort to find a meaningful measure to help describe the overall health of the study population, the registry variable of Functional Independence Measure (FIM) was used. The FIM is a uniform and widely used assessment tool for evaluating a person’s level of independence and/or disability.²⁶ The full scale assesses seven areas, but an abridged version evaluating only locomotion, self-feeding and expression status is included in the registry. At OHSU, FIM is calculated on arrival and discharge by chart abstractors.

FIM on arrival was used to reflect the general health status of patients prior to their traumatic injuries. Similar to GCS and SBP, FIM was transformed into a categorical variable in an effort to provide a more meaningful frame of reference for a patient's total score. Categories included Independent (FIM 12), Independent with Devices (FIM 9-11), Partially Dependent (FIM 6-8) and Totally Dependent (FIM 3-5).

The registry provides data for some patients regarding whether or not they died within 30 days of discharge. However, this data is only recorded if a date of death happens to be in the chart at the time of abstraction, rather than through systematic follow-up or linking to the national death index. Therefore, is not a reliable measure and will not be used in the analysis.

INDIVIDUAL EHR REVIEW

At OHSU, a patient's original paper POLST form is scanned into their EHR, making it possible to view their preferences. For those patients listed in the registry as having a POLST form on file upon arrival (n=180), individual EHR review was done to gather data on each patient's specific preferences in regards to Section A, resuscitation, and Section B, medical interventions. In the event that multiple POLST forms were present, representing changing or updated preferences, the POLST form that most directly preceded the date of arrival was reviewed, as this would have been the form available to providers during the visit.

A second abstractor reviewed the stated preferences on 15% of the charts, selected at random, resulting in a Cohen's kappa statistic of 0.87, indicating very good inter-rater reliability.

When analyzing hospital course among those patients with a POLST from on file, patients who had selected “*Comfort Measures*” or “*Limited Interventions*” were grouped together, due to the main tenets of both to general avoid intubation and/or ICU-level care, and were compared to those patients who had selected the “*Full Treatment*” option. ED disposition groups were collapsed to evaluate simply whether or not a patient was admitted, to either the ICU or the ward, or if they were discharged, either directly from the trauma bay or after <24 hours in the ED observation unit.

In addition to care preferences, the date of POLST form completion was also noted and compared to the date of arrival. This was transformed into a categorical variable of <6 months, 6 months – 1 year, >1 year, >2 years, >3 years, >4 years and >5 years.

Chart notes were reviewed to determine whether a patient had been living in their own independent home or in a coordinated facility prior to arrival. Because many coordinated facilities encourage patients to complete POLST forms,^{3,4} patients were categorized as living in a facility if they lived in any type of environment other than their own independent home, including, but not limited to, an independent retirement community, assisted living facility, skilled nursing facility, adult foster home or hospice care. If the notes were not explicit in regards to where the patient had been living (e.g. simply stated, “patient fell at home”), no data was recorded in an effort to avoid misclassification.

Provider notes written within 24 hours of arrival as well as the main discharge summary, when applicable, were reviewed to determine if the presence of a POLST form

was documented, as well as to qualitatively examine if providers explicitly included a patient's POLST preferences in their decision-making process.

In the event that the term "POLST" was not explicitly used in a provider's note, but, due to the language used, it was reasonable to conclude they were referring to the POLST (e.g. "the form", "comfort measures", "limited interventions"), it was treated as if they were referring to the POLST. In the event that there was any ambiguity about where providers were getting information about care preferences from, no data was recorded in an effort to avoid misclassification.

STATISTICAL ANALYSIS

All data analysis was performed using Stata/SE, version 12.0, and a p-value of <0.05 to indicate significant results.

Initial analysis was conducted to examine the overall prevalence of POLST forms within the study population and provide general descriptive statistics, including age, gender and arrival FIM. Analysis between those with a POLST form on file on arrival and those without were then done for injury-specific factors, such as injury type, injury severity score (ISS), and vital signs on arrival, and hospital course, such as disposition, length of stay, status and disposition at discharge and whether or not a patient was intubated or received CPR.

For patients with a POLST form on file upon arrival, descriptive statistics were compiled relating to resuscitation and intervention choice, as well as place of residence and mention of POLST form within provider notes. Comparisons were then made among and between intervention choices (Full, limited, comfort measures) in regards to ED

disposition, length of stay, intubation and mechanical ventilation, CPR and status at discharge.

