

Brief Report

Determining Goal Concordant Care in the Intensive Care Unit Using Electronic Health Records

Sumera R. Ahmad, MD, Alex D. Tarabochia, MD, LuAnn Budahn, LPN, Allison M. LeMahieu, MS, Lioudmila V. Karnatovskaia, MD, Alison E. Turnbull, PhD, and Ognjen Gajic, MD

Division of Pulmonary and Critical Care Medicine (S.R.A., L.k., O.G.), Mayo Clinic, Rochester, Minnesota; Department of Internal Medicine (A.D.T.), Mayo Clinic, Rochester, Minnesota; Anesthesia and Critical Care Research Unit (L.B.), Mayo Clinic, Rochester, Minnesota; Department of Quantitative Health Sciences (A.M.L.), Mayo Clinic, Rochester, Minnesota; Division of Pulmonary and Critical Care Medicine, School of Medicine (A.E.T.), Johns Hopkins University, Baltimore, Maryland; Department of Epidemiology, Bloomberg School of Public Health (A.E.T.), Johns Hopkins University, Baltimore, Maryland; Outcomes After Critical Illness and Surgery Research group (A.E.T.), Johns Hopkins University, Baltimore, Maryland

Abstract

Background. Goal concordant care (GCC) is the alignment of care to patient values and preferences. GCC is a major outcome of communication with patients and families in serious/critical illness. Using the electronic health record (EHR) to study the provision of GCC would be pragmatic and cost-effective for research and quality improvement efforts.

Research question. Do EHRs contain information to identify GCC?

Methods. This is a feasibility retrospective chart review performed by two independent reviewers. An existing framework containing four questions for identifying GCC was adopted. Two clinicians reviewed multi-disciplinary notes and extracted pertinent information. The primary outcomes were whether the four key questions for determining goal concordance could be answered using information in the EHR. The secondary outcome was the type of goals identified. Cohen's kappa was used to measure agreement between two reviewers.

Results. Patient care was considered goal concordant in 35 (85%) of 41 patients in a random sample comprising of 36 survivors and five who died in hospital. Inter-rater agreement on identifying data to determine GCC was excellent (Kappa 0.70). Patient goals were identified in 80% of charts reviewed. Note sources informative of patient preferences, included social work (39%), hospital progress notes (29%), palliative care (20%), and physical/occupational therapy (15%). "Returning home" and "getting better/ stronger" were among the most common patient goals captured in EHR.

Conclusion. The EHR can be used to understand patient goals, but the information is scattered across the multi-disciplinary notes. Improving EHR and external validation will facilitate ascertainment of goal concordance as an important outcome measure. *J Pain Symptom Manage* 2022;000:e1–e7. © 2022 The Authors. Published by Elsevier Inc. on behalf of American Academy of Hospice and Palliative Medicine. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Key Words

Goal concordant care, patient goals, critical illness, electronic health record (EHR)

Key Message

This feasibility study demonstrates that EHR likely contains sufficient information to assess patient goals for most patients. A framework of questions to structure EHR review was helpful in this process.

Introduction

Patients, families, and providers often differ in their goals and expectations of outcomes following critical illness. Knowing patient's goals and values is vital to delivering appropriate and individualized care. Patient's goals for

Address correspondence to: Sumera R. Ahmad, MD, Division of Pulmonary and Critical Care Medicine, Mayo Clinic, 200 First Street, Rochester, MN 55905, USA. E-mail: ahmad.sumera@mayo.edu

Accepted for publication: 7 November 2022.

quality of life, physical functioning, and family and social engagement can vary broadly; what is acceptable for some may be “worse than death” for others.^{1,2} Care designed to maximally meet a patient goal is termed Goal Concordant Care (GCC). GCC is likely to be as important for patients who are expected to survive the hospitalization as well as for those expected to die and is a preferred outcome for evaluating advance care planning interventions and communication interventions in the setting of the intensive care unit (ICU).^{3–8} Treatment inconsistent with patient goals results in worse ratings on care, pain management, and communication with clinician among patients at the end of life.⁹

