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ORIGINAL ARTICLE

Patient-reported outcomes in light of supportive medications in treatment-naïve lung cancer patients

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Abstract

Purpose The impact of supportive medications on patient-reported outcomes (PROs) has not been systematically evaluated. We describe the supportive medications used by treatment-naïve lung cancer patients and assess their association with PROs from MD Anderson Symptom Inventory (MDASI).

Methods Treatment-naïve lung cancer patients who completed PROs from MDASI at the initial visit to MD Anderson Cancer Center were included. Medications from the initial visit were abstracted from the electronic medical records system and categorized into therapeutic classes based on U.S. Pharmacopeia v7.0. A chi-square or Mann-Whitney *U* test was conducted as appropriate.

Results Among 459 patients, ~ 50% took any analgesics and 25% were on opioids. One-third of patients with moderate-severe pain were not on any analgesics. Patients taking opioids had significantly worse median pain scores (6 vs. 0) compared with those not taking any analgesics ($p < 0.0001$). Higher proportion of patients with moderate-severe pain took opioids compared with those with mild pain (52% vs. 16%, $p < 0.0001$). Patients on opioids also reported significantly worse scores for five other cancer-specific core symptoms and all six symptoms rating interference with daily life. Only 15% of patients with higher composite score for depression-related symptoms were on antidepressants. However, patients taking antidepressants did not significantly differ in any individual MDASI symptom scores compared with those not on antidepressants ($p = 0.4858$).

Conclusions Our results suggest a need for better screening for pain and depression and optimization of pain management in treatment-naïve lung cancer patients since their poor functional status may result in suboptimal cancer therapy.

Keywords Patient-reported outcomes · Lung cancer patients · Supportive care medications · Pain management · Antidepressants

Introduction

Patient-reported outcomes (PROs) are increasingly being incorporated in both interventional trials and in clinical practice especially in cancer patients [1, 2]. While the NCI Common Terminology Criteria for Adverse Events (CTCAE) aids in the objective assessment and grading of the severity of adverse effects of therapy, they do not allow the clinicians to determine the impact of treatment on the patients' perception of symptoms and their quality of life (QOL) [3–7]. Therefore, PROs are important in determining baseline symptom burden of patients as well as assessing the impact of various treatments over time. With aggressive cancers such as lung cancer, where most patients are diagnosed with advanced stage disease, the baseline symptom burden of these patients is high [8, 9]. The psychological impact of the diagnosis and prognosis itself adds significant burden to the QOL of patients requiring

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additional treatment [10–12]. This results in polypharmacy, which may further impact the symptom burden of the patients, especially in older patients [13, 14]. Therefore, careful evaluation of medications is an important factor while evaluating symptom burden regardless of them being clinician-evaluated or patient-reported.

Very few studies have examined the symptom status and supportive care of lung cancer patients before they start definitive cancer treatment. In treatment-naïve patients, understanding of baseline symptom burden and comorbidities is of utmost importance to select appropriate modes of cancer therapies as well as individualized drug therapy regimen for patients to maintain dose intensity without compromising medication adherence [15, 16]. However, determining the cause of the symptoms and their appropriate management is equally important for the patient-centered care model [17, 18]. PROs especially in treatment-naïve patients are thought to be due to the cancer itself. Hence, the impact of medications and comorbidities as the causes of symptoms has not been assessed in greater detail. Conversely, how effective the supportive care medications are in relieving the symptom burden has also not been evaluated.

The MD Anderson Symptom Inventory (MDASI) is a comprehensive questionnaire designed to evaluate the severity of symptoms reported by the cancer patients themselves [19]. It is completed by all patients at their first visit to MD Anderson Cancer Center (MDACC). The score (ranging from 0 to 10) reported by patients rather than clinicians eliminates an external bias by the investigator and reflects the patient's perspectives. Since patients with lung cancer undergo extensive symptom burden [20], MDASI is an essential tool in quantifying this burden. In this study, we aimed to describe the supportive care medications used by treatment-naïve lung cancer patients and assess the association between the use of analgesics or antidepressants and the severity of common symptoms as reported by patients.

Methods

Patients

The study was a retrospective analysis of medication and symptom data in treatment-naïve patients with lung cancer seen at MDACC between February 2008 and February 2015. We defined treatment-naïve patients as those who had received no prior cancer therapy including surgery, radiation, or systemic drug therapy at the time of MDASI completion. The study was approved by the Institutional Review Board at MDACC and University of Houston.