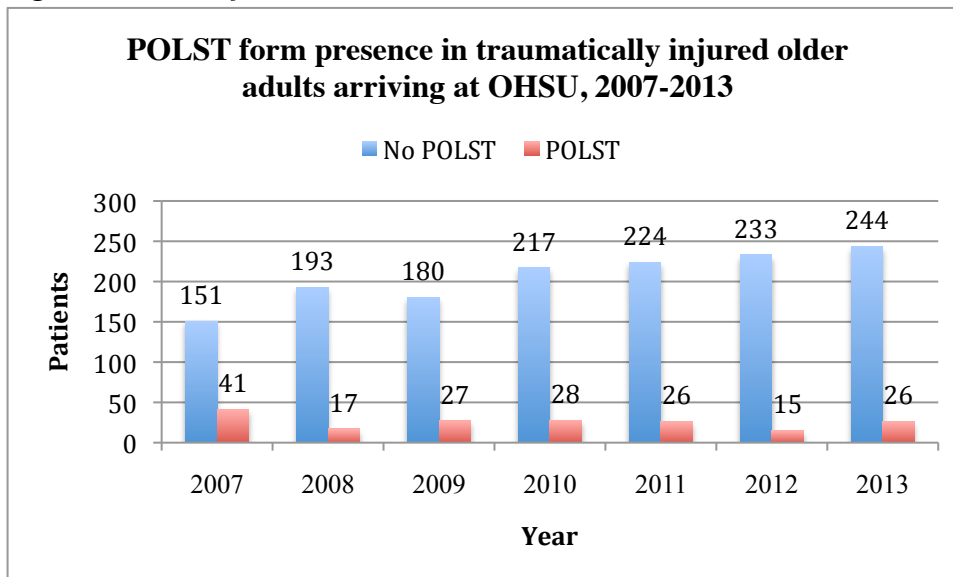
For all analysis, categorical comparisons were conducted using Pearson's chi-square test, unless outcomes were rare (defined as cell frequency <5), in which case a Fisher's Exact test was used. Continuous outcomes with a normal distribution were conducted using the Student t-test. All continuous outcomes analyzed with the Student t-test had equal (defined as standard deviation ratio <2) variances. For continuous outcomes that were not normally distributed the Wilcoxon Rank Sum test was used.

For continuous variables related to total and ICU length of stay and days of mechanical ventilation, one outlier (24 days of mechanical ventilation) was removed from the POLST group and data was reanalyzed.

RESULTS

Of the 1622 patients included in this study, 180 (11.1%) had a POLST form on file upon arrival. Of these, 20 (1.2%) had an advance directive on file in addition to their POLST, 65 (4%) had only an advance directive on file and 1377 (84.9%) of the population had neither. Figure 4 outlines the number of patients with and without a POLST form presenting for care in each study year.

Figure 4. POLST form on arrival, 2007**-2013



**2007 includes data only for March-December

The average age for all study subjects was 78.2 years. Patients with a POLST form on file had an average age of 83.4 years, which was significantly different ($p < 0.0001$) from the average age of 78.1 years for those without a POLST.

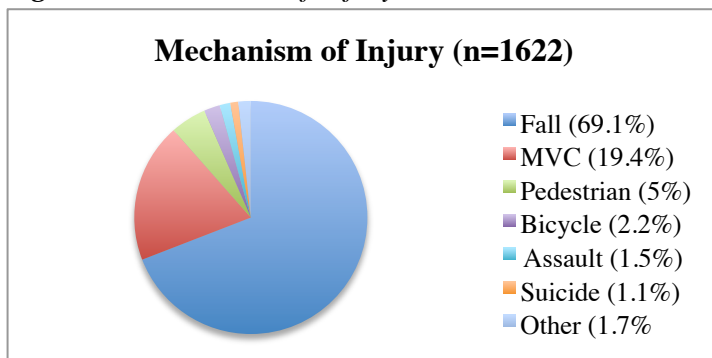
The general study population was 52.3% male and 47.7% female. Among those without a POLST, this ratio remained similar, with 54.3% male and 45.7% female. However, those with a POLST were 37.7% male and 62.3% female, a difference that was significant ($p < 0.0001$). Differences in Functional Independence Measurement (FIM) categorization were also found to be statistically significant ($p < 0.0001$).

