# The Influence of Age on the Likelihood of Receiving End-of-Life Care Consistent with Patient Treatment Preferences

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## Abstract

*Background:* Age differences may help to explain discrepancies in medical care received by cancer patients near death.
*Objectives:* Understanding age differences in advanced cancer patients' end-of-life experiences.
*Design:* NCI and NIMH funded multi-site prospective cohort study.
*Participants:* 396 deceased cancer patients, mean age ($58.6 \pm 12.5$), in the Coping with Cancer study.
*Measurements:* Baseline interviews (Treatment Preference) and 1 week postmortem chart reviews (Treatment Received).
*Results:* 14.1% of patients were 20–44 years old, 54.0% were 45–64 years old, and 31.8% were $\geq$65 years old. Compared to younger patients, middle-aged patients wanted less life-prolonging care (OR 0.32; CI 0.16-0.64). In the last week of life, older patients were less likely to undergo ventilation (OR 0.27; CI 0.07-1.00) than younger patients. Middle-aged patients who preferred life-prolonging care were less likely to receive it than younger patients (OR 0.21; CI 0.08-0.54), but were more likely to avoid unwanted life-prolonging care (OR 2.38; CI 1.20-4.75) than younger patients. Older patients were less likely to receive *desired* life-prolonging care than younger patients (OR 0.23; CI 0.08-0.68), however, they were not more likely to avoid *unwanted* life-prolonging care than younger patients (OR 1.74; CI 0.87-3.47).
*Conclusions:* Likelihood of a patient's treatment preference being consistent with care differ by age and treatment preferences. Older patients preferring life-prolonging therapies are less likely to receive them than younger patients; middle-aged patients who want to avoid life-prolonging care are more likely to do so than younger patients. Both findings have implications for patients' quality-of-death, indicating a need for further research.

## Introduction

**T**ERMINALLY ILL PATIENT TREATMENT PREFERENCES and treatments received differ by age.[1–8] Age differences help explain discrepancies in treatments provided to cancer patients.[9–17] Study to Understand Prognoses and Preferences for Outcomes and Treatments (SUPPORT), a well known end-of-life care study on hospitalized patients with a 6 month prognosis,18 showed that age was associated with decreased desire for—and receipt of—aggressive treatments.[19,20] Al-

though numerous subsequent studies treated age as a covariate among the terminally ill, less is known about specific age differences in patient treatment preferences and treatment received, particularly among advanced cancer patients. Even less is known about how age affects the likelihood a patient will receive treatment consistent with their preferences. As the US population ages a heightened understanding of how age influences health care for terminally ill patients is needed.

Coping with Cancer (CwC), a study of advanced cancer patients followed through death, recruited a diverse,

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primarily outpatient sample. Older studies drew data from *inpatient* settings. Over the last decade advanced cancer patients, particularly older aged patients, received care more frequently in outpatient settings, increasing the need to re-examine advanced cancer patient end-of-life care.

This analysis sought to identify advanced cancer patient age differences in treatment preferences, treatment received and goal attainment (the likelihood that a patient's treatment preference will be consistent with their treatment received). The *a priori* hypothesis predicted that older age would be associated with lower rates of preference for life-prolonging treatment, decreased receipt of life-prolonging care, and higher rates of goal attainment.

## Methods

### Study sample

CwC, an NCI- and NIMH-funded prospective, longitudinal, multi-site, cohort study, recruited advanced cancer patients from August 2002 to October 2008. Eligibility criteria included: diagnosis of advanced cancer, expectation of less than 6 months to live; age at least 20 years; and adequate stamina to complete the interview. Using interviews and chart reviews, patient data were collected at baseline and then at postmortem, roughly 4 months after the baseline interview (median survival time = 146 days). Details on this study, including recruitment and eligibility, are published elsewhere.[21] Of 1035 eligible patients, 723 patients (69.9%) consented and enrolled in the study. Reasons for nonparticipation (N = 302) included "not interested" (N = 120), "other" (N = 69), or "caregiver refuses" (N = 39). Apart from increased rates of higher education among participants (p = 0.003), there were no differences in the socio-demographic characteristics between participants and non-participants. As of May 2008, 396 of the 723 participating subjects were deceased with postmortem data. The deceased cohort (N = 396) did not differ significantly (p < 0.05 was considered significant), by psychological distress or rates of psychiatric disorders, from other participants. This cohort was more debilitated (e.g., had worse performance status and higher symptom burden) and more likely to have characteristics associated with lower socioeconomic status (e.g., younger, less educated, uninsured, and self identified as an ethnic minority). These findings are consistent with prior studies showing increased cancer mortality rates among patients of lower socioeconomic status.[22,23] Of 396 deceased patients, 327 had complete baseline data on the question "If you could choose, would you prefer a course of treatment that focused on extending life as much as possible, even if it meant more pain and discomfort."