Measuring GCC is challenging, as there is no gold standard methodology. Caution has been suggested when attempting to reliably measure “care consistent with goals,”^{6,10} because patients often have multiple competing goals that may change during the course of their illness.¹¹ In serious illness, different ways of measuring goal concordance have included comparison of prospectively documented patient preferences with end-of-life (EOL) health resources utilization, comparison of patient preferences with patient assessment of goal concordance, and retrospective assessment of GCC from bereaved caregivers.^{4,12} Using a life-priority survey to help identify what goals matter most to patients is another way to ascertain the goals of patients with serious or critical illness.³ Another approach uses a framework developed by Turnbull et al. focusing on whether patient goals and limits are known, considered achievable by the clinical team and whether the patient receives treatment expected to help accomplish those goals.^{5,13} This framework has been used previously to assess whether preference-sensitive interventions in critical illness such as feeding tubes and tracheostomy were goal-concordant for individual patients.¹³

Methods for evaluating goal concordance using the electronic health record (EHR) have been proposed.^{5,14} Some of the challenges in developing a scalable tool to measure GCC in the EHR includes documentation of patient goals, reliable classification by reviewers of goals being concordant or not, training of researchers, and developing an algorithm using natural language processing (NLP) to help review EHR notes.¹⁴ If demonstrated to be feasible, these methods could enable clinical researchers to use GCC as an outcome in serious/critical illness. Therefore, this is a feasibility study to determine if the EHR contains sufficient information about patient goals and key features to determine goal concordance.

Methods

Study Design

This study is a secondary analysis of a single center retrospective review of a random sample of ICU patients treated between 2015 and 2019 at the Mayo

Clinic in Rochester, Minnesota exploring changes in health trajectory before and after critical illness.¹⁵ The study was approved by the Institutional Review Board. The EHR system was changed to Epic in May of 2018. EHRs of patients prior to 2018 were transitioned to Epic. The Anesthesia and Critical Care Research Unit (ACRU) at the Mayo Clinic assisted with data extraction and with manual chart review.

A REDCap data base was created to collect patient demographics, diagnosis, and specific ICU interventions received. The REDCap data collection questions pertaining to patient goals were adapted from Turnbull et al.⁵ and included 1) are patient goals known, 2) are limitations to treatment known, 3) are goals achievable or realistic, and 4) were goals achieved. The term “goal” is inclusive of patient specific values and preferences.

We reviewed EHR charts to identify the types of patient goals expressed, and to answer questions related to GCC. We focused on the notes from the ICU stay and the associated hospital encounter but also reviewed those before or after that encounter. Charts were continually revisited until the relevant content was identified by both reviewers. This review was undertaken with a key assumption that what was stated in the chart is an accurate representation of a patient’s true goals.

Two reviewers, SRA and LB, a physician, and a nurse, completed 41 chart reviews. Using the framework of questions by Turnbull et al. each reviewer conducted independent chart analysis and shared challenges and progress. We studied notes and identified high yield areas where information about patient goals were found. We compared subjective impression of each chart in the recurring meetings. Any differences were resolved by a third physician reviewer, ADT. If after reviewing a variety of note sources, we were able to answer “yes” to the four questions, we concluded care to be goal concordant.

Participants

Patients over 65 years old admitted to the ICU between August of 2015 and August 2019 for greater than 24 hours and requiring one or more of the following: high-flow nasal cannula, bilevel or continuous positive pressure ventilation, invasive mechanical ventilation, and vasopressor support were eligible for inclusion in this study. The patients were residents of Olmsted County, Minnesota, with research authorization on file. Patients in a vegetative state at baseline or with intubation for elective surgical procedures only were excluded. In total, 41 patient chart reviews were completed in the primary analysis, with 23 having an index ICU admission prior to the introduction of Epic and 18 after. Charts were revisited and studied to extract goals in free text identified by each reviewer (Fig. 1).

