

TRIAD XI: Utilizing simulation to evaluate the living will and POLST ability to achieve goal concordant care when critically ill or at end-of-life—The Realistic Interpretation of Advance Directives

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ABSTRACT:

Objective: Utilize simulation to evaluate if living wills (LW) or POLST achieves goal concordant Care (GCC) in a medical crisis.

Methods: Nurses and resident-physicians from a single center were randomized to a clinical scenario with a living will (LW), physician orders for life sustaining treatment (POLST) or no document. Primary outcomes were resuscitation decision and time to decision. Secondary outcome was the effect of education.

Results: Total enrollment was 57 and less than 30% received prior training. Types of directives were linked to resuscitation decisions ($P = .019$). Participants randomized to “No Document” or POLST specifying “CPR” performed resuscitation. If a terminal condition presented with a POLST/ do not resuscitate-comfort measures only (DNR-CMO), 73% resuscitated. The LW or POLST specifying DNR combined with medical support resulted in resuscitations in 29% or more of the scenarios. Documents did not significantly affect median time-to-decision ($P = .402$) but decisions for “No Document” and POLST/CPR were at least 10 s less than other scenarios. Scenarios involving POLST DNR/Limited Treatment had the highest median time of 43 s. Prior training in LWs and POLST exerted a 10% improvement in decision making ($P = .537$).

Conclusion: GCC was not always achieved with a LW or POLST. This conclusion supports prior research identifying problems with the interpretation and discordance with LW's and POLST.

INTRODUCTION

The living will (LW) and health care power-of-attorney (HCPOA) are the most common advance directives. The physician's orders for life-sustaining treatment (POLST) is the most common form of end-of-life (EOL) medical order. The LW and POLST are intended to ensure patient autonomy and the implementation of care consistent with patient wishes. This is often described as goal concordant care (GCC). The (HCPOA) is the appointment of a health care proxy who can provide medical decisions when a patient is incompetent to either understand or respond. LWs are standardized forms that select levels of intervention in the face of incompetence and the absence of a health care proxy. A LW is not a physician order. It is a legal document that requires medical interpretation. The LW's intention is to provide a voice to the patient but also a legal and protected framework to protect and guide physicians as they determine care for their patients. One of the deficiencies of a LW or POLST is sporadic accessibility: these documents and orders are not always available at the time of transitions in patient care such as a patient transport or acute medical crisis.¹ POLST originated in Oregon as an attempt to bridge the information gap posed by absent LW documents and create immediately actionable medical orders.² Like a LW, its use should be to reflect a patient's preferences for life-sustaining care (including nutrition, hydration, and antibiotics). Unlike a LW, the POLST medical orders become actionable by "all" health care providers. Depending on the state, these orders can be written by both physicians as well as advance practice providers (APP's such as nurse practitioners and physician's assistants). However, the physician or APP is not required to have the actual conversation or format the POLST medical order.³ Many programs delegate the conversation to other team participants but still require the physician or APP to sign the POLST order.

As it relates to patient safety and prevention of medical errors, the LW and POLST are very important and powerful documents. With health care changing and the lack of primary and specialty care continuity a new phenomenon called Medical Stranger Danger has developed. This is when a patient is cared for by medical providers who do not and cannot accurately represent the patient. This phenomenon threatens patient safety and the delivery of GCC. As such, it is very important in shaping treatment during acute emergent medical conditions that health care providers, at all levels, understand the distinction between the LW and POLST and the requisite

conditions for their enactment. As an example, a LW in the state of Pennsylvania, does not become enacted until/unless the patient is permanently incompetent, in an end stage medical condition or persistent vegetative state.⁴ Despite these well-delineated conditions, prior research have consistently shown the interpretation of a LW incorrectly assumed to be an automatic Do Not Resuscitate (DNR) order⁵⁻⁷). There is research that suggest that utilization of POLST forms can result in withholding resuscitation in patients.^{8,9} However, it must be clearly understood that same research does not ensure the withholding of resuscitation was the right course of action for the populations studied. Additionally, TRIAD POLST research suggests similar confusions exist as far as medical provider understanding and results in both over and under treatment medical errors.^{10,11} More recently, Lee et al confirmed over treatment errors with POLST range from 14% to 20% depending on the formatting of choices designated on the POLST.¹² Both TRIAD XII and previous POLST quality research, suggests an absence of consensual interpretation of POLST documents thus creating risk to patients.^{13,14} The absence of patient concordance and provider consensus further supports the lack of clarity of the POLST.