### Measures

Interviews were conducted by trained research staff in English or Spanish. Patient race/ethnicity was self-reported as non-Hispanic White, non-Hispanic Black, and Hispanic (hereafter referred to as White, Black, and Hispanic). Other patient-reported socio-demographic characteristics included gender, marital status, education, religion, insurance status and Medicare/Medicaid enrollment status. The Karnofsky scale (scale 0–100, where 0 = "dead" and 100 = "asymptomatic") and the Charlson Index of Co-morbidity (scale 0–37, where 0 = no co-morbid conditions and 37 = the maximal possible co-morbid conditions) assessed functional status.

### Independent variables

Age was examined as a continuous variable, to determine the presence of a difference, and categorical variable, to better define that difference. Categorically, age was divided into three groups, younger (20 to 44 years), middle (45 to 64 years), and older aged (≥65 years) Categorical variables were analyzed by separately comparing older, middle and younger aged advanced cancer patients. These categories, used in relatively recent secondary data analyses conducted on age differences in end-of-life care in the SUPPORT study, allow for comparisons between the results of the two data sets.[17,19,20]

### Dependent variables

**Patient treatment preferences.** Direct questions assessed individual patient treatment preferences at end-of-life, e.g., "Would you take chemotherapy and risk side effects such as nausea, eating problems, hair loss, weakness, fatigue, bowel problems, or have to spend more time in the hospital if it would keep you alive: 2 years, 1 year, 6 months, 3 months, 1 month, 1 week?" Patients desiring chemotherapy that would only extend life one week were categorized as preferring life-prolonging care. 1 week was the selected cut off since desiring chemotherapy that kept the patient alive 1 week was the most aggressive option available for the patient to choose and because it best approximated the median split for patient response to this question for the overall CwC sample. For other life-prolonging interventions, any preference for the intervention was categorized as desiring life prolonging care. Patients were also asked, e.g. "If you could choose, would you prefer 1) a course of treatment that focused on extending life as much as possible, even if it meant more pain and discomfort, or 2) on a plan of care that focused on relieving pain and discomfort as much as possible, even if that meant not living as long?" Patients preferring option 1 were considered to prefer life-prolonging care. This question determined patient "extend life" treatment preference in goal attainment analysis.

**End-of-life care received.** Treatment type and location of death were obtained from postmortem chart reviews.

**Patient goal attainment.** Successful goal attainment was defined as patients who wanted and received or did not want and avoided life-prolonging care. Previous literature suggests age differences in patient goal attainment (comparisons between treatment preference and treatment received).[20,24] The likelihood of patients' *baseline* treatment preferences (i.e. life-prolonging vs. non life-prolonging), *matching* patients' care received (objective outcomes recorded in patients' charts) were compared across age groups. Patients were placed into 1 of 4 categories (See Figure): group 1 wanted life-prolonging care and received it; group 2 wanted life-prolonging care but did not receive it; group 3 did not want life-prolonging care but received it; group 4 did not want life-prolonging care and did not receive it. Successful goal attainers, like group 1, got what they wanted or, like group 4, avoided what they did not want. Unsuccessful
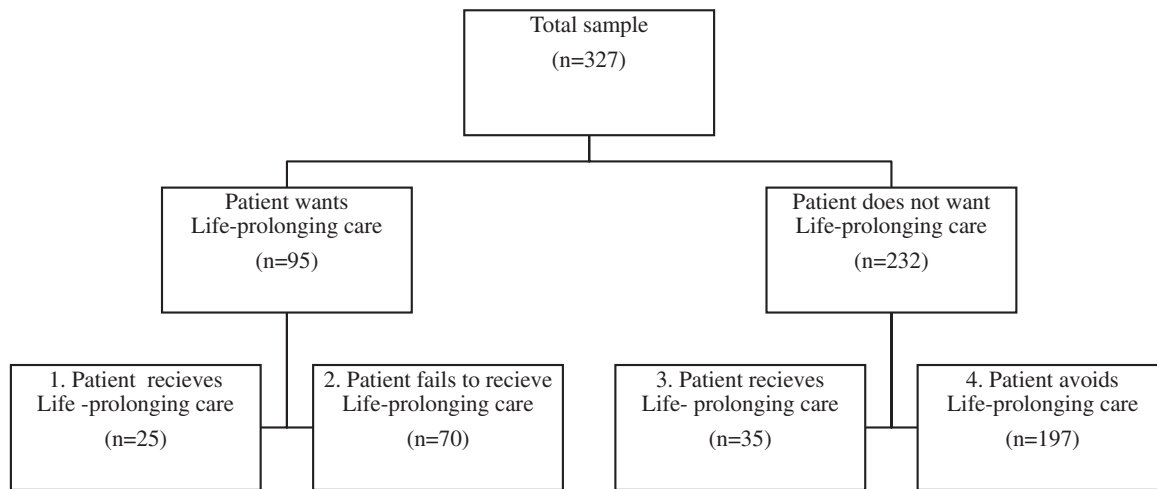
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                        ┌─────────────────────┐
                        │    Total sample     │
                        │      (n=327)        │
                        └─────────────────────┘
              ┌───────────────────┴────────────────────┐
    ┌───────────────────────┐              ┌───────────────────────┐
    │   Patient wants        │              │  Patient does not want │
    │  Life-prolonging care  │              │  Life-prolonging care  │
    │       (n=95)           │              │       (n=232)          │
    └───────────────────────┘              └───────────────────────┘
       ┌──────────┴──────────┐                ┌──────────┴──────────┐
┌──────────────┐  ┌──────────────┐   ┌──────────────┐  ┌──────────────┐
│1. Patient    │  │2. Patient    │   │3. Patient    │  │4. Patient    │
│recieves      │  │fails to      │   │recieves      │  │avoids        │
│Life-prolonging│ │recieve       │   │Life-prolonging│ │Life-prolonging│
│care          │  │Life-prolonging│  │care          │  │care          │
│(n=25)        │  │care (n=70)   │   │(n=35)        │  │(n=197)       │
└──────────────┘  └──────────────┘   └──────────────┘  └──────────────┘
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**FIG. 1.** Goal attainment grouping.