The inclusion criteria included patients with diagnosis of either non-small cell lung cancer (NSCLC) or small cell lung cancer (SCLC) and completion of MDASI 30 days pre-diagnosis and 45 days of post-diagnosis. The exclusion criteria were patients who received any treatment for their lung cancer including surgery, radiation, or systemic therapy and those with missing data.

Data collection

The data was extracted between June 2016 and September 2017. Baseline patient and tumor characteristics (age, gender, race, days from diagnosis, number of medications, clinical stage of cancer, histopathology, and tumor location) at the first visit were abstracted using the EPIC electronic medical records system at MDACC. The list of medications was generated by the clinical oncology team at the first visit. Histopathological description of the tumor was categorized based on the 2015 WHO Classification of Lung Tumors [21].

Patient-reported symptoms were based from MDASI, which is a validated multi-symptom assessment measure developed for use in the patients with lung as well as other types of cancer [19, 22, 23]. The intensity of 12 common cancer-related symptoms (pain, drowsiness, fatigue, nausea/vomiting, disturbed sleep, shortness of breath, lack of appetite, dry mouth, distress, sadness, numbness/tingling, and difficulty remembering) was rated on 0–10 numeric scales ranging from "not present" to "as bad as you can imagine." Six items related to how much symptoms have interfered with enjoyment of life, which were relations with others, walking, general activity, work, and mood were rated on 0–10 numeric scales ranging from "did not interfere" to "interfered completely." In addition to MDASI, patients also responded to four measures of overall well-being/quality of life items (QOL, physical well-being, emotional well-being, and social support) that were rated on a 0–10 scale, with lower scores indicating poorer function. Seven items were used to represent depression based on their relevance to PHQ9 Depression questionnaire [24]. These were emotional well-being, enjoyment of life, mood, disturbed sleep, fatigue, lack of appetite, and sadness. The direction of emotional well-being was reversed to account for its lower scores indicating poorer function. These seven items were composited to create a depression scale of 0 to 70 ranging from "did not interfere" to "interfered completely".

A complete medication list from the first visit was obtained from the EPIC electronic medical record system at the MDACC. Each medication was categorized into various classes based on the classification from the USP Therapeutic Categories Model Guidelines (USP Medicare Model Guidelines v7.0. Available from http://www.usp.org/sites/default/files/usp/document/our-work/healthcare-quality-safety/uspmmg_v7_0_cat-class.pdf. Accessed September 12, 2017). Individual components were categorized into separate classes for drug products containing two or more active ingredients. In this study, we evaluated various analgesic

regimens (opioid, non-opioid, and combination therapy) and antidepressants for their impact on MDASI symptoms. For this analysis, bupropion was categorized as a smoking cessation agent rather than antidepressant because of lung cancer patients.

Data analysis

Descriptive statistics of patients' demographics (gender and race) and tumor characteristics (stages, histopathology and tumor location) were presented for overall and each lung cancer subtypes (NSCLC or SCLC). Median and interquartile range (IQR) were reported for continuous variable, whereas frequency and percentage were reported for categorical variables. Chi-square tests were used to compare the demographics (age and sex), cancer stages (advanced vs. early), and proportion of patients taking various analgesics or antidepressants categorized based on the symptom scores. A Mann-Whitney *U* test was conducted to compare the median/IQR of MDASI symptoms (ordinal variable). All analyses were two-sided and were carried out using SAS® 9.3, Cary, NC, USA.

Results

Patient and tumor characteristics

The patient and tumor characteristics are summarized in Table 1. One thousand five hundred and three patients with lung cancer were seen during the study period and 941 had no prior treatment. A total of 459 patients diagnosed with either NSCLC ($N = 429$ (93.5%)) and SCLC ($N = 30$ (6.5%)) met the inclusion criteria and were evaluated in this analysis (Table 1).

Medications

A complete list of therapeutic categories of medications is provided in Supplementary Table 1. The following medications were taken by at least 15% of lung cancer patients: Dyslipidemics (38.1%), vitamins (37.3%), renin-angiotensin-aldosterone system inhibitors (34.3%), electrolyte/mineral/metal modifiers and replacements (29.6%), opioid analgesics (27.2%), beta-adrenergic blocking agents (25.5%), acetaminophen (23.5%), sympathomimetic bronchodilators (23.3%), non-steroidal anti-inflammatory drugs (21.6%), diuretics (20.9%), proton pump inhibitors (20.0%), low-dose aspirin (20.0%), thyroid agents (18.1%), benzodiazepines (17.6%), antidepressants (15.7%), other gastrointestinal agents (15.5%), antihistamines (15.5%), and inhaled corticosteroids (15.0%).

