Quality of Life of Caregivers of Older Patients with Advanced Cancer

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See related editorial by Huang et al. in this issue.

OBJECTIVES: To evaluate the relationships between aging-related domains captured by geriatric assessment (GA) for older patients with advanced cancer and caregivers' emotional health and quality of life (QOL).

DESIGN: In this cross sectional study of baseline data from a nationwide investigation of older patients and their caregivers, patients completed a GA that included validated tests to evaluate eight domains of health (eg, function, cognition).

SETTING: Thirty-one community oncology practices throughout the United States.

PARTICIPANTS: Enrolled patients were aged 70 and older, had one or more GA domain impaired, and had an incurable solid tumor malignancy or lymphoma. Each could choose one caregiver to enroll.

MEASUREMENTS: Caregivers completed the Generalized Anxiety Disorder-7, Distress Thermometer, Patient Health Questionnaire-2 (depression), and Short Form Health Survey-12 (SF-12 for QOL). Separate multivariate linear or logistic regression models were used to examine the association of the number and type of patient GA impairments with caregiver outcomes, controlling for patient and caregiver covariates.

RESULTS: A total of 541 patients were enrolled, 414 with a caregiver. Almost half (43.5%) of the caregivers screened positive for distress, 24.4% for anxiety, and 18.9% for depression. Higher numbers of patient GA domain impairments were associated with caregiver depression (adjusted odds ratio [aOR] = 1.29; $P < .001$], caregiver physical health on SF-12 (regression coefficient [β] = −1.24; $P < .001$), and overall caregiver QOL (β = −1.14; $P < .01$). Impaired patient function was associated with lower caregiver QOL (β = −4.11; $P < .001$). Impaired patient nutrition was associated with caregiver depression (aOR = 2.08; $P < .01$). Lower caregiver age, caregiver comorbidity, and patient distress were also associated with worse caregiver outcomes.

CONCLUSION: Patient GA impairments were associated with poorer emotional health and lower QOL of caregivers. J Am Geriatr Soc 67:969–977, 2019.

Key words: caregivers; geriatric assessment; emotional health; quality of life

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#Arti Hurria is now deceased.

The number of caregivers of older adults with cancer is on the rise.[1] An informal caregiver was defined as a relative, partner, or friend who provides assistance across multiple areas of functioning and living.[2,3] Most older patients with cancer live at home and depend on informal caregivers for support with cancer treatment, symptom management, and activities of daily living.[4,5] Clinicians often focus on the health of the patients, whereas informal caregivers are subjected to a significant amount of stress that can adversely affect their own physical and emotional health.[6–8]

As the cancer progresses, the level of care burden increases for the caregiver and can profoundly worsen caregivers' quality of life (QOL).[9,10] The role of caregiving itself impacts the emotional health of the caregivers; many studies demonstrate that caregivers experience even more emotional health challenges (eg, anxiety, depression, distress) than the patients they are caring for.[11–14] Furthermore, caregiver distress increases as the patient with cancer declines functionally.[15]

The geriatric assessment (GA) provides a framework that can be incorporated into clinical care to improve decision making and guide interventions for vulnerable older adults with cancer.[16] The GA assesses, with patient-reported and objective validated measures, aging-related domains known to influence morbidity and mortality in older patients with cancer: function, physical performance, comorbidities, polypharmacy, cognition, nutrition, psychological health, and social support.[17] A 2015 Delphi consensus statement from geriatric oncology experts[18] concluded that all of these GA domains are useful for guiding nononcologic interventions and cancer treatment decisions. Eliciting support from caregivers is often a GA-guided recommendation for older patients with cancer.[18]

Although previous studies demonstrated that caregiving for patients with cancer is burdensome,[3,7,19–21] no large study has evaluated if impaired GA domains in older patients with advanced cancer are associated with caregivers' emotional health and QOL in a national cohort. In this analysis of baseline data from a large multicenter study that enrolled patients aged 70 and older with advanced cancer who had at least one impaired GA domain, we describe the characteristics of study patients with a caregiver and evaluate the relationships between impaired GA domains of the patients with the emotional health and QOL of their caregivers. Our primary hypothesis was that a higher number of impaired GA domains would be associated with poorer caregiver emotional health and QOL. These results will inform clinical practice and the development of interventions designed to improve the QOL of both frail older patients with advanced cancer and their caregivers.