goal attainers (groups 2 and 3), while distinct patient populations, had care inconsistent with their treatment preferences.

### Statistical analysis

T-test, Cochran-Mantel-Haenszel, and χ2 test statistics were used, as appropriate, to test for significant differences in socio-demographic characteristics, recruitment sites and cancer type between the three age groups at baseline. Logistic regression models were used to compare age as a continuous variable and age groups by patients' treatment preferences, location of death and care received at end-of-life. All models were adjusted individually for confounders using backward selection. Each dependent variable was compared between age groups and also age as a continuous variable in a separate statistical model evaluating all variables listed in Table 1 as possible confounders. Based on the results, the least powerful non-statistically significant ($p > .05$) variables were removed from each estimated model and the analysis rerun. This process continued until remaining variables from Table 1 were all statistically significant ($p < .05$) confounders. Cox proportional hazards models were applied to examine differences in probability of survival between the age groups. The assumption of proportional hazards was tested and adequately met in this sample. All analyses were performed using SAS version 9.1 (SAS Institute, Inc., Cary, NC).

### Results

Sample characteristics are shown in Table 1. The mean age for older aged patients was 72.4 years (SD = 5.7 years), for middle-aged patients 55.8 years (SD = 5.7 years) and for younger aged patients 38.1 years (SD = 6.1 years). Most variables remained similar across age groups, though differences existed. Comparing patient treatment preference for life-prolonging care (Table 2) to treatment received (Table 3) yielded 4 goal attainment groups that fell into 1 of 2 categories: 1) successful goal attainment (N = 222); 2) unsuccessful goal attainment (N = 105). Successful goal attainers were patients who desired life-prolonging treatment and then got it (N = 25) or were patients who did not want and then avoided life-prolonging care (N = 197) (See Figure). *All age-comparisons* in tables 2, 3, and 4 were adjusted for possible confounders.

### Age differences in sample characteristics, dependent variables, and goal attainment

**Older aged vs middle-aged patients.** Older aged patients were more likely to receive lower Karnofsky scores but higher Charlson Comorbidity scale scores. Older aged patients were more likely to have health insurance and self-identify as Jewish than middle-aged patients (Table 1). Baseline treatment preference data (Table 2) showed that older and middle-aged patients did not differ significantly by treatment preference. In analysis of postmortem data (Table 3) care received by older aged and middle-aged patients did not differ significantly. Goal attainment analysis (Table 4) showed no significant differences between older patients' likelihood of being successful goal attainers compared to that of middle-aged patients with similar treatment preferences.

**Middle-aged vs younger aged patients.** Middle-aged and younger aged patients did not significantly differ on Karnofsky scores, but middle-aged patients were more likely to score higher on the Charlson Comorbidity scale (indicating relatively more comorbid conditions). Middle-aged patients were more likely to be White but less likely to be Hispanic than younger aged patients (Table 1). Analysis of treatment preference (Table 2) showed that middle-aged patients were less likely to prefer life-prolonging care or use of a ventilator to extend life than younger aged patients. In analysis of postmortem data (Table 3) it was found that middle-aged patients were less likely to have received life-prolonging care involving a feeding tube than younger aged patients. Goal attainment analysis (Table 4) showed that middle-aged patients initially wanting life-prolonging care were *less* likely than younger aged patients, with similar treatment preferences, to receive it. Conversely, middle-aged patients not wanting life-prolonging care were *more* likely than younger aged patients, with similar preferences, to successfully avoid life-prolonging care.