Use of analgesics and its association with pain and related symptom scores

Among 459 lung cancer patients, about half were on some type of analgesic therapy, with about one-fourth of them taking opioid-containing regimens (opioids only or combination of opioids and non-opioids) (Table 2). One-third of patients with moderate-severe pain (5 or above on a 0–10 scale) were not on any analgesic therapies. Patients younger than 65 years of age and those with advanced-stage lung cancer had more moderate-severe pain. There was no significant difference in mild versus moderate-severe pain based on gender. Type of analgesic therapy did not have any association with age, gender, or stage of cancer (Supplementary Table 2).

Significantly worse pain scores were reported by patients taking only opioids (median score: 5) or combination of opioids and non-opioids (median score: 6) compared with those not taking any analgesics (median score; 0) ($p < 0.0001$, Mann-Whitney *U* test) (Table 3). Median pain scores were not significantly different in patients taking only non-opioid analgesics (median score; 1) compared with those not on any analgesic therapy (Table 3). Furthermore, moderate-severe pain (vs. mild pain) was reported by a higher proportion of patients taking only opioids (13% vs. 4%, $p < 0.0001$) or combination of opioids and non-opioids (40% vs. 11%, $p < 0.0001$) (Table 2). Patients on opioid-containing pain regimens also reported worse scores for drowsiness, fatigue, nausea/vomiting, disturbed sleep, shortness of breath, lack of appetite, dry mouth, distress, enjoyment of life, relations with others, walking, general activity, work, quality of life, and physical well-being ($p < 0.001$ for Mann-Whitney *U* median test) (Table 3). In addition, four MDASI symptoms (sadness, numbness/tingling, mood, and emotional well-being) had worse scores only in patients taking combination of opioids and non-opioids and not in those on opioids only regimens likely due to larger sample size in the combination group (Table 3).

Use of antidepressants and its association with depression-related symptom scores

About one-fifth of treatment-naïve lung cancer patients were on antidepressants (Table 4) with most taking serotonin or norepinephrine reuptake inhibitors. More than two-thirds of patients with a composite depression score of ≥ 35 were not on antidepressants (Table 4). A composite depression score of ≥ 35 was reported more by younger patients and those with advanced-stage disease. There was no significant difference in composite scores of ≥ 35 versus < 35 based on gender. Females were more likely to be on antidepressants compared with male gender (Supplementary Table 3). Age and stage of cancer did not have any association with the use of antidepressants. The median scores for any MDASI symptoms including

Table 1 Patient and tumor characteristics

	All; *N* (%)	NSCLC; *N* (%)	SCLC; *N* (%)
N	459	429	30
Median age (range)	66 (23–90)	66 (23–90)	67 (47–77)
Gender			
• Male (%)	223 (48.6)	213 (49.7)	10 (33.3)
• Female (%)	236 (51.4)	216 (50.3)	20 (66.7)
Race			
• White (%)	407 (88.7)	380 (88.6)	27 (90.0)
• Black (%)	14 (3.0)	13 (3.0)	1 (3.3)
• Spanish surname	22 (4.8)	20 (4.7)	2 (6.7)
• Other (%)	16 (3.5)	16 (3.7)	0 (0.0)
Median days of MDASI completion from diagnosis (lower, upper)	22 (−30, 45)	24 (−30, 45)	16 (−8, 43)
Number of medications[a]: median (range)	6 (0–22)	6 (0–22)	6 (0–16)
AJCC stage (%)		Early (I/II)—165 (38.5) Advanced (III/IV)—264 (61.5)	Limited—6 (20.0) Extensive—24 (80.0)
Histopathology[b]			
• Adenocarcinoma (%)	265 (57.7)		
• Squamous cell carcinoma (%)	100 (21.8)		
• Small cell carcinoma (%)	30 (6.5)		
• Other (%)	64 (0.2)		

AJCC, American Joint Committee on Cancer (8th edition); *NOS*, not otherwise specified; *NSCLC*, non-small cell lung cancer; *SCLC*, small cell lung cancer

[a] Different medications in a same pharmacological class were considered as one

[b] Histopathology was classified using the 2015 WHO Classification of Lung Tumors [21]

the individual depression-related symptoms (enjoyment of life, mood, disturbed sleep, lack of appetite, emotional well-being, sadness, and relations with others) were not significantly different between patients taking antidepressants compared with those not on the therapy (Table 5).