TRIAD research has been criticized due to lack of real-life crisis evaluation to evaluate how a true, emergent, and realistic crisis would compel quick decision making. As such, this simulation study seeks to simulate a medical crisis, without endangering patients, to determine the impact of LW or POLST documents on resuscitation decisions. Our primary study objective is to evaluate medical residents and staff nursing responses when either LW or POLST documents accompany a "patient" during a medical crisis. We hypothesized that, consistent with prior studies, these documents do not provide unambiguous instruction for EOL care nor is care always appropriate for the patient. In our estimation, decisions to withhold lifesaving care for a patient with a terminal medical condition are appropriate; for patients without such an indication, withholding care would be inappropriate and cannot be justified.

METHODS

This was a single center study conducted between September 2017 and March 2019 at a 400-bed, Level II Trauma Center in Northwestern Pennsylvania. The study was open to residents with ACLS training from the hospital's four graduate residency programs along with staff nurses the emergency department and intensive care

Table 1: Scenarios, Advance Directives, and Appropriates of Resuscitation

Scenario	Document	Appropriateness of resuscitation
Scenario 1: 61-year old (YO) male, chest pain, SOB, diaphoresis. Vitals—pulse 100, RR 24, SaO ₂ 97% RA, temp 37°C BP 100/70. Abrupt VT/VF arrest.	LW	Appropriate
Scenario 2: 52-YO female, terminal lymphoma, chest pain, SOB, diaphoresis. Vitals—pulse 110, RR 30, SaO ₂ 97% RA, temp 37°C, BP 130/70, abruptly unresponsive, arrests.	POLST DNR/CMO	Inappropriate
Scenario 3: 70-YO male, DM, HTN, dyslipidemia, CAD s/p CABG, chest pain, clammy, distress. Vitals—pulse 60, RR 22, SaO ₂ 98% RA, temp 36°C, BP 100/60, abruptly unresponsive, no pulse, VT.	POLST DNR/Ltd Tx	Appropriate
Scenario 4: 79-YO male, CAD, emphysema, diabetic retinopathy, advanced Parkinson’s disease, chest pain, clammy, distress. Vitals—pulse 69, RR 31, SaO ₂ 92% RA, temp 37°C, BP 95/50. Abruptly unresponsive, no pulse VT.	LW	Appropriate
Scenario 5: 90-YO female, SOB, agitated, confused, severe respiratory distress. Vitals—pulse 120, RR 46, BP 84/60, SaO ₂ 72% on nonrebreather, temp 37°C, BP 84/60. Abruptly arrests.	POLST CPR/Full Tx	Appropriate
Scenario 6 (same as Scenario 2)	No document	Appropriate
Scenario 7 (same as Scenario 3)	No document	Appropriate

units. Solicitation was made via posted notices along with periodic electronic reminders. Study subjects were given a general briefing and signed an informed consent document.

The hospital’s patient simulation laboratory was the site of the study. The lab houses several HAL™ adult patient simulators (Gaumard Scientific, Miami, FL) linked to centralized computer control of physiologic responses. It also provides video recording of participants. Participants in this study were randomized via random number generator to a specific critical care scenario programmed into HAL™. Patient prerogative for life sustaining treatment was linked to each scenario. A LW, one of three variants of a POLST document, or no prerogative was represented in this study (Table 1). Prior to the start of the session, each participant was given a brief orientation to the lab to familiarize them with the location of critical care equipment.

A short brief on the medical history of the patient was given at the start of the session. This briefing included signs and symptoms of the patient based on the scenario (Table 1). A “patient medical information” folder was then provided to each participant that included the LW or POLST documents, if pertinent to the scenario. Study investigators refrained from disclosing folder contents to

mitigate bias and simulate an actual critical care crisis. Video recording was started after the briefing. Simulated “patient” verbal responses to clinician’s questions and verbal expressions of pain were provided by an investigator via a microphone in the control room. Two minutes into the session, the patient was programmed to experience pulseless ventricular tachycardia. Participants then had to decide whether to announce a code and resuscitate or not. Once a definitive decision was made, the session was ended. A participant debriefing session followed, wherein the video was replayed, and comments provided by the senior investigator. All study procedures were reviewed and approved by the hospital’s institutional review board (IRB).