Table 1. Study population demographics

	All Patients	Patients with a POLST	Patients without a POLST	p-value
Average Age	78.2 years	83.4 years	78.1 years	<0.0001
Gender	Male 52.3% Female 47.7%	Male 37.7% Female 62.3%	Male 54.3% Female 45.7%	<0.0001
Functional Independence Measurement (FIM)	Independent 50.2% (815) Independent w/devices 18.1% (293) Partially dependent 1.4% (23) Dependent 0.1% (2)	Independent 30.6% (55) Independent w/devices 30.6% (55) Partially dependent 4.4% (8) Dependent 1.1% (2)	Independent 52.7% (760) Independent w/devices 16.5% (238) Partially dependent 1.04% (15) Dependent 0% (0)	<0.0001

The overwhelming majority, 69.1%, of injuries in the total study population were caused by falls. High rates of motor vehicle crashes (MVC) were also noted. Differences in mechanism of injury were statistically significant ($p < 0.0001$) between those with a POLST and those without. Most notably, falls accounted for 86.1% of injuries in those with POLST forms versus 66.9% in those without. Figure 5 outlines the mechanism of injury for the study population as a whole.

Figure 5. Mechanism of injury



Upon arrival at the hospital, statistically significant differences were found between groups relating to GCS categorization ($p < 0.0001$) and whether or not a patient was intubated upon arrival ($p = 0.002$). Subjects in both groups had similar numbers of “severe” level GCS, while patients with a POLST form had more “moderate” level GCS (17.2% vs. 5.6%) and fewer “mild” level GCS (60% vs. 81.1%) than those patients without a POLST form.

Differences in Injury Severity Score (ISS) approached significance ($p = 0.0853$), but did not cross the $p < 0.05$ threshold. No significant differences were seen between SBP quartile and heart rate on arrival. Complete arrival data can be seen in Table 2.

Table 2. Arrival status and vital signs

	All Subjects		Subjects with a POLST		Subjects without a POLST		p-value
Glasgow Coma Scale (GCS) Category	Mild	78.7% (1277)	Mild	60% (108)	Mild	81.1% (1169)	<0.0001
	Moderate	6.9% (112)	Moderate	17.2% (31)	Moderate	5.6% (81)	
	Severe	6.5% (106)	Severe	6.7% (12)	Severe	6.5% (94)	
Average Injury Severity Score (ISS)	10.96	(SD 10.64)	9.63	(SD 9.44)	11.12	(SD 10.78)	0.0853
Intubated on Arrival	3.88% (63)		1.11% (2)		4.23% (61)		0.002
Arrival Systolic Blood Pressure (mmHg)	<80	0.08% (13)	<80	1.1% (2)	<80	0.07% (11)	0.432
	81-110	6.6% (107)	81-110	8.9% (16)	81-110	6.3% (91)	
	111-140	27.9% (453)	111-140	24.4% (44)	111-140	28.4% (409)	
	>149	62.8% (1018)	>149	63.3% (114)	>149	62.7% (904)	
Average Arrival Pulse (BPM)	86.3	(SD 20.69)	88.2	(SD 21.85)	86.1	(SD 20.53)	0.1983

Analysis of events that took place after arrival showed significant differences between those with a POLST and those without in terms of ED disposition as a whole

(p=0.023). Interestingly, those with a POLST form had a higher percentage of ICU admission than those without (52.2% vs. 46.3%). Those with a POLST were also admitted to the ward more often than those without (25.6% vs. 19.6%) and were kept in the ED Observation unit less often (8.9% vs. 15.9%).

Those patients with a POLST on file were significantly less likely (p=0.011) to have been intubated during their stay, with only 8.9% being intubated vs. 16.1% of those without a POLST. Mostly likely because of this, the difference in average days of mechanical ventilation between the two groups was significant as well (p=0.0047).

Within the entire study population, 8.75% of patients died while they were in the hospital. Although approaching significance (p=0.081), it is not possible to conclude that the differences in death in those with a POLST, 12.2%, and those without, 8.3%, are due to something other than chance. Complete hospital data can be seen in Table 3.