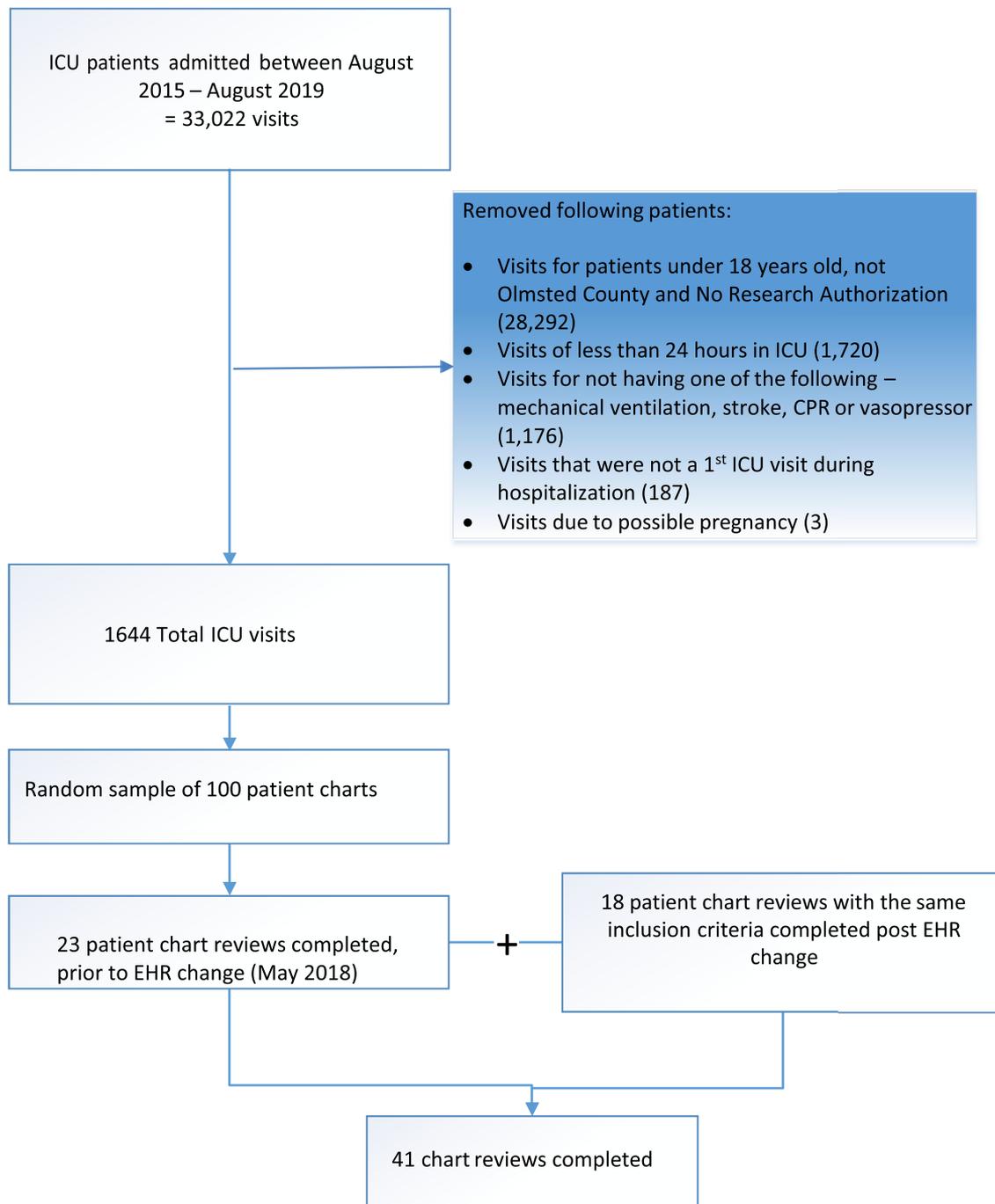


Fig. 1. Consort diagram of patient chart review.

Outcomes

The primary outcome was ability to determine GCC using EHR. The secondary outcome was the type of patient preference identified.

Statistical Analysis

Patient characteristics, interventions, and outcomes were summarized using median and interquartile range

(IQR) for continuous variables and frequency counts and percentages for categorical variables. Cohen's kappa coefficient was used to measure agreement between the two reviewers regarding GCC and patient preferences.¹⁶

Data management and statistical analysis were performed in SAS Studio 3.8 (SAS Institute Inc, Cary, North Carolina) and Microsoft Excel 365 (Microsoft Corporation, Redmond, WA).

Table 1
Patient Demographics and pre-ICU Characteristics.