Primary study outcomes included the resuscitation decision and the time required to make it (as abstracted from the video log). Resuscitation decisions based on scenario were initially categorized “yes,” “no,” or “uncertain,” the latter representing either prolonged delay or abrupt change in decision. Response rates were compared via chi-square test with a *P* value of .05 as the threshold for significance. To improve statistical power, resuscitation decisions were reclassified as “appropriate” or “not appropriate,” based on patient prerogative in concert with presenting signs, symptoms, and medical history. Rates for this reclassified outcome variable were contrasted

Table 2: Participants Demographics and Education

Age* (n = 57)	Sex (n = 57)	Race (n = 57)	Ethnicity (n = 57)	Profession (n = 57)
37 ± 12.6	70% Female (40)	98% Caucasian (56)	98% non-Hispanic (56)	65% Nurses (37) 35% Resident Physicians (20)

*Mean ± standard deviation.

Table 3: Participants Education and Experience

Nurses' education (n = 37)				Nursing experience, years (n = 36)	Residents' experience (n = 20)		Prior LW training (n = 57)		Prior POLST training (n = 57)	
Diploma	Assoc	BS Grad	Degree		PGY1	PGY2	Yes	No	Yes	No
8% (3)	8% (3)	68% (25)	16% (6)	16 ± 12.3*	70% (14)	30% (6)	26% (15)	74% (42)	19% (11)	81% (46)

*Mean ± standard deviation.

against scenario/patient document using Fisher's exact test using a Bonferroni-corrected threshold *P* value of .025. Data for time-to-decision were assessed for normality by the Shapiro-Wilks test and then compared using the nonparametric Kruskal-Wallis test using a *P* value of .05 for statistical significance.

The secondary study outcome looked at the effect of advance directive education on rates of appropriate decisions. The *P* value for significance was set at .05.

RESULTS

Total enrollment for this study was 57 representing 30% of the target population. Most participants were female (70%, 40/57), caucasian and non-Hispanic with an average age of 37 (Table 2). The majority of nurse participants, 68%, held a bachelor's degree with a mean of 16 years of experience (Table 3). Most resident physicians (70%) were in their first year of training. Whether nurse or resident, less than 30% had formal training in advance directives.

The data show an association between advance directive document (or its absence) and resuscitation decisions (Table 4, approximate *P* value of .019). All participants randomized to "no document" made the decision to resuscitate. A similar result was seen for the POLST document specifying CPR. For LW scenarios and those involving a POLST with DNR specified, responses were varied, with 40-60% deciding to resuscitate for the former and 29-73% for the latter. For the sole terminal condition (Scenario 2), 73% decided to resuscitate in the face of

POLST with a DNR. The relatively small sample numbers within categories resulted in an approximate *P* value for several comparisons. Collapsing the "no document" categories into one as well establishing a dichotomous outcome (Table 5) improved but did not fully resolve this issue. Overall, this comparison showed an association between document and appropriateness of the resuscitation decision (*P* approximately .001). Again, the LW document as well as POLST forms specifying DNR resulted in inappropriate decisions in roughly half or more of the scenarios.

Time to arrive at a decision (Table 6) shows that the median times for no document and POLST CPR scenarios were about 12 s, at least 10 s less than for other scenarios. Scenarios involving POLST DNR/LTD treatment had the highest median time of 43 s. Given the high variability of the data (Shapiro-Wilk test *P* values < .05), the nonparametric Kruskal-Wallis test was used for analysis and shows the time differences between documents/scenarios was not significant (*P* = .402).

Regarding the secondary outcome, prior training in advance directives exerted only a 10% improvement in decision making (Table 7, *P* = .537).

DISCUSSION

LW's and POLST are necessary powerful documents and orders that can predict the timing and location of death.¹⁵⁻¹⁷ However, they can also have unintended consequences that translate into medical errors in patient

Table 4: Relationship between Advance Directive Document and Resuscitation Decision

Scenario (n)	Document	Patient Condition	Resuscitation Response			P value
			Resuscitation	No Resuscitation	Uncertain*	
1 (n = 10)	LW	Not terminal	60%	20%	20%	~.019**
2 (n = 11)	POLST DNR/CMO	Terminal	73%	27%	0	
3 (n = 7)	POLST DNR/LT	Not terminal	29%	43%	29%	
4 (n = 5)	LW	Not terminal	40%	20%	40%	
5 (n = 8)	POLST CPR/FT	Not terminal	100%	0	0	
6 (n = 8)	No document	Terminal	100%	0	0	
7 (n = 8)	No document	Not terminal	100%	0	0	

*Delayed or abrupt change in treatment decision.