METHODS

Study Design

This cross-sectional study used baseline data from older patients with advanced cancer and their caregivers from 31 community oncology practice clusters enrolled in the Improving Communication in Older Cancer Patients and Their Caregivers (COACH) study (clinicaltrials.gov NCT02107443; URCC13070) conducted through the University of Rochester (UR) National Cancer Institute (NCI) Community Oncology Research Program (NCORP) Research Base between October 2014 and April 2017. COACH is a cluster randomized trial to evaluate if a GA summary plus GA-guided recommendations improve communication between older patients with cancer, their oncologists, and their caregivers about age-related concerns.[22]

Study Participants

Patients were eligible if they were diagnosed with an advanced solid tumor or lymphoma, were considering or currently receiving any type of cancer treatment, and had an adequate understanding of the English language. Patients had at least one GA domain impairment excluding polypharmacy (due to the known high prevalence of polypharmacy in functionally fit patients); this eligibility criterion was designed to capture patients who are frailer than the fit older patients traditionally enrolled in clinical trials.[23] If patients did not have decision-making capacity, a healthcare proxy was required to sign the consent. One caregiver was chosen by the patient to enroll using this question: "Is there a family member, partner, friend, or caregiver (age 21 or older) with whom you discuss or who can be helpful in health-related matters?" It was not required for a patient to have a caregiver to participate. Caregivers had to be 21 years of age or older, have an adequate understanding of English, and be able to provide informed consent. This study was approved by the UR Research Subjects Review Board and review boards of each NCORP affiliate.

Study Procedures and Measures

Surveys were used to obtain sociodemographic characteristics of each participant and caregiver and to assess their health. Clinical information was collected by research staff. At baseline, patients completed a GA consisting of validated measures to evaluate the health of older adults in eight domains: physical performance, functional status, comorbidity, cognition, nutrition, social support, polypharmacy, and psychological status.[18] If a patient met a cutoff score for a measure, they were considered impaired in that domain (Supplementary Table S1, Table 1). At baseline, caregivers completed multiple validated measures of emotional health and QOL including the two-item Patient Health Questionnaire (PHQ-2), Generalized Anxiety Disorder 7-Item Scale (GAD-7), Distress Thermometer, and Short Form Health Survey-12 (SF-12). A score of 2 on the PHQ-2 suggested depression; a score of 5 or higher on the GAD-7 suggested anxiety.[24–27] Distress was measured for both patients and caregivers using a distress thermometer with a score of 4 or higher (0-10) suggesting at least moderate distress.[28] QOL was captured with total SF-12 score and SF-12 subscales that capture mental and physical health; SF-12 scores and subscales range from 0 to 100, with higher scores indicating better QOL, mental health, and physical health.[29]

Our primary independent variables were number of impaired patient GA domains and specific GA domain impairments. The number of GA domain impairments was the sum of all GA domains that were impaired (range = 1-8).[23]

Statistical Analysis

Descriptive statistics were used to examined demographics, GA impairments, and clinical information. Bivariate analyses compared characteristics of patients enrolled with a caregiver with those patients without one. Bivariate analyses were also used to select significant caregiver and patient covariates, based on $P < .1$, to enter a stepwise regression model. The final multivariate models included information from patient and caregiver dyads. These models included covariates with $P < .1$ from stepwise procedures in addition to caregiver age, sex, race, and patient cancer type. Multivariate logistic regressions and linear regressions were performed for binary outcomes (depression, anxiety, and distress) and continuous outcomes (physical health, mental

Table 1. Demographics, Clinical Characteristics, and Geriatric Assessment Impairments of Patients with Caregivers[a]