Characteristics	Overall (N= 41)
Gender, n (%)	
Female	12 (29%)
Male	29 (71%)
Age, median (Q1, Q3)	75.0 (69.0, 84.0)
Pre-ICU residence, n (%)	
Assisted living	5 (12%)
Home	30 (73%)
Nursing home	5 (12%)
Short-term Nursing facility	1 (2%)
Pre-existing chronic mechanical ventilation, n (%)	1 (2%)
Pre-existing tracheostomy, n (%)	1 (2%)
Pre-existing feeding tube, n (%)	1 (2%)
Chronic hemodialysis, n (%)	0 (0%)
ICU Interventions for study inclusion	
Mechanical ventilation (new), n (%)	33 (80%)
Non-invasive mechanical ventilation (new), n (%)	16 (48%)
Vasopressor support, n (%)	29 (71%)
Hospital outcomes	
Status at hospital discharge, n (%)	
Alive	36 (88%)
Dead	5 (12%)
Hospital length of stay, median (Q1, Q3)	12.0 (7.0, 17.5)
Status at ICU discharge, n (%)	
Alive	39 (95%)
Dead	2 (5%)
ICU length of stay, median (Q1, Q3)	5.0 (2.3, 7.0)

Table 2
ICU Interventions.

Interventions	Overall (N= 41)
Mechanical ventilation (new), n (%)	33 (80%)
Non-invasive mechanical ventilation (new), n (%)	16 (48%)
Vasopressor support, n (%)	29 (71%)
Family meetings, n (%)	
Yes	22 (55%)
No	12 (30%)
Unable to determine	6 (15%)
Palliative care consult, n (%)	10 (24%)
Ethics consult, n (%)	3 (7%)

An example is a case of an elderly man with a do-not-resuscitate and do-not intubate order admitted for empyema and subsequent hemorrhagic shock. He received a feeding tube during hospitalization. Social work notes documented patient goals as “returning home” and “getting stronger.” The EHR revealed home discharge after ICU/ hospital course and short-term rehabilitation with no recurrent hospitalizations. In this case, when applying the framework of GCC questions, we answered that goals were known, limitations were known, goals were realistic, and goals were achieved. Hence, care in the ICU/ hospital course was considered goal concordant.

We had at least substantial agreement between the two reviewers on whether care was goal concordant, partially concordant, not concordant, or concordance could not be determined (Table 3). There was almost perfect inter-rater agreement in answering most questions except for the impression on whether the “goals were achievable/realistic.” While the agreement was substantial, there was still uncertainty in seven (18%) charts.

Table 4 provides examples of specific preferences expressed which were captured in over 80% of the charts reviewed. “Returning home” and “getting better” were the two most common patient preferences. Some of the social work and physical/occupational therapy notes incorporated a detailed template to capture these goals as well as relevant dialogue.

Eight charts did not contain any specific patient preferences in the ICU/hospitalization data. In those cases, review of patient’s clinical trajectory post-ICU and documented outpatient dialogue reflecting provider-patient interaction assisted the reviewers in understanding whether patients received goal concordant care. Here, we assumed that there were no limitations to care and considered goal concordance to be equivalent to anticipated outcomes of medical/surgical care. An example is of a patient needing urgent valvular surgery, needing intensive care, eventually discharged home without long term complications, where during the hospital stay no specific patient preferences were documented.

Results

This secondary analysis included 41 randomly selected patients, among whom 36 survived their hospital stay and five died during the hospitalization (Table 1). All but two patients had no pre-existing mechanical ventilation, tracheostomy, or feeding tube. No patient had prior renal replacement therapy in this sample. Common ICU interventions included mechanical ventilation and vasopressor use as per our inclusion criteria. Family meetings were identified in about half of the charts (N= 22), and palliative care consults were identified in 24% (N= 10) of charts (Table 2).

We tested whether information could be extracted during chart review to answer the four questions proposed by the framework from Turnbull et al. for assessing the presence of goal concordant care.⁵

Of the notes eliciting patient preferences, those from social work were most informative (16, 39%) followed by progress notes inclusive of advanced care planning notes (12, 29%), palliative care (8, 20%), and physical/occupational therapy (6, 15%). One patient had preferences documented in a chaplain note and one in the ethics note. Eight patients had no documentation of their preferences; 12 patients had preferences documented in more than one type of note. Overall, we did not find one consistent spot to locate “patient goals,” even for charts reviewed after the EHR change.

Table 3
Goal Concordance in EHR.