**Older aged vs younger aged patients.** Older aged patients did not significantly differ from younger aged patients

TABLE 1. CHARACTERISTICS OF SAMPLE PATIENTS ($N = 396$)

| Sociodemographic variables | Descriptive statistics | | | | | | | | Comparative analysis | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total sample n = 396 | | Older Aged (≥65) n = 126 | | Middle-aged (45–64) n = 214 | | Younger aged (20–44) n = 56 | | t or χ² | DF | p-value |
| Age, M (SD) | 58.6 | (12.5) | 72.4 | (5.7) | 55.8 | (5.7) | 38.1 | (6.1) | | | |
| Education, M (SD) | 12.6 | (4.0) | 12.3 | (5.1) | 12.9 | (3.3) | 12.5 | (3.6) | 0.9 | 2 | 0.41* |
| Karnofsky, M (SD) | 64.9 | (16.1) | 61.9 | (16.0)[a] | 66.9 | (15.6)[a] | 64.0 | (17.5) | 3.8 | 2 | **0.02** |
| CC M (SD) | 8.3 | (2.7) | 10.0 | (2.7)[ac] | 8.0 | (2.1)[ab] | 5.9 | (1.9)[bc] | 65.7 | 2 | **<0.001**[†] |
| Male, n (%) | 221 | (55.8) | 75 | (59.5) | 118 | (55.1) | 28 | (50.1) | 1.5 | 2 | 0.47 |
| Health Insurance, n (%) | 239 | (61.9) | 95 | (77.9)[ac] | 116 | (55.8)[a] | 28 | (50.0)c | 19.9 | 2 | **<0.001** |
| Medicare, n (%) | 170 | (43.9) | 102 | (84.3)[ac] | 48 | (22.8)[a] | 20 | (36.4)[c] | 119.8 | 2 | **<0.001** |
| Married, n (%) | 244 | (62.4) | 75 | (61.0) | 134 | (63.2) | 35 | (62.5) | 0.2 | 2 | 0.92 |
| Race, n (%) | | | | | | | | | 25.0 | 8 | **0.002** |
| White | 260 | (65.7) | 92 | (73.0)[c] | 144 | (67.3)[b] | 24 | (42.9)[cb] | 16.2 | 2 | **<0.001** |
| Hispanic | 58 | (14.7) | 18 | (14.3)[c] | 23 | (10.8)[b] | 17 | (30.4)[cb] | 13.7 | 2 | **0.001** |
| Black | 7 | (17.9) | 14 | (11.1) | 44 | (20.6) | 13 | (23.2) | 6.1 | 2 | **0.05** |
| Asian | 5 | (1.3) | 2 | (1.6) | 2 | (0.9) | 1 | (1.8) | 0.4 | 2 | 0.81 |
| Other | 2 | (0.5) | 0 | (0.0) | 1 | (0.7) | 1 | (4.0) | 4.2 | 2 | 0.13 |
| Religion, n (%) | | | | | | | | | 20.8 | 14 | 0.11 |
| Catholic | 145 | (36.6) | 50 | (39.7) | 74 | (34.6) | 21 | (37.5) | 0.9 | 2 | 0.63 |
| Protestant | 70 | (17.7) | 25 | (19.8) | 40 | (18.7) | 5 | (8.9) | 3.5 | 2 | 0.17 |
| Jewish | 20 | (5.1) | 12 | (9.5)[a] | 7 | (3.3)[a] | 1 | (1.8) | 7.9 | 2 | 0.02 |
| Muslim | 5 | (1.3) | 2 | (1.6) | 3 | (1.4) | 0 | (0.0) | 0.9 | 2 | 0.65 |
| Pentecostal | 9 | (2.3) | 2 | (1.6) | 5 | (2.3) | 2 | (3.6) | 0.7 | 2 | 0.71 |
| Baptist | 57 | (14.4) | 13 | (10.3) | 34 | (15.9) | 10 | (17.9) | 2.6 | 2 | 0.27 |
| Other | 71 | (17.9) | 19 | (15.1) | 37 | (17.3) | 13 | (26.8) | 3.7 | 2 | 0.15 |
| None | 19 | (4.8) | 3 | (2.4) | 14 | (6.5) | 2 | (3.6) | 3.2 | 2 | 0.20 |
| Site, n (%) | | | | | | | | | 52.9 | 12 | **<0.001** |
| Yale | 81 | (20.5) | 24 | (19.1) | 46 | (21.5) | 11 | (19.6) | 0.3 | 2 | 0.87 |
| VACT | 25 | (6.3) | 12 | (9.5) | 12 | (5.6) | 1 | (1.8) | 4.3 | 2 | 0.12 |
| MSK | 30 | (7.6) | 11 | (8.7) | 15 | (7.0) | 4 | (7.1) | 0.4 | 2 | 0.83 |
| Simmons | 32 | (8.1) | 10 | (7.9) | 15 | (7.0) | 7 | (12.5) | 1.8 | 2 | 0.40 |
| Parkland | 152 | (38.4) | 27 | (21.4)[ac] | 94 | (43.9)[a] | 31 | (55.4)[c] | 24.7 | 2 | **<0.001** |
| DFCI/MGH | 9 | (2.3) | 1 | (0.8) | 7 | (3.3) | 1 | (1.8) | 2.2 | 2 | 0.33 |
| NHOH | 67 | (16.9) | 41 | (32.5)[ac] | 25 | (11.7)[a] | 1 | (1.8)[c] | 36.0 | 2 | **<0.001** |
| Diagnosis, n (%) | | | | | | | | | 12.5 | 10 | 0.25 |
| Lung cancer | 85 | (21.5) | 28 | (22.2) | 50 | (23.4) | 7 | (12.5) | 3.5 | 2 | 0.18 |
| Colorectal cancer | 57 | (14.8) | 18 | (14.3) | 32 | (15.0) | 7 | (12.5) | 0.3 | 2 | 0.87 |
| Breast cancer | 42 | (10.6) | 8 | (6.4) | 26 | (12.2) | 8 | (14.3) | 3.4 | 2 | 0.19 |
| Pancreatic cancer | 37 | (9.6) | 16 | (12.7) | 19 | (8.9) | 2 | (3.6) | 4.4 | 2 | 0.11 |
| Other GI cancer | 54 | (13.6) | 16 | (12.7) | 28 | (13.1) | 10 | (17.9) | 0.7 | 2 | 0.70 |
| Other cancers | 121 | (30.6) | 40 | (31.8) | 59 | (27.6) | 22 | (39.3) | 3.0 | 2 | 0.22 |