Variables	Patients with caregivers (n = 414) N (%)	Variables	Patients with caregivers (n = 414) N (%)
Age, mean (SD), y	76.8 (5.4)	Physical performance	389 (94.0)
70-79	299 (72.4%)	TUG > 13.5 s	161 (39.0)
80-89	103 (24.9%)	SPPB ≤ 9 points	325 (78.5)
≥90	11 (2.7%)	Falls history ≥ 1 in previous 6 mo	107 (25.8)
Sex		OARS Physical Health ≥ 1	316 (76.3)
Female	176 (42.6%)	Functional status	254 (61.4)
Male	237 (57.4%)	ADL ≥ 1	115 (27.8)
Race/Ethnicity		IADLs ≥ 1	243 (58.7)
Non-Hispanic white	371 (89.8%)		
African American	30 (7.3%)		
Others	12 (2.9%)	Comorbidity	
Education		OARS Comorbidity ≥ 3 or ≥ 1	263 (63.5)
<High school	57 (13.8%)		
High school graduate	142 (34.4%)		
Some college or above	214 (51.8%)		
Income		Cognition	144 (34.8)
≤$50 000	193 (46.8%)	BOMC ≥ 11 or	12 (2.9)
>$50 000	219 (53.2%)	Mini-Cog 0 words recalled or 1-2 words	
Living arrangements		recalled and abnormal clock	144 (34.8)
Independent living (more than one story)	172 (41.7%)		
Independent living (one story)	223 (54.1%)	Nutrition	259 (62.6)
		BMI < 21.0 kg/m^2 or	45 (10.9)
Others	17 (4.1%)	Weight loss > 10% in the past 6 mo or	62 (15.0
Cancer type		MNA ≤ 11 points	248 (59.9)
Gastrointestinal	103 (24.9%)	Social support	
Lung	109 (26.4%)	OARS Medical Social Support ≥ 1	91 (22.0)
Other	201 (48.7%)		
Cancer stage			
Stage III	35 (8.5%)	Polypharmacy	350 (84.5)
Stage IV	365 (88.4%)	Polypharmacy Log ≥ 5 regularly	
Others	13 (3.1%)	scheduled prescription or medications or	
Cancer treatment		Polypharmacy high-risk drug review	
Any treatment (≥1)	404 (97.8%)	≥1 high-risk medication or	
Multiple treatments (≥2)	136 (32.9%)	Labs Creatinine clearance or GFR <60	
Chemotherapy	282 (68.3%)	mL/min	
Monoclonal antibodies	102 (24.7%)	Psychological status	112 (27.1)
Hormonal treatment	66 (16.0%)	GAD-7 ≥ 10 points	39 (9.4)
Orally administered cancer treatment	73 (17.7%)	GDS ≥ 5 points	100 (24.2)
Radiation therapy	40 (9.8%)		

Abbreviations: ADLs, activities of daily living; BMI, body mass index; BOMC, Blessed Orientation Memory Concentration test; GAD-7, General Anxiety Disorder 7-item scale; GDS = Geriatric Depression Scale; GFR, glomerular filtration rate; IADLs, instrumental activities of daily living; MNA, mini nutritional assessment; OARS, Older Americans Resources and Services; SPPB, Short Physical Performance Battery; TUG, timed up-and-go.
[a]There were some missing data (no more than six missing data points for any question); percentages and statistics are calculated from available data.

health, and total score on SF-12), respectively. In the models evaluating the number of patient GA domain impairments as primary variable of interest, the number was included as a continuous variable. For the models evaluating specific GA domains, each domain was included if associated with the outcome at $P < .1$. Likelihood ratio tests from linear or generalized mixed models with practice oncology site as random effects were not statistically significant (all $P > .1$), suggesting a weak clustering effect of practice site; therefore, the results from the original multivariate models were presented. Two-sided $P < .05$ were considered statistically significant. All analyses were conducted with SAS v.9.4 (SAS Institute Inc., Cary, NC) and Stata v.13.0 (StataCorp LLC, College Station, TX).

RESULTS

Patient Demographics

In total, 414 eligible older patients with advanced cancer who were enrolled with a caregiver were included in this analysis. On average, the patients were 76.8 years of age (standard deviation [SD] = 5.4; range = 70-96 y). Most of the cohort was non-Hispanic white (89.8%) and had stage IV cancer (88.4%). The mean number of GA domain impairments for the sample was 4.48 (SD = 1.53); 89.6% had three or more domains impaired (Supplementary Figure S1). More than 80% of the patients had polypharmacy, and nearly all the patients had physical performance

problems (94.0%) (Table 1). Just over one-third (34.8%) of patients had an abnormal screen for cognitive impairment, 63.5% had significant comorbidities, and 27.1% had a positive screen for depression or anxiety.

Caregiver Demographics

The average caregiver age was 66 years (range = 26-92 y); 48.9% of caregivers were aged 70 and older (Table 2). Most of the caregivers were female (75.4%), non-Hispanic white (89.8%), and the patient's spouse or cohabiting partner (67.2%). Close to 40% of caregivers had significant comorbidities of their own; 43.5% reported moderate to high distress, 18.9% reported depressive symptoms, and 24.4% were anxious. Mean SF-12 scores were 98.0 (SD = 14.2); 46.9 (SD = 10.5) for the physical health subscale and 51.1 (SD = 9.8) for the mental health subscale.