Table 3. Hospital course

	All Subjects		Subjects with a POLST		Subjects without a POLST		p-value
ED Disposition	ICU	46.9% (761)	ICU	52.2% (94)	ICU	46.3% (667)	0.023
	Floor	20.3% (329)	Floor	25.6% (46)	Floor	19.6% (283)	
	OR	2.5% (41)	OR	0% (0)	OR	2.8% (41)	
	Obs	15.2% (246)	Obs	8.9% (16)	Obs	15.9% (230)	
	D/C	13.8% (221)	D/C	12.8% (23)	D/C	13.9% (200)	
	Other	1.3% (22)	Exp	0.05% (1)	Other	1.5% (21)	
CPR	2.28%	(37)	1.11%	(2)	2.42%	(35)	0.424
Intubated	15.29%	(248)	8.9%	(16)	16.1%	(232)	0.011
Average Days of Mechanical Ventilation	0.85	(SD 3.52)	0.33	(SD 1.97)	0.91	(SD 3.66)	0.0047
Average Total Length of Stay (days)	5.16	(SD 8.13)	5.16	(SD 8.49)	5.15	(SD 8.09)	0.5822
Average ICU Length of Stay (days)	2.01	(SD 4.62)	1.62	(SD 4.35)	2.05	(SD 4.65)	0.8723
Discharge Status	Alive	91.25% (1480)	Alive	87.8% (158)	Alive	91.7% (1322)	0.081
	Deceased	8.75% (142)	Deceased	12.2% (22)	Deceased	8.3% (120)	

When evaluating average length of total hospital stay and length of ICU stay, significant differences were not found between those with and without a POLST, as can be seen in Table 3. However, when length of stay was evaluated based on status at discharge, living or dead, significant differences were seen for both total hospital length of stay and ICU length of stay. These results can be seen in Table 4.

Table 4. Length of stay based on status at discharge

	Alive at D/C		Dead at D/C		p-value
Average Total Length of Stay (days)	5.28	(SD 8.16)	4.19	(SD 7.80)	0.0001
Average ICU Length of Stay (days)	1.93	(SD 4.56)	2.82	(SD 5.19)	<0.0001

RESULTS AMONG THOSE WITH A POLST FORM ON ARRIVAL

Of the 180 patients with a POLST form on file upon arrival, in regards to resuscitation choice, 71.1% (n=128) chose “Do Not Resuscitate” (DNR), while 25% (n=45) chose “Attempt CPR” (CPR). In regards to medical interventions, 22.8% (n=41) chose “Comfort measures only”, while 51.1% (n=92) chose “Limited interventions” and 20% (n=36) chose “Full treatment”.

When evaluating preference combinations, the three most common combinations were DNR/Limited Interventions (43.9%), DNR/Comfort Measures (21.7%) and CPR/Full Treatment (16.7%). Table 5 outlines all possible choices regarding resuscitation and medical interventions.

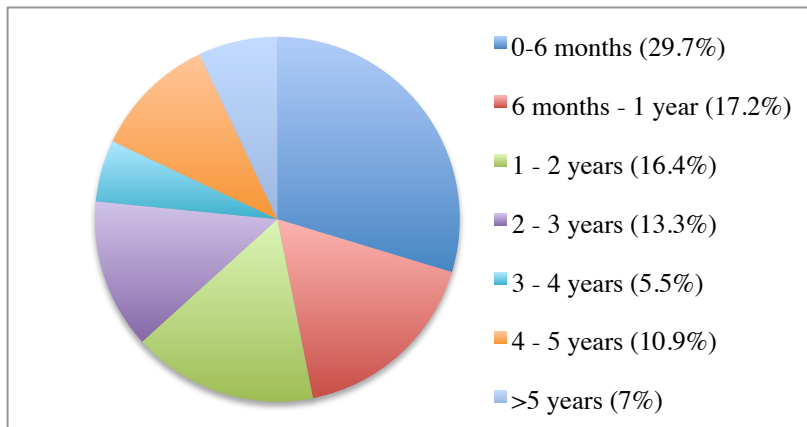
Table 5. POLST preferences for resuscitation and medical interventions

	Comfort Measures	Limited Interventions	Full Treatment
DNR	21.7% (39)	43.9% (79)	3.3% (6)
CPR	0.05% (1)	7.2% (13)	16.7% (30)

In regards to place of residence prior to arrival, 66.7% (n=119) of patients with a POLST were living in some sort of coordinated facility, while 16.7% (n=30) were living in their own, independent homes. Place of residence information was not available for the remaining 16.7% (n=30).

The date of POLST completion was compared to the date of arrival and it was determined that 46.9% of patients suffered their traumatic injury within 1 year of completing their POLST. The majority of patients, or 63.3%, suffered their traumatic POLST within 2 years of completing their POLST. Figure 6 outlines this information for all patients with a POLST form.

Figure 6. Time from POLST completion to time of injury



When evaluating resuscitation status, two patients who chose “CPR” received CPR during their hospital stay. No patients who chose “DNR” received CPR during their hospital stay.

