

Age-related Differences in Recall of Information and Handling of Chemotherapy-related Side Effects in Cancer Patients: The ReCap Study

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Abstract

Background: To prevent severe toxicity and hospital admissions, adequate management and recall of information about side effects are crucial and health literacy plays an important role. If age-related factors impact recall of given information and handling of side effects, revised ways to give information are required.

Patients and Methods: We undertook a questionnaire-based survey among 188 newly diagnosed patients with pancreatic cancer or colorectal cancer and chemo-naïve patients with prostate cancer treated with adjuvant or first-line palliative chemotherapy comprising satisfaction with given information, recall of potential side effects, and handling of hypothetical side effect scenarios. We evaluated the association between baseline characteristics, ie, age, frailty (G8 score), comorbidity (Charlson Comorbidity Index), cognitive function (Mini-Cog), satisfaction, recall of information, and handling of side effects.

Results: Reduced ability to recall information about several side effects (eg, chest pain) was associated with older age (odds ratio adjusted for cancer [aOR] 0.94 [95% CI, 0.88-0.98]) and poor cognitive screening (aOR 0.56 [95% CI, 0.33-0.91]). Insufficient or dangerous handling of side effects was associated with older age (aOR 0.96 [95% CI, 0.92-0.99]) and cognitive impairment (aOR 0.70 [95% CI, 0.50-0.95]).

Conclusion: Older age and poor cognitive screening may impact patients' ability to understand and adequately handle chemotherapy-related side effects. Cognitive screening and focus on individual ways to give information including assessment of recall and handling are needed.

Key words: age; chemotherapy; side effects; information; recall.

Implications for Practice

To reduce the risk of severe side effects and hospitalizations during chemotherapy, patients' recall and understanding of information and awareness of clinical symptoms are crucial for adequate handling of side effects at home. The Recap study found older age and poor cognitive screening to be negatively associated with the recall of information about side effects as well as insufficient or dangerous handling of potential side effects at home. Our findings call for an increased focus on needs for individual information methods including following up on recalled information by hospital staff among older patients.

Introduction

Health literacy and a patient's ability to be aware of side effects and morbidity are crucial in the trajectory of cancer treatment.¹ For adequate handling of side effects, patients need sufficient information about treatment and symptoms, along with a comprehensive understanding of potential risks and how to act if side effects occur.

Advanced age is the leading risk factor for the development of cancer,² and although the number of older patients with

cancer is expected to rise,³⁻⁶ research is limited regarding the management of comorbidities, geriatric syndromes, and optimal doses and regimens of chemotherapy in older cancer patients.^{7,8} Aging is a highly individual process and involves a continuum of changes in biological and psychological functions. Older patients with cancer comprise a highly heterogeneous group, ranging from fit to frail, with varying comorbidities including cognitive impairments.⁹ Older patients, and especially frail patients,¹⁰ have an increased risk

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of severe toxicity. Many older patients present with various geriatric impairments,¹¹ which must be considered to provide optimal treatment and care.

Chemotherapy agents cause several distressing side effects such as fatigue, anorexia, nausea, diarrhea, mucositis, infections, nerve, and skin problems.^{12,13} Chemotherapy-induced side effects can have a considerable impact on patients' daily activities and are associated with impaired quality of life (QoL) and increased psychological distress.¹⁴⁻¹⁶ Side effects from chemotherapy can frequently be prevented or managed with appropriate medical interventions. To mitigate chemotherapy-induced side effects and to prevent the development of severe toxicity including hospital admissions and life-threatening conditions, it is important that patients are provided with adequate information about possible side effects and that patients understand and recall the given information.

Reasons for developing severe toxicity in older age might not be due to comorbidity and physical impairment alone. Hearing impairments, cognitive function, and attention seem crucial to enable patients to understand and adequately handle toxicity at home. However, as there is a research gap with only a single study has investigated recall of toxicity information among older patients with cancer, and it did not include cognitive screening or frailty indicators.¹⁷

In the present study, we investigated the impact of age and age-related variables and educational level on recall of and satisfaction with information and the ability of patients with newly diagnosed pancreatic cancer (PC), colorectal cancer (CRC), or prostate cancer (PRC) to adequately handle treatment-related side effects.

Methods and Materials

Study Population

Patients diagnosed with PC, CRC, or PRC and assessed for chemotherapy at the Department of Oncology, Copenhagen University Hospital were eligible for the study.