**Approximate value.

Table 5: Relationship between Advance Directive Document and Appropriate Decision Making*

Document	Appropriate Decision		P value
	Yes	No	
None (n = 16)	100%	0	~.001**
LW (n = 15)	53%	47%	
POLST DNR/CMO (n = 11)	27%	73%	
POLST DNR/LT (n = 7)	29%	71%	
POLST CPR/FT (n = 8)	100%	0	

*Scenarios without document combined based on responses in Table 2.

**Approximate P value.

Table 6: Time (s)-to-Decision

	No Document (n = 16)	LW (n = 12)	POLST DNR/LT (n = 6)	POLST DNR/CMO (n = 10)	POLST CPR/FT (n = 8)	P value*
Mean (SD)	24 (25.0)	32 (37.2)	37 (17.4)	32 (27.7)	21 (21.1)	.402
Median [IQR]	12.5 [22]	21 [38]	43 [29]	19[29]	11 [25]	

Abbreviation: IQR, interquartile range.

care.¹⁸ These medical errors have now resulted in both wrongful prolongation of life and wrongful death litigation.¹⁹ Our data reveal that at least half of the scenarios resulted in inappropriate resuscitation decisions. Even if our definition of appropriate resuscitation is

contested, nonetheless the crosstabulation of the raw responses point to a lack of consensual decisions involving LW and POLST forms. This supports our hypothesis that these documents are subject to misinterpretation and provides validation for prior survey studies.^{10,11}

Table 7: Effect of prior advance directives training on decision making*

Prior Training	Appropriate Response		P value
	Yes	No	
Yes	73% (11)	27% (4)	.537
No	62% (26)	38% (16)	

*LW and POLST documents.

Most of the LW and POLST research evaluates whether the patient died however, no research prior to TRIAD evaluates whether or not the care was correct or concordant with the patient’s wishes and informed consent. Similarly, simulation is utilized in EOL care research to teach how to have an EOL discussion but does not evaluate the provider response to the LW or POLST to evaluate provider competency.²⁰ This simulation study is different with respect to two issues. First, we determine which patients we would expect resuscitation to be provided and withheld with or without a LW or POLST (Table 1). We also portray what would be described as under resuscitation (Figure 1), over resuscitation (Figure 2), as well as what would be depicted as a high-quality response to an EOL scenario (Figure 3). These are cases that are common to see every day in the practice of medicine. Second, we utilized sim to evaluate the providers response to resuscitate, not resuscitate, or be uncertain of the decision to resuscitate. With the cases provided we stress that the decision “uncertain” is not acceptable as the lack of rapid resuscitation would result in the patient’s death. We chose

that decision measurement to reveal how LW and POLST can cause a form of medical decision paralysis and lead to harm (Table 4). For example, the POLST with a DNR/LTD treatment took three times as long for a provider to make a decision to act or not act. What this study does reinforce is if there is no LW or POLST, then resuscitation will take place even if the condition is terminal and lifesaving care would not be helpful (Table 4, Scenario 6 and 7). Thus, patients who are at EOL still require some form of protection to ensure their wishes are honored and that they will not be over resuscitated causing pain and overutilization of expensive resources.

What is evident from this research is that more is required to protect patients than a paper and a decision by a medical team member, who can range from a physician to an EMS provider, with different levels of competency and training. Recent research into incorrect interpretation of hospital DNR revealed physicians, as a whole, but more so nursing and surgical specialties are more prone to make errors.²¹ In this study, the relationship between a LW and POLST and the appropriate resuscitation decision was seen in only two instances (Table 5). The first being if no document existed and a default resuscitation, which is felt to be standard of care was provided. The second being if a POLST CPR/full treatment order was present. Those are the only two instances resulting in the appropriate care being provided 100% of the time. In the remaining scenarios, no LW or POLST resulted in appropriate treatment decisions being provided with such high levels of concordance. The POLST DNR/CMO treatment initially saw an over resuscitation rate of 73% and the POLST DNR/LTD treatment order saw an initial under resuscitation rate of 71%. Our research supports previous research that combinations of POLST are not feasible to

**Figure 1:
Example of Underresuscitation**

TRIAD XI – Simulation Example of Under-Resuscitation(Living Will)

- Case History
 - 61-year-old male with Chest Pain presented to the Emergency Room with a Living Will Created as part of his Estate Plan.
 - Image depicted to the right
 - Scan the QR code with a Smart Device to see the scenario

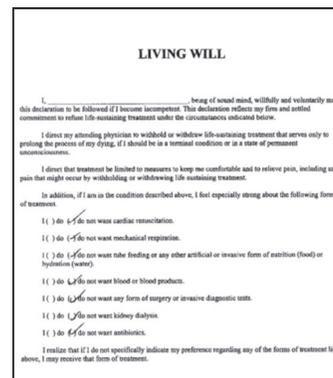


Figure 2:
Example of Overresuscitation

TRIAD XI – Simulation Example of Over-Resuscitation(POLST)