CC -Charlson Comorbidity; VACT -Veteran's Association of Connecticut; MSK -Memorial Sloan Kettering; DFCI -Dana Farber Cancer Institute; MGH -Massachusetts General Hospital; NHOH -New Hampshire Oncology-Hematology; GI -Gastrointestinal.

*All outcomes for continuous variables were calculated using the t-test.

[†]All dichotomous comparisons were calculated using the Fisher Chi square test. If expected cell count was less than 5, the Cochran-Mantel-Haenszel General Association Statistics were used.

[a]indicates a significant (p < .0167) difference between older aged and middle-aged patients.

[b]indicates a significant (p < .0167) difference between middle-aged and younger aged patients.

[c]indicates a significant (p < .0167) difference between older aged and younger aged patients.

in their Karnofsky scores but were more likely to score higher on the Charlson Comorbidity scale. Older aged patients were more likely to have health insurance than younger aged patients. Older aged patients were more likely to be White but less likely to be Hispanic than younger aged patients. Analysis of baseline treatment preference data (Table 2) showed that older patients were less likely to desire life-prolonging treatment involving a ventilator than younger aged patients. Analysis of postmortem data (Table 3) shows that older patients were less likely to receive ventilator therapy or resus-

citation to sustain life. Goal attainment analysis (Table 4) showed that older patients wanting life-prolonging care were less likely than younger aged patients, with similar treatment preferences, to receive it (Table 4).

**Age as a continuous variable.** Using age as a continuous variable, preference to extend life (O.R. 0.97; p < .01), to do so with a ventilator (O.R. 0.97; p = 0.001), or with chemotherapy (O.R. 0.98; p = .01) was decreased with age. For treatment received likelihood of an ICU death (O.R. 0.96;

TABLE 2. AGE GROUP COMPARISONS OF BASELINE PATIENT TREATMENT PREFERENCES ($N=396$)

| | | | | | | | | | Unadjusted descriptive statistics | | | | | | Adjusted group comparisons[¶] | | | | | |
| | | | | | | | | | | | | | | | Older aged vs middle-aged | | Middle-aged vs younger aged | | Older aged vs younger aged | |
| Baseline variables | Total sample n=396 | | Older aged (≥65) n=126 | | Middle-aged (45–64) n=214 | | Younger aged (20–44) n=56 | | | | | | | | | | | | | |
| Pt Treatment Preference[‡] | n | (%) | n | (%) | n | (%) | n | (%) | OR | | (CI) | | OR | | (CI) | | OR | | (CI) | |
| Ventilator | 86 | (24.2) | 23 | (20.7) | 42 | (21.8) | 21 | (40.4) | 0.93 | | (0.42-1.65) | | **0.41** | | **(0.21-0.79)** | | **0.39** | | **(0.19-0.79)** | |
| Chemo 1 wk before death | 194 | (55.0) | 57 | (52.3) | 103 | (53.7) | 34 | (65.4) | 1.29 | | (0.75-2.22) | | 0.75 | | (0.37-1.53) | | 0.78 | | (0.37-1.66) | |
| Extend life[§] | 95 | (29.1) | 29 | (27.9) | 43 | (24.6) | 23 | (47.9) | 1.34 | | (0.74-2.41) | | **0.32** | | **(0.16-0.64)** | | 0.49 | | (0.23-1.02) | |
| Against ICU death | 131 | (37.1) | 46 | (42.2) | 70 | (36.3) | 15 | (29.4) | 0.85 | | (0.48-1.51) | | 1.18 | | (0.57-2.41) | | 0.95 | | (0.41-2.21) | |
| Pt Completed DNR Order | 149 | (33.2) | 51 | (46.0) | 79 | (40.9) | 19 | (36.5) | 1.51 | | (0.67-1.98) | | 1.08 | | (0.56-2.08) | | 0.83 | | (0.34-2.02) | |
| Tell Life Expectancy | 262 | (72.8) | 81 | (72.3) | 148 | (75.5) | 33 | (63.5) | 0.82 | | (0.49-1.40) | | 1.99 | | (1.00-3.95) | | 1.38 | | (0.67-2.85) | |

Pt-Patient; psych-psychological; wk-week; chemo-chemotherapy; DNR-Do Not Resuscitate; ICU- Intensive Care Unit; TI –Terminal Illness. All values in bold and italicized are at least $p < .05$.