EHR Review to Answer Questions of Goal Concordance	Reviewer 1 (N= 41)	Reviewer 2 (N= 41)	Kappa
Patient goals documented, n (%)			0.926
Yes	33 (80%)	32 (78%)	
No	8 (20%)	9 (22%)	
Limitations to treatment known, n (%)			0.950
Yes	17 (41%)	18 (44%)	
No	24 (59%)	23 (56%)	
Goals achievable/ realistic, n (%)			0.807
Yes	30 (75%)	32 (80%)	
No	3 (8%)	3 (8%)	
Maybe	7 (18%)	5 (13%)	
Goal achieved, n (%)			1.000
Yes	32 (80%)	32 (80%)	
No	8 (20%)	8 (20%)	
Goal concordant care per documentation, n (%)			0.701
Yes	35 (85%)	36 (88%)	
No	2 (5%)	0 (0%)	
Partial	2 (5%)	3 (7%)	
Unable to determine	2 (5%)	2 (5%)	

Kappa values from 0.81 to 1.00 represent "Almost perfect agreement," 0.61–0.8 represents "Substantial agreement".

There were two cases where determination of GCC was challenging, and reviewers differed in their final impression of GCC despite same response to all the four questions. This resulted from differing impressions of what the patient may have understood of the medical condition when expressing those goals, and the changes in goals over time. An example is of a patient with an anticipated poor prognosis who originally expressed a preference for "life prolongation at all costs" and "not wanting to go to a skilled nursing facility." Subsequent follow-up notes several months later documented a change in preference to "time at

home with wife" and a shift of focus to "comfort care." There were two charts where it could not be determined whether GCC took place. No specific goals were found in the chart. Here the category "unable to determine" was applied.

Discussion

In this study we demonstrated that important aspects of GCC can be found in EHR in most cases. The framework proposed by Turnbull et al.⁵ was helpful in structuring the chart review for this purpose.

Themes of values were easily distinguished in the "free text" in different note sources such as conversations documented by social worker, chaplain, and physical therapists. There is much similarity in themes previously described for patients at the end of life.³ A new angle that surfaced in our exploration was the impact of socioeconomic determinants of health like challenges with family dynamics, financial constraints, and living conditions on GCC especially in the few cases when reviewers did not agree in their concluding impressions. These aspects were best described in social work notes. Besides patient factors, discrepancy in GCC could also be reflective of quality of communication.

The meaning and implications of patient "goals" have seen an evolution over the decades as we reform our care strategies to be more patient centric. From the time of the SUPPORT trial (Study to understand prognoses and preferences for outcomes and risks of treatments) in 1995, when addressing code status and

Table 4
Themes of Preferences in EHR

Common Themes of Preferences Found in EHR Chart Review	Reviewer 1 (N= 41)	Reviewer 2 (N= 41)	Examples
Continue with life prolonging measures	8 (19.5%)	8 (19.5%)	-Wants everything done at this moment. -Asks that we proceed with aggressive care as necessary to improve outcome.
Being with family	8 (19.5%)	8 (19.5%)	-Her values are to be at home with husband. She values her family, friends, and pets. -His ultimate goal is to be home with his beloved wife.
Return home	18 (44%)	18 (44%)	"I'm going home one way or another." "I want to go home and stop coming to the hospital."
Symptom control	7 (17%)	8 (19.5%)	-Patients' family, including his wife, spoke on behalf of patient, with the goal of focusing on comfort and preventing any harm. -Goal was pain control.
Treat with respect Get better/stronger/ back to baseline	1 (2.4%) 12 (29.3%)	1 (2.4%) 14 (34.1%)	-He had wished to be treated kindly amongst others. -To be mobile and get better. -He is understandably frustrated and tearful in the changes he has in his independence due to his surgery.
Limit hospital care	2 (5%)	2 (2.4%)	-He does not want to be intubated or resuscitated long-term, specifically if his outcome is going to be poor.
Recreation	3 (7%)	3 (7%)	-He wanted to be able to play music again. -Patient would like to be able to be out in the snow with his dog. -He would like to remain independent with most of his activities and do things such as fishing and camping as best he can.
Other	6 (14.6%)	4 (9.8%)	-Hope of no longer needing oxygen, "it gets in the way." -Keeping his stress level as low as possible. -A meaningful quality of life would consist mostly of the ability to verbally interact in a meaningful way with friends and family.
No preferences	8 (19.5%)	9 (22%)	

symptoms at end of life were brought to general medical attention as important patient goals, clinicians strive to focus on a combination of personal, life and health goals of the critically ill.^{3,11,17}