Hospital course was evaluated between “*Comfort Measures/Limited Interventions*” patients and “*Full Treatment*” patients and significant differences were not found between each group regarding ED disposition (p=0.210), intubation during stay (p=0.741), status at discharge (p=0.254) and days of mechanical ventilation (p=0.568).

In regards to length of stay, significant differences were found between the groups for both total length of stay and ICU length of stay (p=0.0098 and p=0.0242, respectively). Full information on hospital course can be seen in Table 6.

Table 6. Hospital course among those with a POLST form

	Comfort/Limited		Full		p-value
ED Disposition	ICU	49.2% (65)	ICU	69.4% (25)	0.210
	Floor	27.3% (36)	Floor	22.2% (8)	
	DC/Obs	49.6% (31)	DC/Obs	8.4% (3)	
Average Total Length of Stay (days)	4.89	(SD 9.10)	6.34	(SD 6.02)	0.0098
Average ICU Length of Stay (days)	1.37	(SD 4.21)	2.04	(SD 3.29)	0.0242
Intubated	9.02%	(12)	11.1%	(4)	0.741
Days MV	0.18	(SD 0.82)	0.33	(SD 1.10)	0.568
Discharge Status	Alive	84.9% (113)	Alive	94.4% (34)	0.254
	Deceased	19.5% (20)	Deceased	5.6% (2)	

Chart review revealed that, among those with a POLST on file upon arrival, a provider commented on the presence of the POLST within 24 hours in 53.1% of patients, while the POLST was mentioned in the discharge summary in 39.2% of patients.

Qualitative review of those notes that mentioned the POLST form yielded four interesting areas of focus, including, common language used to indicate POLST presence and/or preferences, ways in which the presence of a POLST form changed common practice, instances in which flexibility was used within the structure of the POLST form and, finally, clinical vignettes showing the overall utility of the POLST in terms of

medical decision-making and patient care. Figures 7-10 include chart extractions highlighting each of these four areas.

Figure 7. Common language used in regards to POLST presence

The patient has a POLST form, which came with him from the assisted-living facility, stating that he is DNR/DNI. This was placed in his chart and discussed with his daughter, who agrees with this plan.

Patient has POLST form and is DNR with limited interventions.

Review of her paperwork showed she is DNR/DNI, but she is amenable to some conservative therapy such as IV medications and pain control.

He does have a POLST form, which states he is DNR/DNI.

POLST clearly states wishes of comfort care only and her family confirms this. We will admit her and ensure her comfort. No need for further diagnostic studies.

Figure 8. Instances in which POLST presence changed common practice

We were also worried about (the patient's) mental status; however, on review of his POLST form it appears that he is DNR/DNI, and given his POLST form, I do not feel that intubation is warranted, when otherwise he would have warranted airway protection.

Though her initial GCS was 13, she was clearly not protecting her airway and she was mildly hypoxic. However, she had a POLST form with her, which clearly indicated her wishes to not be intubated or undergo cardiac resuscitation. We initiated IVFs and antibiotics as well as small doses of pain medication. During evaluation she became progressively hypotensive and hypoxic, eventually becoming bradycardic and then asystolic. No attempts at cardiopulmonary resuscitation were made in accordance with her previously stated wishes.

Since she has a POLST form stating DNR/DNI status and comfort measures only, a CT and further imaging was not completed. Her family was present and agreed with her wishes.

He has clear preferences established with POLST and the family agrees he should not be intubated or receive surgical intervention...I will clear his CTL spines given his DNR and DNI status, as I think the risk of restraints and bed rest exceeds the benefits.

Because he has a POLST that is DNR/DNI, limited interventions, the decision was made not to pursue head imaging, despite the fact that he had a GLF on Plavix, because he would not want an intervention even if a bleed were discovered.

Figure 9. Flexibility within the structure of the POLST form

The patient is DNR with limited interventions per her POLST form, but the daughter, who is POA, consented for intubation. The patient will likely be made comfort care, but her daughter would like to wait until other family members arrive.

She has a POLST form stating comfort measures only, however, she would like us to perform the studies necessary to determine what is wrong and treat her. She also informed me that she would want to be intubated if it were deemed temporary.

Patient had DNR POLST that directed limited intervention. However, the daughter stated that she was not quite ready to have his body stop functioning by removing the breathing tube. Patient's wife expressed to me that she thinks that he would not want to be on the machines at all at this point, but would like to give her daughter a little more time with him.