Discussion

In this study, we describe the supportive medications used by treatment-naïve lung cancer patients at baseline and assess the association between their use and PROs. We report that one-

Table 2 Patient demographics and the use of analgesic therapy in patients with high (≥ 5) vs. low (< 5) score for pain

	Any pain score		< 5 pain		5 or above pain		Chi square *p* value
	N = 459	%	*N* = 316	%	*N* = 143	%	
Type of analgesic							
Any analgesics	213	46.4	114	36.1	99	69.2	< 0.0001
Opioids only	32	7.0	14	4.4	18	12.6	< 0.0001
Non-opioids only	88	19.2	64	20.3	24	16.8	0.0614
Combination	93	20.3	36	11.4	57	39.9	< 0.0001
No analgesics	246	53.6	202	63.9	44	30.8	< 0.0001
Age category							
< 65	208	45.3	133	42.1	75	52.4	0.0389
65 or above	251	54.7	183	57.9	68	47.6	
Sex							
F	236	51.4	160	50.6	76	53.2	0.6179
M	223	48.6	156	49.4	67	46.9	
Cancer stage							
Early	171	37.3	134	42.4	37	25.9	0.0005
Advanced	288	62.7	182	57.6	106	74.1	

Table 3 Median MDASI symptom scores (interquartile range) for patients taking various analgesic regimens

MDASI symptoms	Opioids only ($N = 32$)	p value*	Non-opioids only ($N = 88$)	p value*	Combination ($N = 93$)	p value*	No analgesics ($N = 246$)
Symptoms (MDASI)							
Pain[a]	5 (0–9)	< 0.0001	1 (0–5)	0.1900	6 (2.5–8)	< 0.0010	0 (0–3)
Drowsiness[a]	3 (1–7)	0.0010	0 (1–3)	0.9100	2.5 (0–6)	0.0004	0 (0–3)
Fatigue[a]	6 (3.5–8)	0.0005	3 (0–6)	0.6183	5 (3–7)	< 0.0001	2 (0–5)
Nausea/vomiting[a]	2 (0–3)	< 0.0001	0 (0–0)	0.9250	0 (0–1)	0.0168	0 (0–0)
Disturbed sleep[a]	5 (1.5–8)	0.0053	2 (0–5)	0.9821	4 (2–7)	< 0.0001	2 (0–5)
Shortness of breath[a]	5 (2–7)	0.0020	1.5 (0–4)	0.6940	3 (0–6)	0.0036	1 (0–4)
Lack of appetite[a]	3.5 (1.5–7)	< 0.0001	0 (0–1)	0.5701	1 (0–4)	0.0064	0 (0–2)
Dry mouth[a]	1.5 (0–5)	0.0048	0 (0–2)	0.1344	1 (0–5)	< 0.0001	0 (0–1)
Distress[a]	2 (0.5–7)	0.6199	1 (0–5)	0.2035	4 (1–7)	0.0682	2 (0–5)
Sadness[b]	2 (0–6)	0.1698	1 (0–4)	0.8122	3 (0–7)	0.0136	1 (0–4)
Numbness/tingling[b]	0 (0–2.5)	0.2565	0 (0–1)	0.9411	0 (0–3)	0.0290	0 (0–1)
Remembering	1.5 (0–4)	0.0501	0 (0–1.5)	0.5020	1 (0–3)	0.1003	0 (0–2)
Interferences (MDASI)							
Enjoyment of life[a]	4.5 (1.5–8)	0.0024	2 (0–5)	0.6883	4 (1–8)	< 0.0001	1.5 (0–5)
Relations[a]	1 (0–6)	0.0130	0 (0–2)	0.7963	2 (0–5)	< 0.0001	0 (0–2)
Walking[a]	4.5 (2–8)	0.0001	1 (0–5)	0.0310	5 (0–7)	< 0.0001	0 (0–4)
General activity[a]	6 (2.5–9)	0.0002	2 (0–5)	0.1024	5 (3–8)	< 0.0001	1 (0–4)
Work[a]	7 (3.5–9)	0.0002	2.5 (0–6.5)	0.3922	5.5 (3–8)	< 0.0001	1 (0–5)
Mood[b]	2 (1–5.5)	0.2355	1 (0–5)	0.7178	5 (1–7)	< 0.0001	2 (0–4)
Other symptoms (QOL)							
Quality of life[a]	6 (3–8)	0.0112	8 (5–9)	0.7488	6 (4.5–8)	< 0.0001	8 (5–9)
Physical well-being[a]	5 (2–8)	0.0311	7 (4–8)	0.6807	5 (3.5–7)	< 0.0001	7 (5–9)
Emotional well-being[b]	7 (5–9)	0.1962	8 (4–9)	0.6452	6 (4–8)	< 0.0001	8 (5–9)
Social support	9 (5–10)	0.2728	9 (7.5–10)	0.1018	9 (7–10)	0.2381	10 (8–10)