Multivariable Analyses

Several caregiver characteristics were associated with caregiver outcomes (Table 3, Table 4). Increasing caregiver age was associated with less anxiety and depression, as well as better SF-12 mental health but poorer SF-12 physical health. Being female was associated with less distress (adjusted odds ratio [aOR] = .43; 95% confidence interval [CI] = .25-.74; $P < .01$). An income higher than $50 000/year was associated with a higher SF-12 physical subscale and total scores. In the models evaluating the number of GA domains, caregiver comorbidities were associated with caregiver anxiety (aOR = 2.94; 95% CI =1.70-5.09; $P < .001$), depression (aOR = 3.13; 95% CI = 1.74-5.60; $P < .001$), poorer SF-12 physical health (regression coefficient [β] = −8.11; 95% CI = −10.09 to −6.13; $P < .001$), poorer SF-12 mental health (β = 3.99; 95% CI = −6.00 to −1.97; $P < .001$), and poor overall QOL (β = −11.86; 95% CI = −14.57 to −9.16); $P < .001$).

In the models evaluating the number of GA domains, patient distress was associated with caregiver anxiety (aOR = 2.07; 95% CI = 1.22-3.52; $P < .01$), caregiver distress (aOR = 2.79; 95% CI) = 1.76-4.44; $P < .01$), caregiver mental health on SF-12 (aOR = −2.62; 95% CI = −4.70 to −0.54; $P < .05$), and overall QOL on SF-12 (β = −3.51; 95% CI) = −6.28 to −.74; $P < .05$)

Our primary independent variables of interest were the number of GA domain impairments for the patient and individual domain impairments (Tables 3 and 4; Figure 1.). In the multivariate analysis, the number of patient GA domain impairments was associated with caregiver depression (aOR = 1.29; 95% CI = 1.07-1.55; $P < .001$), lower caregiver physical health (β = −1.24; 95% CI = −1.85 to −.63; $P < .001$), and lower caregiver QOL (β = −1.14; 95% CI = −2.01 to −.27; $P < .01$). In separate models for individual GA domains, impaired patient functional status was associated with significantly worse caregiver physical health (β = −2.55; 95% CI = −4.45 to −.56; $P < .05$) and overall QOL (β = −4.11; 95% CI = −6.73 to −1.48; $P < .001$). Impaired patient nutrition was significantly associated with caregiver depression (aOR = 2.08; 95% CI = 1.15-3.77; $p < .01$).

Table 2. Caregiver Demographics and Clinical Characteristicsª

Variables	N = 414 N (%)
Age, mean (SD), y	66.5 (12.5)
<70	210 (51.1)
70-79	151 (36.7)
≥80	50 (12.2)
Sex	
Female	310 (75.4)
Male	101 (24.6)
Education	
Less than high school	30 (7.3)
High school graduate	118 (28.7)
Some college or above	263 (64.0)
Race	
Non-Hispanic white	369 (89.8)
African American	27 (6.6)
Other	15 (3.6)
Relationship	
Spouse/Cohabiting partner	276 (67.2)
Son/Daughter	94 (22.9)
Other	41 (10.0)
Income, annual	
<$50 000	151 (36.8)
>$50 000	259 (63.2)
Living arrangements	
Independent living (more than one story)	188 (45.9)
Independent living (one story)	215 (52.4)
Other	7 (1.7)
Comorbidity[b]	
Yes	162 (39.4)
No	249 (60.6)
Anxiety (GAD-7) (≥5)	
Yes	97 (24.4)
No	300 (75.6)
Distress (≥4)	
Yes	177 (43.5)
No	230 (56.5)
Depression (PHQ-2) (≥2)	
Yes	75 (18.9)
No	322 (81.1)

Abbreviations: GAD-7, Generalized Anxiety Disorder 7-item scale; PHQ, Patient Health Questionnaire; SD, standard deviation.
ªMissing data ≥3% for any variable; percentages are calculated from available data.
[b]Defined using the Older American Resources and Services Comorbidity Form that assesses the presence of 13 illnesses and how much each problem interferes with his or her function; caregiver was noted to have the domain impaired if she or he answered "yes" to three illnesses or answered that one illness interferes "a great deal."