[‡]Patients were asked a series of questions regarding their preferences for treatment at the end of life. Desiring the use of a ventilator to extend life for any period of time was recorded as preferring aggressive care. Desiring non palliative chemotherapy to extend life for one week or less was considered preference for aggressive care. Against ICU death was a dichotomous measuring of patients' perception of dying in an ICU setting as a bad death. Tell Life Expectancy assessed patients' desire to know exactly when they would die if that information was available.

[§]Complete data on patient preference to extend life (N = 327) fell short of the total sample size (N = 396). Extend life (If you could choose, would you prefer a course of treatment that focused on extending life as much as possible, even if it meant more pain and discomfort)

[¶]Adjustments were made by running all Table 1 variables as possible confounders using backwards selection.

$p < .05$) was decreased marginally with age while likelihood of a nursing home death (O.R. 1.06; $p < 0.05$) or hospice death (O.R. 1.03; $p < .05$) was increased with age. Likelihood of a patient wanting and then receiving life-prolonging care (OR 0.94; $p < .001$) was decreased with age while likelihood of not wanting and avoiding life-prolonging care (OR 1.02; $p = .017$) was increased with age.

## Discussion

This study revealed that older and middle-aged advanced cancer patients desired and received less life-prolonging care than younger aged cancer patients. Younger aged patients wanting life-prolonging care were more likely to receive it compared to middle-aged or older adults. But, younger aged

TABLE 3. AGE GROUP COMPARISONS OF END-OF-LIFE CARE ($N=396$)

| | | | | | | | | | Unadjusted descriptive statistics | | | | | | Adjusted group comparisons[†] | | | | | |
| | | | | | | | | | | | | | | | Older aged vs middle-aged | | Middle-aged vs younger aged | | Older aged vs younger aged | |
| Postmortem variables | Total sample n=396 | | Older aged (≥65) n=126 | | Middle-aged (45–64) n=214 | | Younger aged (20–44) n=56 | | | | | | | | | | | | | |
| Life-Prolonging Treatment | n | % | n | % | n | % | n | % | OR | | (CI) | | OR | | (CI) | | OR | | (CI) | |
| ICU | 37 | (9.4) | 9 | (7.2) | 20 | (9.4) | 8 | (14.3) | 0.81 | | (0.35-1.88) | | 0.57 | | (0.23-1.42) | | **0.29** | | **(0.09-0.92)** | |
| Ventilator | 28 | (7.1) | 5 | (4.0) | 17 | (8.0) | 6 | (10.7) | 0.51 | | (0.18-1.43) | | 0.72 | | (0.27-1.93) | | **0.27** | | **(0.07-1.00)** | |
| Chemotherapy | 25 | (6.3) | 8 | (6.4) | 14 | (6.5) | 3 | (5.4) | 0.51 | | (0.18-1.46) | | 1.46 | | (0.40-5.40) | | 1.20 | | (0.31-4.69) | |
| Feeding tube | 31 | (7.9) | 10 | (8.0) | 13 | (6.1) | 8 | (14.6) | 1.33 | | (0.57-3.13) | | **0.38** | | **(0.15-0.98)** | | 0.51 | | (0.19-1.37) | |
| Resuscitation | 31 | (4.1) | 1 | (0.8) | 10 | (4.7) | 5 | (8.9) | 0.16 | | (0.02-1.29) | | 0.50 | | (0.17-1.54) | | **0.08** | | **(0.01-0.72)** | |
| Location of Death | | | | | | | | | | | | | | | | | | | | |
| ICU | 28 | (7.1) | 5 | (4.0) | 15 | (7.0) | 8 | (14.3) | 0.59 | | (0.20-1.71) | | 0.41 | | (0.16-1.07) | | **0.20** | | **(0.06-0.70)** | |
| Hospital | 86 | (21.7) | 22 | (17.5) | 48 | (22.4) | 16 | (28.6) | 0.72 | | (0.40-1.27) | | 0.70 | | (0.35-1.37) | | 0.53 | | (0.25-1.11) | |
| Home | 219 | (55.3) | 71 | (56.4) | 119 | (55.6) | 29 | (51.8) | 1.00 | | (0.61-1.65) | | 1.37 | | (0.73-2.57) | | 1.24 | | (0.60-2.57) | |
| Nursing Home | 16 | (4.0) | 7 | (5.6) | 9 | (4.2) | 0 | (0.0) | 1.59 | | (0.55-4.62) | | ----- | | ------------ | | ----- | | ------------ | |
| Hospice | 47 | (11.9) | 21 | (16.7) | 23 | (10.8) | 3 | (5.4) | 1.45 | | (0.72-2.92) | | 2.03 | | (0.53-7.76) | | 4.09 | | (0.91-18.33) | |
| Survival* | mdn | (Q₁-Q₃) | mdn | (Q₁-Q₃) | mdn | (Q₁-Q₃) | mdn | (Q₁-Q₃) | HR | | (CI) | | (CI) | | HR | | HR | | (CI) | |
| Survival time (in days) | 146 | (62-312) | 125 | (68-297) | 157 | (61-313) | 143 | (60-347) | 0.88 | | (0.68-1.15) | | 1.07 | | (0.78-1.49) | | 0.74 | | (0.50-1.08) | |