[a] Significant difference for opioids and combination

[b] Significant difference only for combination but not opioid

* In comparison with no analgesics group

Table 4 Patient demographics and the use of antidepressants in patients with high (≥ 35) vs. low (< 35) composite score for depression

	Any composite score		< 35 composite score[a]		35 or above composite score[a]		Chi square
	$N = 459$	%	$N = 357$	%	$N = 102$	%	p value
Antidepressants							
No	381	83.0	294	82.4	87	85.3	0.4858
Yes	78	17.0	63	17.6	15	14.7	
Age category							
< 65	208	45.3	152	42.6	56	54.9	0.0279
65 or above	251	54.7	205	57.4	46	45.1	
Sex							
F	236	51.4	180	50.4	56	54.9	0.4249
M	223	48.6	177	49.6	46	45.1	
Cancer stage							
Early	171	37.3	147	41.2	24	23.5	0.0014
Advanced	288	62.7	210	58.8	78	76.5	

[a] Composite score for depression consisted of the following symptoms: enjoyment of life, mood, disturbed sleep, lack of appetite, emotional well-being, sadness, and relations with others

Table 5 Median MDASI symptom scores (interquartile range) for patients taking antidepressants

MDASI symptoms	Antidepressants ($N = 78$)	No antidepressants ($N = 381$)	p value
Symptoms (MDASI)			
Pain	1 (0–5)	1 (0–6)	0.5938
Drowsiness	1 (0–4)	1 (0–4)	0.5155
Fatigue	3 (1–6)	3 (0–6)	0.3699
Nausea/vomiting	0 (0–1)	0 (0–0)	0.1043
Disturbed sleep	2 (0–5)	2 (0–6)	0.6996
Shortness of breath	3 (0–6)	2 (0–5)	0.2274
Lack of appetite	0 (0–2)	0 (0–3)	0.6557
Dry mouth	0 (0–3)	0 (0–2)	0.7460
Distress	2 (0–5)	2 (0–5)	0.6674
Sadness	2 (0–5)	1 (0–4)	0.1341
Numbness or tingling	0 (0–1)	0 (0–1)	0.3199
Remembering	1 (0–3)	0 (0–2)	0.0259
Interferences (MDASI)			
Enjoyment of life	2 (0–5)	2 (0–6)	0.4989
Relations	1 (0–3)	0 (0–3)	0.0661
Walking	2 (0–5)	1 (0–5)	0.1106
General activity	3 (0–5)	2 (0–6)	0.7306
Work	3 (0–5)	3 (0–7)	0.8327
Mood	3 (0–5)	2 (0–5)	0.3993
Other symptoms (QOL)			
Quality of life	7 (5–9)	7 (5–9)	0.1747
Physical well-being	6 (4–8)	6 (4–8)	0.3962
Emotional well-being	7 (5–9)	8 (5–9)	0.3635
Social support	9 (6–10)	10 (8–10)	0.5122

third of patients with moderate-severe pain scores (5 or above) were not on any analgesic therapy, and over two-thirds of patients with composite depression scores (35 or above) were not on any antidepressants. Furthermore, patients on opioid-containing analgesic therapy for pain had significantly worse scores for pain and 15 out of 22 PROs compared with those on no pain medications.