Inclusion criteria

Received adjuvant, neoadjuvant, or first-line palliative chemotherapy, ability to speak and read Danish and provide a signed informed consent.

Exclusion criteria

Prior chemotherapy, severe dementia, psychotic disorders, or other cognitive diseases that hindered informed consent.

Design

At the first visit to the clinic, an oncologist assessed patients diagnosed with PC, CRC, or PRC and determined the chemotherapy regimen. All patients received oral and written information about possible side effects of the planned chemotherapy according to hospital guidelines.

At the second visit, ie, first treatment cycle, an oncological nurse again gave patients oral and written information about possible side effects of the scheduled chemotherapy. Furthermore, all patients were informed about the current study and given written patient information and time to consider participation in the study.

At the third visit, ie, second treatment cycle, patients who accepted participation in the study signed a written consent form and participated in the survey.

Data Collection

Clinical and demographic baseline data

Included age, sex, treatment regimen, performance status (PS),¹⁸ comorbidities (assessed by age-adjusted Charlson Comorbidity Index [CCI]¹⁹), number of medications, civil status, and educational level divided into no further education versus further or higher education.

The Survey

Recall of information

Assessed by using a list of 13 frequently experienced side effects. Participants were asked to note which side effects they could recall being informed about. According to departmental guidelines, all patients treated with 5-fluorouracil (5-FU) or capecitabine should be informed about possible diarrhea, fever, chest pain, mucositis, and palmar-plantar erythrodysesthesia. All patients treated with oxaliplatin or docetaxel/nab-paclitaxel should be informed about diarrhea, fever, and neuropathy. Analyses of recalled information were performed only in participants likely to have been informed about the above-mentioned side effects.

Handling of side effects

Participants were asked to describe how they would handle three hypothetical scenarios. One scenario was about fever, a potentially serious treatment-related side effect, and two of the scenarios were about diarrhea of various intensity and potential severity ([Supplementary Material](#)). The participants were asked to describe their likely actions, which could include the use of prescribed medications, whether they would stay at home and observe further development, or if they would contact the Department of Oncology or a general practitioner. The author team created a predefined scoring manual, and one of the authors (HMM) performed the scoring. Uncertain answers were assessed within the author group. Patients received 2 points for a "Correct" answer (eg, when to contact the department or the general practitioner, what to observe at home, and how to use prescribed medications (non-chemotherapy). An answer was considered "Insufficient" and patients were given 1 point if the answer was not according to the written patient information, but there was no increased risk of severe toxicity (eg, contacting a general practitioner and not the Department if high fever occurred or not taking drugs as prescribed). Zero points were given for a "Dangerous" answer, where there was an increased risk of aggravation of toxicity or morbidity (eg, getting into bed with long-lasting high fever or severe diarrhea without contacting anyone). "Insufficient" or "Dangerous" handling was considered as "Incorrect" handling of side effects.

Patients' evaluation of received information

Evaluated by the validated European Organization for Research and Treatment of Cancer (EORTC) quality of life questionnaire (QLQ-Info 25).²⁰ The questionnaire (25 items) evaluates the level of received information regarding disease, prognosis, treatment, side effects, and patients' satisfaction with the provided information. The study focused on the question regarding satisfaction with information and the global total score.

Frailty

The survey also included a few complementary questions including self-rated health to allow the authors to complete a full G8 frailty screening.²¹ The G8 is specifically developed and validated for use in the oncological setting to identify frail or vulnerable patients. The questionnaire consists of eight items concerning nutritional status, weight loss, body mass index (BMI), motor skills, psychological status, number of prescribed medications, self-perception of general health, and the patient's age.²¹ For a G8 score ≤ 14 , a full geriatric assessment is recommended.²² A recent Danish study has suggested a cut-off of ≤ 11 as a more suitable cut-off for older Danish patients with cancer.²³

Cognitive impairment

Screening for cognitive impairment was done by an oncological nurse using the Mini-Cog.²⁴ The Mini-Cog is validated for use in community-based populations and has demonstrated high sensitivity and specificity for the detection of cognitive impairment.^{25,26} The Mini-Cog consists of a three-word recall test and a clock drawing test. The test score is graded on a 5-point scale, where 3-5 indicate a lower risk of dementia,²⁴ but a score of <3 does not rule out some degree of cognitive impairment.