DISCUSSION

In this large cohort of older patients with advanced cancer and their caregivers, patient GA measures were associated with emotional health and QOL of informal caregivers. Specifically, a higher number of patient GA impairments was associated with caregiver depression and lower caregiver QOL.

Informal caregivers provide essential support for older patients with advanced cancer receiving treatment including assisting with activities of daily living, performing medical- and nursing-related tasks, and providing direct physical and emotional assistance.[30] Our descriptive results are similar to

Table 3. Association of Caregiver/Patient Predictors with Caregiver Emotional Health and Quality-of-Life Outcomes in Models with Number of Geriatric Assessment Domains Impaired

Independent variables	Anxiety (GAD-7) OR (95% CI)	Distress OR (95% CI)	Depression (PHQ-2) OR (95% CI)	SF-12 Physical health Coef. (95% CI)	SF-12 Mental health Coef. (95% CI)	SF-12 Total score Coef. (95% CI)
Caregiver predictors						
Age	.96 (.94-.99)*	.98 (.96-1.00)[a]	.97 (.94-.99)*	−.13 (−.21 to −.05)*	.23 (.14-.31)**	.08 (−.4 to .19)
Female (vs male)	.93 (.50-1.73)	.43 (.25-.74)*	.72 (.37-1.42)	2.14 (.06-4.34)	.30 (−1.95 to 2.54)	2.15 (−.84 to 5.14)
Non-Hispanic white (vs other)	1.17 (.51-2.67)	.90 (.45-1.84)	.8 (.36-1.79)	.12 (−2.93 to 3.16)	−1.78 (−4.90 to 1.34)	−1.59 (−5.74 to 2.56)
Income > $50 000 + "Decline to answer" (vs < $50 000)	.62 (.37-1.03)	...	...	2.40 (.48-4.32)[a]	...	4.03 (1.39-6.66)*
Comorbidity	2.94 (1.69-5.09)**	...	3.13 (1.74-5.60)**	−8.11 (−10.09 to −6.13)**	−3.99 (−6.00 to −1.97)**	−11.86 (−14.57 to −9.16)**
Patient predictors						
Cancer type (vs GI)						
Lung	1.22 (.62-2.39)	1.04 (.58-1.88)	.84 (.41-1.71)	−1.16 (−3.72 to 1.41)	.13 (−2.51 to 2.77)	−1.03 (−4.54 to 2.47)
Others	.84 (.45-1.56)	.57 (.34-.97)[a]	.68 (.36-1.27)	−2.48 (−4.73 to −.24)[a]	.64 (−1.66 to 2.94)	−1.85 (−4.91 to −1.21)[a]
Distress (≥4)	2.07 (1.22-3.52)*	2.79 (1.76-4.44)**	...	...	−2.62 (−4.70 to −.54)[a]	−3.51 (−6.28 to −.74)[a]
Number of GA domains impaired	.98 (.82-1.16)	1.11 (.96-1.29)	1.29 (1.07-1.55)**	−1.24 (−1.85 to −.63)**	.00 (−.66 to .65)	−1.14 (−2.01 to .27)*

Note: Lower scores for the GAD-7, distress thermometer, and PHQ-2 indicate lower anxiety, distress, and depression, respectively; while higher scores on the SF-12 indicate greater quality of life.
[a]P < .5, *P < .1, **P < .001.
Predictors with empty cells were excluded in the stepwise procedure.
Abbreviations: CI, confidence interval; Coef, coefficient; GA, geriatric assessment; GAD-7, Generalized Anxiety Disorder 7-item scale; GI, gastrointestinal; OR, odds ratio; PHQ, Patient Health Questionnaire; SF-12, 12-item Short Form Health Survey.