The use of EHR as a patient centered platform is of significant interest, as studies such as ours serve as a call to action for providers to systematically document patient goals, encouraging discussions with patients/their families and thereby fostering communication. EHR can thereby be useful in pragmatic clinical research, particularly in facilitating quality improvement projects in critical care. Generally, patient's goals are expected to be incorporated into the advance care planning (ACP) notes. Recent recommendations to improve ACP notes included incorporating goals of care conversations, undergoing training to improve documentation, having a centralized and consistent location for the information in the note, and including prompts that reflect goals of care into procedure-focused discussions.¹⁸ Unfortunately, documentation of advance care planning has not been consistent in the EHR.^{18,19} In our study, we reviewed a variety of note types to identify the ones with highest yield for patient care goals particularly those using "free text." Free text is of particular interest, as the use of natural language processing (NLP) with machine learning has previously been successfully used to identify patient goals from goals of care conversations documented in provider notes, physician order for life-sustaining treatment, and hospice referrals.²⁰ In an EHR chart review of 679 patients with serious illness from sepsis, clinical documentation looking for goals of longevity, function or comfort were present for 40% of patients with care being considered as goal concordant in 68%.²¹ Being a feasibility study, the project was not designed to capture prevalence of goal concordance. EHR based applications are being trialed to sniff pertinent data with the aim to overcome unmet palliative care needs and include goal concordance among other outcomes.^{22–24}

The study has several limitations. First, with chart review studies there is no real time comparison to help validate our findings. It was assumed that EHR documentation was a true reflection of patient goals and discourse between the patients and providers. Second, for the charts with absence of documented goals or where goals were unclear, one cannot truly ascertain if communication occurred. Impressions of goal concordance can be challenged for subjectivity by the reviewers. Third, documentation is highly variable across providers and services, and even the ACP notes are not consistent in capturing this dialogue. Even though there is a dedicated area to capture "patient goal" in EPIC, this area remains largely unrecognized. Fourth, over half of study patients' charts were reviewed just prior to change of institutional EHR. Fifth, manual

chart review itself is not efficient for large scale clinical research.

GCC could evolve as an important measurable outcome for future studies centered on communication in serious and critical illness including in survivors. The study emphasizes the need to improve the EHR to include essential measures of communication as a patient centered outcome with the vision to integrate it with the patient portal system.²⁵ This project can serve to expand the "free text" needed for the natural language processing and machine learning to build an NLP ontology. At this time, the ability of NLP to capture nuanced and dynamic goals needed for GCC is unknown. Therefore, the future of using GCC accurately as an outcome measure in artificial intelligence is currently uncertain.

As this is a feasibility study, similar exploration will need to be repeated across different hospital set ups with varying resources of multi-disciplinary ICU teams to account for differences in communication, documentation, and inter-rater agreements on GCC in reviewers of differing backgrounds in the health sciences research. Amongst some questions related to GCC, is its value in patients of diverse cultural, racial, and socioeconomic backgrounds as well its bearing on quality of dying and survival.

Disclosures and Acknowledgments

Small Grant Award, Mayo Clinic, Rochester.

Critical Care Research Subcommittee Grant, Mayo Clinic, Rochester.

The authors have no relevant financial or non-financial interests to disclose.

References

1. McPeake JM, Harhay MO, Devine H, et al. Exploring patients' goals within the intensive care unit rehabilitation setting. *Am J Crit Care* 2019;28:393–400.
2. Rubin EB, Buehler AE, Halpern SD. States worse than death among hospitalized patients with serious illnesses. *JAMA Intern Med* 2016;176:1557–1559.
3. Sanders JJ, Miller K, Desai M, et al. Measuring goal-concordant care: results and reflections from secondary analysis of a trial to improve serious illness communication. *J Pain Symptom Manage* 2020;60:889–897.e882.
4. Modes ME, Heckbert SR, Engelberg RA, et al. Patient-reported receipt of goal-concordant care among seriously ill outpatients-prevalence and associated factors. *J Pain Symptom Manage* 2020;60:765–773.
5. Turnbull AE, Hartog CS. Goal-concordant care in the ICU: a conceptual framework for future research. *Intensive Care Med* 2017;43:1847–1849.