- Case History
 - 52-year-old female with end stage medical condition presented to an emergency with chest pain and trouble breathing. She has a POLST DNR/CMO
 - Image depicted to the right
 - Scan the QR code with a Smart Device to see the scenario



Figure 3:
Example of High-Quality End of Life Scenario

TRIAD XI – Simulation Example of High-Quality EOL Scenario (POLST)

- Case History
 - 52-year-old female with end stage medical condition presented to an emergency with chest pain and trouble breathing. She has a POLST DNR/CMO
 - Image depicted to the right
 - Scan the QR code with a Smart Device to see the scenario



honor.^{22,23} Conversely, the LW saw an underresuscitation rate of 47%. Regardless of the type of document or medical order utilized, the idea of GCC would not be attained based upon this and previous research.

Education had a 10% improvement on performance. Education is also commonly mentioned as a solution to this confusion that propagates patient safety risk. However, this as well as previous research further support that the existing education is not having significant impacts or sustained effects to ensure provider competency and

patient safety^{24,25} (Table 3). This simulation study now presents an opportunity to guide education, policy, and quality assurance oversight in a manner that does not place patients in active harm's way.

In the face of educational constraints, confusions, provider competency and patient safety risk, what must be done to ensure GCC and patient wishes are safely followed? One option is to focus on high quality advance care planning (ACP) conversations. However, this approach although of benefit is one sided and does not ensure the next provider,

the medical stranger, will be able to follow through on the plan of care so that GCC can be achieved. The reason high quality ACP discussions are not a complete fix is the output. What comes of those discussions is a paper-based form of communication. Often that communication is limited to a paper or digitized LW or POLST. Research already reveals this is limited in its safety and effectiveness.^{26,27} Resuscitation pause checklists have been created and recommended but utilization has not been widespread.²⁶ Patient safety DNR & POLST order verifications tools have been created, published, and show promise but have not been adopted or validated in larger scales.¹³ With error rates shown in larger more established systems adoption would seem prudent.²¹ Research utilizing audio alone or audio and video show great promise. Previous research (TRIAD VIII) with scripted patient to clinician video (SPCV) and EOL documents has demonstrated statistically significant improvement in understanding EOL documents. The provision of care in the SCPV arm was concordant or achieved statistically significant changes nearing concordance and thus achieving GCC.²⁵ Furthermore, the legal community is in the process of amending legal requirements and education in preparation for video based advance directives.²⁸ What is of paramount importance for both medical providers and systems to recognize and act upon is the growing patient safety risk. With what we have described as deficiencies and safety risks of the LW and POLST alone, combined with the concept of medical stranger danger, more than just paper or digitized medical or legal documents are required to ensure GCC.

Our simulation study had limitations. First and foremost, the sample size in this study was small and limited to a single center. This center accepts physicians nationwide into its emergency medicine residency program, nullifying a purely regional bias. How we evaluated participant education and training was limited to a yes or no question and did not pursue the type or amount of education and training. Lastly, this study was not a prospective, randomized investigation. It does reinforce past safety research and reinforces the need to complete further and extensive research with respect to patient informed decision making and provider concordance with what is documented in the LW and POLST.

CONCLUSION

The LW and POLST are very much needed documents and medical orders. Without them terminally ill patients would be resuscitated in 100% of occurrences. When utilized correctly, they powerfully work to enact a patients EOL wishes and prevent the over utilization of health care resources. However, the LW and POLST, as they exist and are operationalized today, do not provide patients the ability to have informed patient decision making and the assurance that providers will follow through on what is documented in paper or digitized form. The call to action is to keep patients safe and medical care concordant. To do

so multiple actions may need to be deployed simultaneously. Education should be based upon research and could be mandated by States and medical systems upon credentialing and recredentialing. Safeguards need to be investigated and research with SPCV has shown to be an effective and powerful communication tool to inform those providers who must interpret documents. Simulation has the ability to promote GCC and is already being utilized to train medical providers to have EOL discussions. Simulation can be designed to teach providers how to interpret EOL documents in the stressful and time constrained acts of resuscitation where errors can be high and devastating. If systems accept the status quo, then patents will remain at risk and discordant care will continue. If systems embrace the deficiencies noted and utilize existing (simulation) as well as new technology (SCPV), then patient care, safety and concordance can be achieved.

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