Figure 10. Excellent examples of the POLST form in complex decision-making

We have admitted her to the ICU for active rewarming and supportive care but her POLST and family are very clear that intubation or CPR would not be acceptable. We will do our best to support her and hope that she improves but given her age and existing comorbidities, this may well be a fatal set of injuries....She never returned to baseline mental status and, in keeping with her previously stated wishes, she was supported, treated and kept comfortable, but no intubation, CPR or feeding tube placement took place. She experienced progressive failure to thrive, never regaining full consciousness and died (seven days after arrival).

Given intracranial hemorrhage and declining GCS patient was intubated in the ED. CT revealed life-threatening hemorrhage and he was admitted to the ICU on mechanical ventilation. Patient has no immediate family available. We were able to obtain his POLST forms and talk to his long-term care facility nurse, who states that he clearly would not want aggressive intervention for his intracranial hemorrhage. We proceeded with extubation and initiation of comfort care.

Patient was transferred to the trauma ward after a prolonged Trauma ICU hospitalization for multiple injuries sustained during a motor vehicle crash. On initial presentation, he was noted to have a type 3 C2 dens fracture, pneumothorax and multiple rib fractures. During his hospitalization, he developed delayed splenic hemorrhage requiring splenectomy, pneumonia, acute kidney injury, post-trauma NSTEMI, substantial delirium, required a tracheostomy, and developed ventilator-associated pneumonia. Social work and family were constantly involved in his care and, after 26 days, his POLST surfaced showing that he did not want these interventions and he was placed on comfort care. We called the PA who signed his POLST a year ago and she had no doubt about his wishes expressed on the form. He died comfortably two days later, surrounded by his loving family.

DISCUSSION

The findings of this study help to support the success and usefulness of the POLST program in general and, specifically, as a useful decision-making tool in the setting of traumatic injuries. Overall, trauma patients with a POLST form on file at time of arrival were less likely to be intubated ($p=0.011$) during their hospital stay and had significantly different ED dispositions ($p=0.023$) than those without a POLST form on file at the time of arrival. Individual chart review shed light on how providers are using the POLST form in their decision-making process and, in some cases, how the presence of a POLST form may change common practice for complex trauma patients.

Among those with a POLST form, patients who had selected “*Comfort Measures*” or “*Limited Interventions*” had significantly shorter total hospital and ICU length of stays ($p=0.0098$ and $p=0.0242$, respectively) compared to those patients who had selected “*Full Treatment*”, indicating that fewer high-level interventions took place for these patients and, overall, that previously stated wishes were respected.

Although statistically significant differences were expected between POLST intervention groups (“*Comfort Measures/Limited Interventions*” vs. “*Full Treatment*”) in regards to ED disposition, intubation and status at discharge, the non-significant findings help to support and account for the fact that the POLST form is a tool to guide decision-making rather than a concrete directive. That is, it allows for mitigating factors, such as changes in patient or family preference, to influence care received, when appropriate.

Furthermore, the high-level of ICU admissions among all study patients, including all POLST intervention groups, is most likely explained by the fact that, as a large academic medical center, OHSU houses five ICUs, including a specific Trauma

ICU. In many cases, even “*Comfort Measure*” and “*Limited Intervention*” patients may have been admitted to the Trauma ICU due to space or personnel constraints or, more likely, because they may have required closer monitoring and/or more nursing attention in order to ensure their wishes were met. Thus, ICU admission as criteria for assessing whether or not a patient’s previously stated wishes were met may have minimal utility at OHSU or similar centers with multiple ICUs.

When comparing POLST patients who had selected “*Full Treatment*” to those without a POLST on file, no significant differences in hospital course or outcome were found. These findings indicate that, although some think of the POLST as a tool to limit or withdraw care, it is also used to direct higher-level interventions when desired. Along similar lines, the lack of significant differences in status at discharge, both between POLST vs. no POLST and among POLST intervention groups, further supports the fact that the POLST form accommodates numerous preferences and does not set out to limit care in any way.

Demographic data from this study agrees with previously reported data in that the majority of patients with a POLST on file upon arrival were older (average age of 83.4 years) and female (62.3%). The average prevalence of POLST forms for the duration of the study was just over 11%, which is slightly higher than expected, most likely explained by the fact that patients living in or around the Portland metro area may be more likely to receive care from a healthcare provider who is familiar with the POLST program due to the fact that it was created at OHSU. If transfer patients had been included in the study population it is possible that the overall POLST prevalence would have been lower. However, the possibility that possibility that trauma patients with a

POLST form in the field were not even transported to OHSU by EMS represents a potential selection bias that could have resulted in an underrepresentation of POLST forms in this study.