Sample Size and Statistical Analyses

The power calculation was based on the results from the international validation study of the EORTC QLQ-INFO25 questionnaire.²⁰ The minimal clinically important difference in the EORTC QLQ-INFO25 has not been established but was estimated to be a 10% difference between two groups (eg, patients below versus above 70 years of age) in the total test score. With 100 patients included, such a difference would be detected with a probability (power) of 90% at a 5% significance level. To account for differences in cancer diagnoses, we included 60 patients from each cancer group to ensure a broad spectrum of cancer diagnoses, 180 in all.

Categorical variables were analyzed using a chi-square test where appropriate; otherwise, Fischer's exact test was used. Binary outcomes were analyzed by logistic regression and presented as odds ratios (ORs) and 95% CIs. Analyses were made as crude analyses and adjusted for cancer diagnosis. Info 25 QLQ data were presented as means and SDs, and differences between the groups were analyzed using the Wilcoxon test or Kruskal-Wallis test where appropriate. Missing data in the Info 25 questionnaire were handled with multiple imputations.

The significance level of all tests was set at $P < .05$. The statistical software R version 3.5.2 and SPSS version 25 were used for all analyses.

Approvals and Ethics

The study was assessed by the local ethics committee (Capital Region, reference number H-18034911) and approved by the Danish Data Protection Agency, reference number: I-suite nr.: 6600 J.nr.: VD-2018-154). Written informed consent was obtained from all enrolled patients.

Results

Totally, 372 patients were screened for eligibility and 188 patients were included in the survey from December 2018 to July 2020 (Fig. 1); 49% were ≥ 70 years and 71% were males.

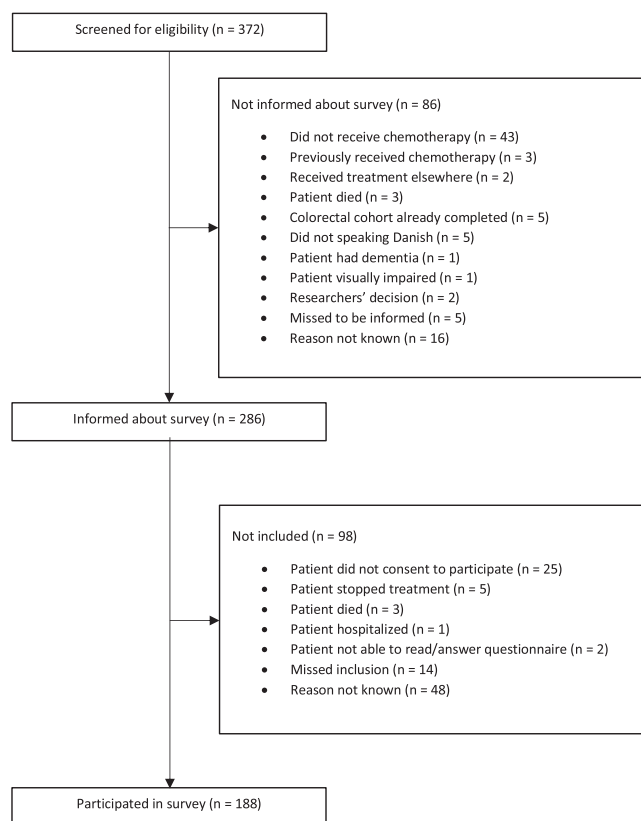


Figure 1. The ReCap study; screening, inclusion and exclusion.

Patients received chemotherapy for PC ($n = 63$), CRC ($n = 60$), and PRC ($n = 65$). For baseline characteristics, see Table 1. According to the G8 screening, 68% of patients were frail ($G8 < 14$ points). Multiple comorbidities ($CCI \geq 3$) were registered in only 7.4%. Totally, 13 patients (6.9%) had a possible cognitive impairment according to the Mini-Cog screening but in none were cognitive impairments, depression, or stress described in the primary oncological assessment.

Patients with PRC were significantly older, had more comorbidities, but had better PS, were less frail according to the G8 frailty screening and were more likely to live together with a spouse compared with patients with PC or CRC. All patients with PRC received palliative chemotherapy. Patients with PC were younger, but frailer and had poorer PS and lower educational level and were more likely to live alone but had less comorbidity than the other groups.

Due to the significant differences in baseline characteristics between the three cancer groups, the following analyses were also performed adjusted for cancer diagnosis.