ICU -Intensive Care Unit; EOL-End of Life; Pt-Patient; psych-psychological; mdn-Median $Q_1$ -Lower Quartile (25%); $Q_3$ -Upper Quartile (75%); HR-Hazard Ratio.

All values in bold are at least $p < .05$.

*Survival time was measured from the baseline assessment of advanced cancer patients with a 6 month prognosis.

[†]Adjustments were made by running all Table 1 variables as possible confounders using backwards selection.

Table 4. Age Group Comparisons of End-of-Life Goal Attainment (N = 327)*

| Baseline variables | Unadjusted descriptive statistics | | | | | | | | Adjusted group comparisons† | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | Total sample n = 327 | | Older aged (≥65) n = 104 | | Middle-aged (45–64) n = 175 | | Younger aged (20–44) n = 48 | | Older aged vs middle-aged | | Middle-aged vs younger aged | | Older aged vs younger aged | |
| **Goal Attainment** | n | (%) | n | (%) | n | (%) | n | (%) | OR | CI | OR | CI | OR | CI |
| Successful Goal Attainment | 222 | (65.9) | 70 | (67.3) | 119 | (68.0) | 33 | (68.8) | 0.76 | (0.42-1.34) | 1.03 | (0.49-2.13) | 0.84 | (0.39-1.84) |
| Wanted and Received LPT | 25 | (7.4) | 6 | (5.8) | 9 | (5.1) | 10 | (20.8) | 1.00 | (0.34-2.98) | **0.21** | **(0.08-0.54)** | **0.23** | **(0.08-0.68)** |
| Did Not Want and Avoided LPT | 197 | (58.5) | 64 | (61.5) | 110 | (62.9) | 23 | (47.9) | 0.90 | (0.53-1.53) | **2.38** | **(1.20-4.75)** | 1.74 | (0.87-3.47) |
| Unsuccessful Goal Attainment | 105 | (31.2) | 34 | (32.7) | 56 | (32.0) | 15 | (31.3) | 1.33 | (0.74-2.36) | 0.98 | (0.47-2.03) | 1.25 | (0.58-2.70) |
| Wanted But Did Not Receive LPT | 70 | (20.8) | 23 | (22.1) | 34 | (19.4) | 13 | (27.1) | 1.27 | (0.14-0.70) | 0.62 | (0.29-1.31) | 0.86 | (0.37-2.02) |
| Did Not Want But Received LPT | 35 | (10.4) | 11 | (10.6) | 22 | (12.6) | 2 | (4.2) | 0.82 | (0.38-1.77) | 3.31 | (0.75-14.60) | 3.29 | (0.64-16.83) |

GA- Goal Attainment; LPT- Life-Prolonging Treatment.

All values in bold are at least p < .05.

Goal Attainment has 4 categories: 1) patient wants and receives life-prolonging treatment 2) patient wants but does not receive life-pronging treatment 3) patient does not want but fails to avoid life-prolonging treatment 4) Patient does not want and avoids life-prolonging treatment. Patient in categories 1 & 4 were grouped as successful Goal Attainment while groups 2 & 3 were grouped as unsuccessful Goal Attainment.

*Goal Attainment sample was limited by sample size of the "Extend Life" measure of patient treatment preference (N = 327).

†Adjustments were made by running all Table 1 variables as possible confounders using backwards selection.

patients not desiring life-prolonging care were *less* likely to receive care consistent with their treatment preference compared to middle-aged or older adults.

The original hypothesis that advanced cancer patient age would be associated with: a) less desire for life-prolonging treatment; b) a lower likelihood of receiving life-prolonging treatment; and c) increased goal attainment was not completely supported by the results. As expected, middle and older aged patients were less likely to desire and receive life-prolonging treatment than younger aged patients. Previous research indicated that older and middle-aged patients would differ in desire for, or receipt of, life-prolonging care.[9–20] These differences were not present using age as a categorical variable but were present across the full sample using age as a continuous variable. The age groups are particularly helpful in comparing CwC to prior work done on the SUPPORT study.[17,19,20] The CwC, is a more recent study, indicating possible cohort effects of demographic and or practice pattern shifts over time regarding interventions in Table 2. Additionally, the CwC, recruited heavily from outpatient facilities. Advanced cancer patients, particularly those over 65 years old, often receive outpatient cancer care instead of inpatient hospital care. This study's results might be more applicable to current populations of advanced cancer patients; although replication of these findings among the inpatient advanced cancer patient subgroup is needed to determine the extent these findings can be generalized.