The main strengths of this study include the multi-method design that utilized the objective data points of the Trauma Registry and also the more subjective elements involved in the individual chart review. The Trauma Registry is an extremely well organized dataset, providing detailed information and with very few missing values, despite the difficulties of gathering information in acute settings. Individual chart review not only provided information about the choices individuals made on their POLST forms, but was also an interesting and informative method for evaluating how the POLST form is used in the medical decision making process.

However, the chart review portion of this study was limited by the fact that the information gathered was only as good as the information originally included in the chart. Anecdotally, mention of the presence of a POLST form, stated preferences and, in particular, what role the POLST may have played in the decision-making process varied greatly based on the provider(s) for any specific encounter.

One main limitation of the study included the fact that the POLST form is not a binary entity. That is, a POLST form does not simply equal “Do Not Resuscitate”, but, rather, can accommodate a variety of patient preferences and, as such, piecemeal analysis of POLST prevalence and/or specific interventions may not adequately evaluate the impact of the POLST on care.

Along similar lines, mitigating factors such as changes in patient preference, family involvement or acute changes in hospital or injury course may have resulted in

interventions that appear to be in conflict with a person's previously stated wishes. For example, in multiple cases, family members agreed with a patient's previously stated wishes for minimal interventions, but consented to life-prolonging measures so that other family members could travel to the hospital and/or have more time to emotionally come to terms with a poor prognosis.

Further limitations included an inadequate method for determining a patient's health status prior to their traumatic injury, as discussed in the methods section in regards to comorbidity and Functional Independence Measure (FIM) data points. Trauma registry data did include information on discharge disposition (e.g. home, skilled nursing facility, etc), however, without information on where a patient was living prior to their injury, it was difficult to contextualize this information.

Although it would have been interesting to evaluate how many patients, particularly those who selected "*Comfort Measures*", were discharged to hospice, this was not tracked as a data point in the Trauma Registry until February 2014 and, as such, not available for this study population. Similarly, no standardized follow-up data is collected for trauma patients and, as such, it is not known which patients may have died shortly after their hospitalization as a result of their injuries.

Lack of follow-up represents one potential area for future research. Specifically, it would be possible to link those patients listed as having a POLST form upon arrival to the Oregon POLST Registry, which is also linked to the national death index, in an effort to determine outcome at 30 days, six months and one year post-injury.

Another main area for future research would be to focus on the majority of study subjects who did not have a POLST form upon arrival. Specifically, it would be very

interesting to determine whether or not these patients left the hospital with a completed POLST on file, as well as evaluate the incidence of hospital-related complications, such as urinary tract infections, pneumonias, etc., among this group as compared to the original POLST group.

When present, the POLST was mentioned in the notes for 53% of patients. This represents an area for improvement for the teams taking care of trauma patients, as many would argue that the presence of a POLST form should be checked and documented 100% of the time. Recognizing lack of POLST awareness in trauma situations as an issue, OHSU's Emergency Communication Center, which is responsible for paging out incoming trauma information, will soon begin to include POLST status and preferences in the preliminary information shared with care teams for all patients aged 65 years and older. A natural experiment could evaluate whether or not this new policy had any effect on mention of POLST status and/or preferences in the chart notes.

Finally, more information is needed about how providers and patients alike understand and interpret the POLST, both in terms of medical decision-making and in completing the form itself. In April 2015, OHSU integrated an electronic version of the POLST, or ePOLST, into the Epic EHR, which represents an opportunity to evaluate provider knowledge about POLST use and interpretation, as well as provide *in situ* educational content aimed at increasing awareness and correct use of POLST forms.

SUMMARY & CONCLUSIONS

The POLST form is a useful decision-making tool in the setting of traumatic injuries that allows for a variety of patient preferences to be met and, in some cases, changes the common practices for treating complex trauma patients, particularly related to ED disposition, intubation and diagnostic work-up. This study is the first to evaluate the POLST form in the trauma setting and adds to the growing body of evidence supporting the utility of the POLST form in a multitude of medical environments.

Further research is needed to better understand the way in which health care providers and patients understand and interpret the POLST form, particularly in emergency situations. Additionally, educational efforts and systemic changes should aim to increase awareness of and promote inclusion of POLST status and preferences within each patient's individual health record and care plan to aid with medical decision-making and ensure that patient preferences are being respected.