Outcomes

Recall of given information

Nausea, diarrhea, fever, fatigue, and loss of hair were side effects most frequently remembered being informed about (Table 3). Although all patients should have been informed about diarrhea and fever, in sub-group analyses based on received chemotherapy (Table 3), 86%-88% of patients recalled information about diarrhea and 81%-84% of patients recalled being informed about fever. Furthermore, only 69% of patients receiving capecitabine or 5-FU remembered being informed about chest pain.

Table 1. Baseline characteristics.

Variable		All (n = 188)		Pancreas (n = 63)		Colorectal (n = 60)		Prostate (n = 65)		P*
		n	%	N	%	n	%	n	%	
Age	<70 years	95	50.5	38	60.3	38	63.3	19	29.2	<.001
	≥70 years	93	49.5	25	39.7	22	36.7	46	70.8	
Sex	Female	54	28.7	33	52.4	21	35.0	-	-	<.001
	Men	134	71.3	30	47.6	39	65.0	65	100	
PS	0	117	62.2	28	44.4	47	78.3	42	64.6	.003
	1	62	33.0	30	47.6	10	16.7	22	33.8	
	2+	7	3.7	4	6.3	3	5.0	-	-	
	NK	2	1.1	1	1.6	-	-	1	1.5	
Treatment setting	Neo-adjuvant	9	4.8	1	1.6	8	13.3	-	-	<.001
	Adjuvant	61	32.4	26	41.3	35	58.3	-	-	
	Palliative	118	62.8	36	57.1	17	28.3	65	100	
Civil status	Single	47	25.0	21	33.3	17	28.3	9	13.8	.030
	Living together	141	75.0	42	66.7	43	71.7	56	86.2	
Education	No further education	23	12.2	10	15.9	5	8.3	8	12.3	.048
	Further or higher education	162	86.2	53	84.1	53	88.3	56	86.2	
	NK	3	1.6	-	-	2	3.3	1	1.5	
CCI Non-age-adjusted	0-2	174	92.6	59	93.7	56	93.3	59	90.8	.79
	3+	14	7.4	4	6.3	4	6.7	6	9.2	
G8 score	Median, range	13 (5-17)		10 (5-17)		13 (6.5-17)		15 (8-17)		.018
G8 score	>14	61	32.4	5	7.9	19	31.7	37	56.9	<.001
	≤14	127	67.6	58	92.1	41	68.3	28	43.1	
	>11	125	66.5	20	31.7	47	78.3	58	89.2	
	≤11	63	33.5	43	68.3	13	21.7	7	10.8	
Mini-Cog score	≥3	175	93.1	57	90.5	58	96.7	60	92.3	.38
	<3	13	6.9	6	9.5	2	3.3	5	7.7	

Abbreviations: CCI, Charlson Comorbidity Index; PS, performance status.
P* Subgroups based on cancer diagnosis compared with the other two groups.

After adjustments for cancer disease, older age was associated with poorer odds of recalling information about diarrhea (adjusted OR [aOR] 0.94 [95% CI, 0.91-1.00]) (Table 4), fever (aOR 0.96 [95% CI, 0.91-1.00]), neuropathy (aOR 0.94 [95% CI, 0.89-0.99]), and chest pain (aOR 0.94 [95% CI, 0.88-0.98]). Cognitive impairment was associated with reduced odds of recalling information about chest pain (aOR 0.56 [95% CI, 0.33-0.91]). Further or higher education was associated with higher odds of recalling information about diarrhea (aOR 1.91 [95% CI, 1.14-12.39]).

Handling of side effects

Fourteen patients (7.4%) were handled dangerously in at least one scenario, and 48 patients (26%) were handled insufficiently in at least one scenario. Only 64% of patients managed to handle all scenarios adequately. Three patients with dangerous handling of the fever scenario did not recall being informed about fever as a common side effect.

Nine percent of patients ≥70 years handled dangerously in at least one scenario compared with 6.5% of younger patients ($P = .022$), and 44% of older patients presented insufficient or dangerous handling of scenarios compared with 25% of younger patients ($P = .007$) (Supplementary Table S2 and Fig. 2). No decreased ability to handle side effects was seen in frail patients ($G8 \leq 11$) or in patients with high comorbidity,

possible cognitive impairment (Mini-Cog < 3), or low educational level. However, 54% of patients with possible cognitive impairment demonstrated incorrect (ie, dangerous or insufficient) handling, compared with only 33% of patients with normal cognitive screening ($P = .21$). Totally, 43% of patients with a high comorbidity burden (CCI ≥ 3) demonstrated incorrect handling of side effects compared with only 33% of patients with CCI < 3 ($P = .67$).