Goal attainment compares individual patient preference to patient outcome; *successful* goal attainers get what they want (group 1) or avoid what they do not want (group 4) (See Figure). Successful goal attainment was differentiated into subgroups to determine if age affected the patient's likelihood of getting wanted care or avoiding unwanted

care. Among patients wanting to *avoid* life-prolonging care, the likelihood of care consistent with patients' treatment preferences *increased* with age. But, among patients preferring life-prolonging care, the likelihood of care consistent with patients' treatment preference *decreased* with age. Stark age differences between successful goal attainment subgroups suggest that physicians' age biases may influence the likelihood of patient care being consistent with treatment preferences.[17]

Previous studies show physicians of elderly advanced cancer patients can be inconsistent in their understanding of patients' treatment preference.[26–29] Older aged patients wanting life-prolonging care and young patients not wanting it, challenges the societal norms that a young persons' death is unacceptable relative to the acceptability of an older person's death. In this study, treatment differed by patient preference and age despite adjusting for confounders like Karnofsky and Charlson comorbidity. Age bias, while not a surprising conclusion, needs further examination. Although not honoring known patient preferences would appear in conflict with notions that honoring patient treatment preference is essential to quality end-of-life care, honoring futile treatment preferences could potentially cause harm by increasing suffering among patients and families. Research is needed to determine how age bias affects quality-of-death outcomes in the four goal attainment subgroups. Results did not fully support the hypothesis that both subgroups of goal attainment would increase with age, but they revealed groups of patients at risk of receiving care inconsistent with treatment preference. Previous arguments asserted that care consistent with patient's wishes, aggressive or palliative, is an ethical imperative and important for ensuring a good death.[30–35] A good death, free from avoidable distress and suffering and consistent with

patients' wishes,[34] is important for patients, their families and the health care system.[36] Researching subgroups defined by age and treatment preference might help to predict quality-of-death.

This study has some noteworthy limitations. Although power to detect a difference by age group for the low rate dichotomous outcomes (e.g., relative rarity of resuscitation) was limited, significant associations were still observed, demonstrating the robustness of the results. Although the cohort studied in this paper had a lower education level than surviving CwC participants and education was included as a potential confounder in data analysis models, the lower level of education among CwC nonparticipants highlights the need for replication in less educated samples. A single assessment determined patient preference, which could change over time. Forthcoming research within the CwC patient sample indicates that treatment preference did not significantly change with survival time from baseline assessments nor with Karnofsky scores (Wright et al., in press).

Overall results for goal attainment remained stable among patients who acknowledge that they are dying; demonstrating the stability of patient treatment preference over time in the CwC dataset.[37] Recent studies have shown small, but significant decreases in willingness to undergo life-prolonging therapy among critically ill geriatric patients.[35] Studies have also shown that patient treatment preferences and course of treatment vary over time.[38] These studies were not specific for advanced cancer patients and even acknowledged significant differences between cancer and non-cancer patients (i.e. decreased desire for burdensome care, lower proportions of inconsistent treatment trajectories, and greater likelihood of receiving preferred aggressive care) in their patient samples.[34,38] Cancer is distinct from many diseases; it has a "death sentence" connotation that could affect advanced cancer patients' treatment preferences. More cancer specific research on treatment preference and goal attainment is needed to define advanced cancer patients with respect to age differences.

Cancer deaths are on a trajectory to become the leading cause of death among older adults, increasing the importance of identifying advanced cancer patients at greatest risk for a bad death. To that end, the benefits of honoring patient treatment preferences warrant further investigation. Successful goal attainers and unsuccessful goal attainers are two categories comprised of four distinct patient populations. Among non successful goal attainers it is important to note that patient autonomy in medicine is defined by the right to decline treatment, not by a right to receive desired treatment. Further research is needed to differentiate these four subgroups by their associations with patient outcomes like quality-of-life and quality-of-death. Despite limitations, this study's identification of at risk advanced cancer patient populations offers new insight and opportunities for improving end-of-life care. Educating clinicians about the existence, influence and prevalence of age bias on end-of-life care offers a first step towards limiting its potentially negative effects on patient care. Awareness of the increased risks for misinterpreting certain patients' treatment preference (e.g. older patients wanting life-prolonging care and younger patients not wanting life-prolonging care) could help identify such patients and help physicians be prepared to guide conversations on end-of-life treatment options with them.

## Author Disclosure Statement

No competing financial interests exist for any of the authors.

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