Our study highlights pain as a major symptom burden of treatment-naïve lung cancer patients that is poorly managed in community practice before the patients are referred to MDACC. First, one-third of patients with moderate-severe pain scores were not taking any analgesic therapy. In addition, one-fifth of patients with moderate-to-severe pain were taking only non-opioid regimens despite opioids being considered as a first-line approach in this setting [25]. Since pain impacts daily living as well as QOL of patients, undertreated pain is associated with higher severity of multiple other cancer-related symptoms. The relationship between pain and mood as well as activities of daily living has been well-recognized [26–28]. The NCCN guidelines on Adult Cancer Pain state that the goals of pain management are to optimize pain relief, activities of daily living, and mood while minimizing adverse effects and avoiding addiction [25]. This is emphasized by our study finding that the group of patients with worse pain scores also had worse scores for most other symptoms related to daily living, mood, and QOL. The inadequate pain control in treatment-naïve lung cancer patients may be a result of deficient knowledge of pain management among community providers and stigma associated with pain among patients as well as providers [29–33]. Opioid overdoses and death rates associated with opioid abuse have increased substantially in the past few years. The fear of drug abuse in patients may contribute to prescribers' reservations for using opioids in some cases [34, 35]. There is also a lack of consensus among prescribers on how to use opioids for pain in non-cancer patients, emphasizing the need to educate community providers about these issues [36].

The pain scores along with the scores for drowsiness and nausea/vomiting were higher in patients taking opioid-containing regimen, suggesting inadequate pain control as well as undesired adverse effects. An optimal analgesic treatment in cancer patients with chronic pain should typically include regularly scheduled analgesics for persistent pain control along with supplemental doses of analgesics to manage breakthrough pain [25]. The analgesic regimen needs to be designed based on this principle with proper understanding of pharmacology of opioids as well as dose conversions for many different opioid agents with varying doses and dosage forms available in the market to achieve patient-specific goals for comfort and function for optimal pain management [37, 38].

Our findings are based on retrospective analysis of the data and need to be confirmed in prospective studies. In addition, the cross-sectional analysis conducted in this study limits the evaluation of changes to the supportive care regimen made by the clinical oncology team. Other limitations include assessment of medications for only nociceptive and not neuropathic pain (such as tricyclic antidepressants and gabapentin) due to multiple indications of these agents, and the reliability of electronic medical records as a source of current medication. A future prospective longitudinal study that includes patient interviews to determine the reason for using each medications and recording of the current medications cross-checked by pharmacy records may allow more comprehensive assessment of supportive care medications. In our study, we were also not able to assess the appropriateness of the analgesic therapy without additional clinical data to determine the site and etiology of pain. While pain is likely due to cancer itself, coincidental non-cancer pain may also add to the symptom burden. Consideration of non-cancer comorbidities, such as arthritis, neuropathy, fibromyalgia, trauma/injury, or migraine, may also help in assessing appropriateness of therapy as well as impact of the medications on symptoms. In this study, we did not evaluate patients' comorbidities that can influence

PROs. However, future prospective studies should evaluate the impact of comprehensive clinical assessment and interventions on pain and other symptoms to maximize the utility of PROs in clinical management of cancer patients.

While the major emphasis of this study was on pain management, we also found that only 15% of patients with higher composite score for depression-related symptoms were on antidepressants. However, patients taking antidepressants did not significantly differ in any individual MDASI symptoms compared with patients not on antidepressants. These results may suggest that antidepressants, when properly used, are effective in managing the depression-related symptoms. However, these findings need to be confirmed in the prospective studies. Our findings that more female compared with male patients were on antidepressants are also consistent with other reports [39]. A comprehensive evaluation of depressive symptoms using PHQ-2 and PHQ-9 is a common practice to screen for depression [40]. However, the "sadness" symptom from MDASI has been suggested as a useful initial screen for assessing depression [24]. Future studies to incorporate a prescreening approach for cancer patients may improve the efficiency and acceptability of such a simple tool for clinicians and patients.

In conclusion, this is the first study to systematically evaluate and report the associations between supportive care medication and PROs in cancer patients prior to definitive cancer treatment. Our study highlights the importance of assessing the need for concomitant supportive care medication at the beginning of cancer therapy and suggests that symptom assessment and evaluation of the etiologies for higher symptom burden should be included in the initial plan for treatment selection. Our study also emphasizes the need for longitudinal and multi-institutional studies to evaluate the effectiveness and impact of supportive care medications on PROs over the course of cancer care. Screening for pain and depression and optimization of pain management in treatment-naïve lung cancer patients need attention of community providers as well as oncology clinicians. Since patients' poor functional status may result in suboptimal cancer therapy, our results highlight a need for early symptom assessment and therapeutic interventions in these patients.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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