6. Sudore RL, Heyland DK, Lum HD, et al. Outcomes that define successful advance care planning: a delphi panel consensus. *J Pain Symptom Manage* 2018;55:245–255.e248.
7. Cooper Z, Koritsanszky LA, Cauley CE, et al. Recommendations for best communication practices to facilitate goal-concordant care for seriously ill older patients with emergency surgical conditions. *Ann Surg* 2016;263:1–6.
8. Narang AK, Wright AA, Nicholas LH. Trends in advance care planning in patients with cancer: results from a national longitudinal survey. *JAMA Oncol* 2015;1:601–608.
9. Khandelwal N, Curtis JR, Freedman VA, et al. How often is end-of-life care in the united states inconsistent with patients' goals of care? *J Palliat Med* 2017;20:1400–1404.
10. Bernacki R, Hutchings M, Vick J, et al. Development of the serious illness care program: a randomised controlled trial of a palliative care communication intervention. *BMJ Open* 2015;5:e009032.
11. Berntsen GK, Gammon D, Steinsbekk A, et al. How do we deal with multiple goals for care within an individual patient trajectory? A document content analysis of health service research papers on goals for care. *BMJ Open* 2015;5:e009403.
12. Glass DP, Wang SE, Minardi PM, Kanter MH. Concordance of end-of-life care with end-of-life wishes in an integrated health care system. *JAMA Netw Open* 2021;4:e213053.
13. Turnbull AE, Sahetya SK, Colantuoni E, et al. Inter-rater agreement of intensivists evaluating the goal concordance of preference-sensitive ICU interventions. *J Pain Symptom Manage* 2018;56:406–413.e403.
14. Halpern SD. Goal-concordant care - searching for the holy grail. *N Engl J Med* 2019;381:1603–1606.
15. Ahmad SR TA, Budahn L, Lemahieu AM, et al. Feasibility of extracting meaningful patient centered outcomes from the electronic health record following critical illness in the elderly. *Front Med* 2022;9:826169. <https://doi.org/10.3389/fmed.2022.826169>.
16. McHugh ML. Interrater reliability: the kappa statistic. *Biochem Med (Zagreb)* 2012;22:276–282.
17. A controlled trial to improve care for seriously ill hospitalized patients. The study to understand prognoses and preferences for outcomes and risks of treatments (SUPPORT). The SUPPORT Principal Investigators. *JAMA* 1995;274:1591–1598.
18. Lamas D, Panariello N, Henrich N, et al. Advance care planning documentation in electronic health records: current challenges and recommendations for change. *J Palliat Med* 2018;21:522–528.
19. Grudzen CR, Buonocore P, Steinberg J, et al. Concordance of advance care plans with inpatient directives in the electronic medical record for older patients admitted from the emergency department. *J Pain Symptom Manage* 2016;51:647–651.
20. Lee RY, Brumback LC, Lober WB, et al. Identifying goals of care conversations in the electronic health record using natural language processing and machine learning. *J Pain Symptom Manage* 2021;61:136–142.e132.
21. Taylor SP, Kowalkowski MA, Courtright KR, et al. Deficits in identification of goals and goal-concordant care after sepsis hospitalization. *J Hosp Med* 2021;16:667–670.
22. Cox CE, Riley IL, Ashana DC, et al. Improving racial disparities in unmet palliative care needs among intensive care unit family members with a needs-targeted app intervention: the ICUconnect randomized clinical trial. *Contemp Clin Trials* 2021;103:106319.
23. Courtright KR, Dress EM, Singh J, et al. Prognosticating outcomes and nudging decisions with electronic records in the intensive care unit trial protocol. *Ann Am Thoracic Soc* 2021;18:336–346.
24. Cox CE, Jones DM, Reagan W, et al. Palliative care planner: a pilot study to evaluate acceptability and usability of an electronic health records system-integrated, needs-targeted app platform. *Ann Am Thoracic Soc* 2018;15:59–68.
25. Dalal AK, Dykes P, Samal L, et al. Potential of an electronic health record-integrated patient portal for improving care plan concordance during acute care. *Appl Clin Inform* 2019;10:358–366.