In the logistic regression, older age and poor cognition were significantly associated with incorrect handling of side effects, but after adjustments for cancer diagnosis, only older age remained significant (aOR 0.96 [95% CI, 0.92-0.99]) (Table 5). After adjusting for all other factors, cognitive impairments were found to be associated with incorrect handling of side effects (aOR 0.70 [95% CI, 0.50-0.95]), but frailty or comorbidity was not.

Satisfaction with given information

For scores of the Info 25 questionnaire, see Supplementary Table S1. Patients with PC reported having received less information about the disease, medical tests, and treatment than patients with CRC and PRC. Furthermore, the mean satisfaction with information was lower for patients with PC compared with the other groups (78.7 versus 87.1, $P = .029$) (Table 2) as was the global score (65.1 versus 70.9, $P = .010$).

Table 2. Satisfaction with and evaluation of given information; global score.

Variable	Cut-off	Satisfaction Mean (SD)	P	Global score Mean (SD)	P
Age, years	≥70	84.9 (23.9)	.26	69.5 (13.5)	.65
	<70	83.5 (19.5)		68.3 (12.5)	
G8 score	>14	87.8 (19.6)	.12	72.6 (12.4)	.023
	≤14	82.5 (22.5)		67.1 (12.9)	
G8 score	>11	88.2 (18.3)	.001	71.2 (11.8)	.006
	≤11	76.3 (25.6)		64.1 (13.9)	
Mini-Cog	≥3	84.7 (21.0)	.45	69.3 (13.0)	.07
	<3	77.8 (29.6)		61.5 (10.7)	
CCI	≥3	88.9 (21.7)	.32	67.3 (16.0)	.91
	<3	83.8 (21.7)		69.0 (12.7)	
Civil status	Single	80.3 (26.6)	.34	66.0 (12.5)	.16
	Living together	85.5 (19.9)		69.7 (13.0)	
Further or higher education	No	78.8 (30.1)	.422	72.0 (13.5)	.059
	Yes	84.8 (20.3)		68.1 (12.7)	
Cancer	Pancreas	78.7 (26.6)	.029	65.1 (14.1)	.010
	Colorectal	86.9 (19.8)	.24	69.8 (9.6)	.49
	Prostate	87.4 (16.3)	.13	72.0 (13.6)	.037

Abbreviation: CCI, Charlson Comorbidity Index.

Patients with PRC had a higher global score compared with the other two groups (72.0 versus 67.3, $P = 0.037$).

There was no difference in satisfaction of given information or global score among older patients compared with younger patients or for patients with possible cognitive impairments (Mini-Cog < 3), compared with patients with normal screening (Mini-Cog ≥ 3) (Table 2). For frail patients (G8 ≤ 14 points) compared with fit patients, the satisfaction of given information was comparable; however, frail patients had a lower global score than fit patients ($P = .023$). Using the cut-off of G8 ≤ 11, frail patients were less satisfied with given information ($P = .001$), with a lower global score than fit patients ($P = 0.006$). No differences were seen for patients with and without comorbidities and for patients with further or higher education compared with patients without further education.

In an analysis of baseline characteristics and satisfaction with given information, fitness (G8 >14) was found to be positively associated with higher satisfaction ($P < .001$), as was normal cognitive function ($P = .049$).

Discussion

In this cross-sectional survey investigating satisfaction with and recall of information and ability to handle side effects, we found age and age-related factors negatively associated with the recall of information of some side effects and management of potential adverse events. Furthermore, we found significant differences between patients with PC, PRC, and CRC in median age, PS, comorbidity, and frailty, all of which were expected to have a possible impact on outcomes. Therefore, analyses were performed with and without adjustments for cancer diagnosis. Patients with PRC were older, had higher

Table 3. Recall of given information for all patients and based on given chemotherapy.