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APPENDIX A

HIPAA PERMITS DISCLOSURE TO HEALTH CARE PROFESSIONALS & ELECTRONIC REGISTRY AS NECESSARY FOR TREATMENT			
Physician Orders for Life-Sustaining Treatment (POLST)			
<p>Follow these orders until orders change. These medical orders are based on the patient's current medical condition and preferences. Any section not completed does not invalidate the form and implies full treatment for that section. With significant change of condition new orders may need to be written.</p> <p><i>Guidance for Health Care Professionals:</i> http://www.ohsu.edu/polst/programs/documents/Guidebook.pdf</p>	Patient Last Name:	Patient First Name	Middle Init.
	Date of Birth: (mm/dd/yyyy)	Gender: <input type="checkbox"/> M <input type="checkbox"/> F	Last 4 SSN <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
	Address: (street / city / state / zip)		
A	CARDIOPULMONARY RESUSCITATION (CPR): <i>Patient has no pulse <u>and</u> is not breathing.</i>		
Check One	<input type="checkbox"/> Attempt Resuscitation/CPR <input type="checkbox"/> Do Not Attempt Resuscitation/DNR When not in cardiopulmonary arrest, follow orders in B and C.		
B	MEDICAL INTERVENTIONS: <i>If patient has pulse and/or is breathing.</i>		
Check One	<input type="checkbox"/> Comfort Measures Only (Allow Natural Death). Relieve pain and suffering through the use of any medication by any route, positioning, wound care and other measures. Use oxygen, suction and manual treatment of airway obstruction as needed for comfort. <i>Patient prefers no transfer to hospital for life-sustaining treatments. Transfer if comfort needs cannot be met in current location.</i> Treatment Plan: Maximize comfort through symptom management.		
	<input type="checkbox"/> Limited Additional Interventions In addition to care described in Comfort Measures Only, use medical treatment, antibiotics, IV fluids and cardiac monitor as indicated. No intubation, advanced airway interventions, or mechanical ventilation. May consider less invasive airway support (e.g. CPAP, BiPAP). <i>Transfer to hospital if indicated. Generally avoid the intensive care unit.</i> Treatment Plan: Provide basic medical treatments.		
	<input type="checkbox"/> Full Treatment In addition to care described in Comfort Measures Only and Limited Additional Interventions, use intubation, advanced airway interventions, and mechanical ventilation as indicated. <i>Transfer to hospital and/or intensive care unit if indicated.</i> Treatment Plan: Full treatment including life support measures in the intensive care unit.		
<i>Additional Orders:</i> _____			
C	ARTIFICIALLY ADMINISTERED NUTRITION: <i>Offer food by mouth if feasible.</i>		
Check One	<input type="checkbox"/> No artificial nutrition by tube. <i>Additional Orders:</i> _____ <input type="checkbox"/> Defined trial period of artificial nutrition by tube. _____ <input type="checkbox"/> Long-term artificial nutrition by tube. _____		
D	DOCUMENTATION OF DISCUSSION:		
	<input type="checkbox"/> Patient (Patient has capacity)	<input type="checkbox"/> Health Care Representative or legally recognized surrogate	
	<input type="checkbox"/> Parent of minor	<input type="checkbox"/> Surrogate for patient with developmental disabilities or significant mental health condition (Note: Special requirements for completion. See reverse side.)	
	<input type="checkbox"/> Court-Appointed Guardian	<input type="checkbox"/> Other _____	
Signature of Patient or Surrogate			
Signature: <u>recommended</u>		Name (print):	Relationship (write "self" if patient):
This form will be sent to the POLST Registry unless the patient wishes to opt out, if so check opt out box <input type="checkbox"/>			
E	SIGNATURE OF PHYSICIAN / NP/ PA		
<small>My signature below indicates to the best of my knowledge that these orders are consistent with the patient's current medical condition and preferences.</small>			
Print Signing Physician / NP / PA Name: <u>required</u>		Signer Phone Number:	Signer License Number: (optional)
Physician / NP / PA Signature: <u>required</u>		Date: <u>required</u>	Office Use Only

SEND FORM WITH PATIENT WHENEVER TRANSFERRED OR DISCHARGED. SUBMIT COPY TO REGISTRY
 © CENTER FOR ETHICS IN HEALTH CARE, Oregon Health & Science University, 3181 Sam Jackson Park Rd, UH1-08, Portland, OR 97239-3008 (503) 494-3965