Table 4. Association of Caregiver/Patient Predictors with Caregiver Emotional Health and Quality of Life Outcomes in Models with Individual Geriatric Assessment Domains

Independent variables	Anxiety (GAD-7) OR (95% CI)	Distress OR (95% CI)	Depression (PHQ-2) OR (95% CI)	SF-12 Physical health Coef. (95% CI)	SF-12 Mental health Coef. (95% CI)	SF-12 Total score Coef. (95% CI)
Caregiver predictors						
Age	.96 (.94-.99)*	.98 (.96-1.00)*	.96 (.94-.98)**	−.13 (−.21 to −.05)*	.23 (.14-.31)**	.07 (−.4 to .18)
Female (vs male)	.92 (.50-1.71)	.44 (.26-.75)*	.74 (.38-1.46)	2.43 (.23-4.64)[a]	.30 (−1.93 to 2.52)	2.35 (−.64 to 5.34)
Non-Hispanic white (vs other)	1.17 (.51-2.67)	.86 (.42-1.75)	.72 (.32-1.60)	.15 (−2.88 to 3.19)	−1.78 (−4.89 to 1.33)	−1.50 (−5.62 to 2.63)
Income > $50 000 + "Decline to answer" (vs < $50 000)	.61 (.37-1.03)	...	...	2.41 (.50-4.33)[a]	...	4.27 (1.65-6.89)*
Comorbidity	2.91 (1.69-5.04)**	...	3.46 (1.94-6.18)**	−7.86 (−9.85 to -5.87)**	−3.99 (−5.99 to −1.98)**	−11.56 (−14.28 to −8.85)**
Patient predictors						
Cancer type (vs GI)						
Lung	1.22 (.62-2.39)	1.06 (.59-1.92)	.86 (.42-1.74)	−1.30 (−3.85 to 1.26)*	.13 (−2.50 to 2.76)	−1.02 (−4.51 to 2.47)
Others	.84 (.45-1.56)	.60 (.35-1.01)[a]	.71 (.38-1.35)	−2.47 (−4.71 to −.24)[a]	.64 (−1.66-2.94)	−1.85 (−4.90-1.19)
Distress (≥4)	2.03 (1.22-3.38)*	2.95 (1.89-4.61)**	...	...	−2.62 (−4.61 to −.64)*	−3.97 (−6.64 to −1.31)*
Impaired function	...	...	...	−2.50 (−4.45 to −.56)[a]	...	−4.11 (−6.73 to −1.48)**
Impaired nutrition	...	1.45 (.92-2.26)	2.08 (1.15-3.77)*	...	...	...

Note: Lower scores for the distress thermometer and PHQ-2 indicate distress and depression, respectively, whereas higher scores on the SF-12 indicate greater quality of life.
[a]P < .05, *P < .01, **P < .001.
Predictors with empty cells were excluded in the stepwise procedure.
Abbreviations: Coef, coefficient; GA, geriatric assessment; GAD-7, Generalized Anxiety Disorder 7-item scale; GI, gastrointestinal; OR, odds ratio; PHQ, Patient Health Questionnaire; SF-12, 12-item Short Form Health Survey.
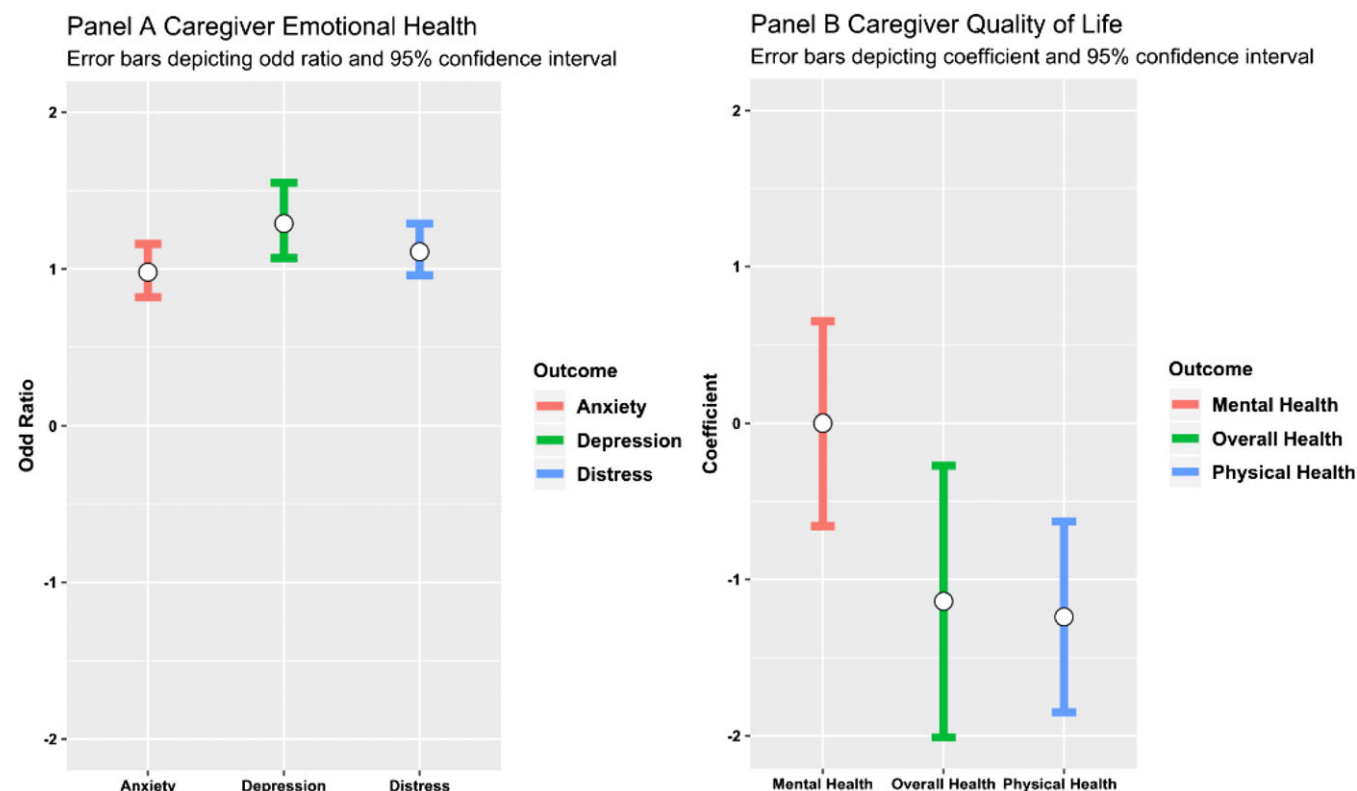
Figure 1. Association between Number of Impaired Patient Geriatric Assessment Domains and Caregiver Outcomes. Note: Besides caregiver age, sex, race, and patient cancer type, the following covariates were also included in the multivariate models if they had a *P* value <.1 in the stepwise models: caregiver education, family income, living arrangement, comorbidity, distress; patient cancer treatments.

previous studies.[7,31,32] Hsu et al[33] found that in 100 patients aged 65 years and older (70% with advanced cancer) and their caregivers, caregivers were mostly female (73%) and spouses (68%); 79% lived with the patient. Jones et al[32] found that in 76 caregivers of older patients with cancer, 19.1% and 23.6% reported moderate or greater anxiety and depression, respectively. In this study, lower caregiver age was associated with higher prevalence of emotional health issues (ie, anxiety, depression), and caregiver comorbidities were adversely associated with all caregiver outcomes except for distress. Clinicians should consider caregiver comorbid conditions when evaluating the caregiver's emotional health and QOL.

Our study adds to evidence supporting an interdependent relationship between patient and caregiver health. Patient distress is associated with caregiver distress.[34] In a study of 43 caregiver/patient dyads, caregivers of patients with depression experienced greater emotional distress.[35] In this study, we also showed that patient function is associated with caregiver outcomes. In the study by Hsu et al,[32] caregivers reported that patients had poorer physical function and mental health than the patients reported for themselves. In multivariate analysis, those caring for patients who required more help with instrumental activities of daily living were more likely to experience high caregiver burden. Germain et al[7] showed that in close to 100 older patients with cancer and their caregivers, older patient age, perceived burden by caregiver, and patient functional status were associated with lower caregiver QOL.

In contrast, Rajasekaran et al[36] did not find an association between patient GA measures and caregiver burden using

the Zarit Burden Interview, a measure that captures physical and mental health constructs in the context of caregiving. SF-12, used in this study, captures physical and mental health more globally and does not ask about these constructs in the context of caregiving. Caregivers may self-report global QOL deficits, without communicating caregiver burden. Other potential reasons for differences in outcomes between studies could be related to patient sample; our sample included only patients with advanced cancer who had at least one GA domain impairment, which is less robust than studies that also included patients undergoing curative intent therapy.

This study is the first to show the association between the number of GA impairments and caregiver health (specifically caregiver depression, poorer physical health, and poorer QOL) in older patients with advanced cancer. In this nationwide study, 89.6% had three or more GA domains impaired. This number is likely high due to our eligibility criteria, although comparable with some studies enrolling "real-world" patients.[17] The number of GA domain impairments was independently associated with caregiver outcomes beyond other patient and caregiver clinical and demographic factors. In addition to the number of GA domains, two specific GA domains had strong independent associations: nutrition with caregiver depression and impaired functional status with poorer caregiver physical health and QOL. Previous studies showed that patient function is associated with caregiver burden and QOL, and caregivers have expressed that nutritional concerns (eg, anorexia, cachexia) can affect their emotional health.[13,37–39,54] These findings suggest that the

clinical team should address caregiver needs especially when the patient's GA shows a high number of domain impairments and/or when patients have significant nutritional, functional, or mental health concerns. Audio recordings of clinical encounters between older patients, caregivers, and oncologists showed that although caregivers are unlikely to bring up their own emotional and physical health needs, they do provide clues when they bring up patients' age-related concerns such as medication, functional, and nutritional issues that increase their own distress.[40,41] These conversations are opportunities for oncology teams to offer support for caregivers.

A symposium of experts convened by the NCI and National Institute of Nursing Research in 2016 highlighted the need for developing and testing interventions for caregivers.[1] Other research reports have discussed the need to develop interventions to improve psychosocial care for older patients and their caregivers.[42,43] In one large study, lack of formal training in medical/nursing skills was associated with greater levels of caregiver burden.[30] Skills training is a potential area for interventions, but research on how best to provide training for caregivers (ie, the content, mode of delivery, and timing) is needed.[30] In another study, unhealthy behaviors (ie, low physical activity, binge drinking) were associated with worse emotion-focused coping of caregivers; interventions that provide support for promoting healthier behaviors for caregivers may improve their emotional health.[44] Early and integrated palliative care and psychosocial interventions for both patients and caregivers were shown to improve outcomes, although more work on dissemination and implementation is needed.[45]

Although the American Society of Clinical Oncology[17] and other guidelines[46,47] have recommended GA for older patients with cancer receiving chemotherapy, limited data are available on how GA can help guide interventions to improve QOL and emotional health in caregivers of older adults with cancer. Given the aging of both patients with cancers and their caregivers, a GA-guided dyadic approach to interventions should be studied.[48] Engaging both older patients and their caregivers in the research process from design to dissemination of interventions may improve the successful implementation and integration of interventions for vulnerable caregivers at high risk for poor emotional health and QOL. In a series of focus groups with older adults and caregivers, Puts et al[49,50] found that the stakeholders were motivated to work with a research team, but there are logistical considerations (such as accessibility of technology and transportation) that need to be addressed to support engagement. Trevino et al held a 1-day conference with older patient and caregiver stakeholders and found that tailoring interventions for older adults and modifying institutional-level factors to allow for ease of implementation was important to them.[43]

Strengths of this study include its large sample size of older frail patients with advanced cancer and their caregivers. Limitations of this study involve the use of a cross-sectional design that prevents determination of causation. Furthermore, cross-sectional designs present limitations by using only one time point to assess outcomes. Patients and caregivers were enrolled in a clinical trial from community oncology clinics that may not be as representative as a population-based sample. There is also a potential sample bias because all participants were required to have a GA impairment that could lend to more frail older adults being included in the analysis.

Additionally, to minimize the burden of this study on participants, only broad screening tools, as opposed to more refined diagnostic tools, were used to assess caregiver burden, anxiety, depression, and QOL, which may lead to some error in the measurement of these constructs. Although the relationships between patient GA factors and caregiver outcomes are reasonably strong, we did not adjust for multiple comparisons[51] The study's results should be considered hypothesis generating and require validation in other cohorts.

In conclusion, this study indicates that caregivers for older patients with advanced cancer are a vulnerable group. Caregivers are often older themselves, and their own comorbidities are associated with poor emotional health and QOL. Future studies should explore GA-guided interventions that include not only the older patient with cancer but also their caregivers, as a dyadic or triadic (with the oncologist)[52] approach to interventions. Given that poor caregiver emotional and self-rated health is associated with patient-perceived quality of care, interventions may not only improve clinical outcomes but also patient and caregiver satisfaction with care delivery.[53]

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SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article.

Supplementary Figure S1: Percentage of patients who exhibited any given number of Geriatric Assessment Domain Impairments (N = 414).

Supplementary Table S1: Geriatric Assessment Domains, Tools, Descriptions, and Definitions of Impairment[a]

[a]Impairment is considered present within each domain if there is one impairment noted on at least one tool.