Side effects	All patients (N = 188)	Patients receiving 5-FU or capecitabine (N = 86)	Patients receiving oxaliplatin, docetaxel or nab-paclitaxel (N = 154)
	n (%)	n (%)	n (%)
Diarrhea	161 (86)	76 (88)	133 (86)
Fever	157 (84)	70 (81)	130 (84)
Chest pain	99 (53)	59 (69)	
Mucositis	119 (63)	59 (69)	
PPE	109 (58)	68 (79)	
Neuropathy	142 (76)		128(83)
Nausea/vomiting	164 (87)		
Shortness of breath	93 (50)		
Rash	96 (51)		
Dry mucous membranes	148 (79)		
Fatigue	161 (86)		
Sexual dysfunction	72 (38)		
Loss of hair	164 (87)		

Abbreviations: 5-FU, 5-fluorouracil; PPE, Palmar Plantar Erythrodysesthesia.

According to department guidelines patients treated with 5-FU or capecitabine, were most likely informed about diarrhea, fever, chest pain, mucositis, and PPE. Patients treated with oxaliplatin or docetaxel/nab-paclitaxel should at least have been informed about diarrhea, fever and neuropathy.

comorbidity, all were treated with palliative chemotherapy, their cognitive screening scores were slightly better, and they were more satisfied and had a more positive evaluation of given information than the other patients.

Recall of Information and Handling of Side Effects

In the present study, hypothetical scenarios were created to evaluate the most important questions: can we as health care professionals deliver information enabling patients to recall information and manage potential side effects at home (or after discharge)? And can we identify patients for whom the current type of information (oral and written) should be improved?

More than a third of all patients failed to handle scenarios with potential side effects adequately. Older patients and patients with poor cognitive function were more likely to handle potential side effects incorrectly than younger patients and patients with higher cognitive scores.

In agreement with prior studies,^{27,28} poor recall of information about some of the side effects was found to be associated with higher age. Jansen et al¹⁷ investigated recall of information among newly referred cancer patients compared with actual communication from audio-recordings and found that recall of information decreased with age and information load. Their findings suggest an adverse effect of cognitive overload among older patients with cancer,¹⁷ which is also in line with the results of Lehmann et al who found that patients who prefer limited information recall even less if provided with extensive information.²⁹

Table 4. Association between age-related factors and recall of side effect information.

	Crude		Adjusted for cancer diagnosis	
	OR	95% CI	aOR	95%CI
Diarrhea				
Older age	0.96	0.91-1.00	0.94	0.91-1.00
Low G8 score	0.96	0.82-1.12	0.96	0.82-1.12
Low Mini-Cog score	0.82	0.59-1.19	0.82	0.54-1.19
High comorbidity	1.01	0.68-1.56	1.05	0.63-1.74
Further or higher education	1.92	1.14-12.45	1.91	1.14-12.39
Fever				
Older age	0.97	0.93-1.01	0.96	0.91-1.00
Low G8 score	0.95	0.82-1.10	0.94	0.81-1.09
Low Mini-Cog score	0.78	0.57-1.10	0.77	0.55-1.08
High comorbidity	0.93	0.64-1.40	0.92	0.63-1.38
Further or higher education	1.39	0.96-6.20	1.37	0.99-6.08
Mucositis*				
Older age	0.99	0.95-1.03	0.99	0.95-1.03
Low G8 score	0.91	0.75-1.09	0.91	0.73-1.11
Low Mini-Cog score	0.93	0.57-1.55	0.95	0.58-1.60
High comorbidity	1.15	0.72-1.97	1.16	0.72-2.01
Further or higher education	0.99	0.96-1.03	0.99	0.96-1.02
Neuropathy**				
Older age	0.96	0.91-1.01	0.95	0.89-0.99
Low G8 score	1.00	0.84-1.17	0.98	0.83-1.16
Low Mini-Cog score	0.75	0.53-1.09	0.73	0.51-1.06
High comorbidity	0.74	0.49-1.13	0.72	0.47-1.11
Further or higher education	0.99	0.97-1.02	0.99	0.97-1.02
Chest pain*				
Older age	0.94	0.87-0.98	0.94	0.88-0.98
Low G8 score	0.94	0.78-1.13	0.97	0.78-1.20
Low Mini-Cog score	0.54	0.32-0.88	0.56	0.33-0.91
High comorbidity	0.81	0.51-1.30	0.83	0.52-1.33
Further or higher education	0.99	0.96-1.03	0.99	0.96-1.02
PPE*				
Older age	0.97	0.92-1.02	0.97	0.92-1.02
Low G8 score	0.93	0.75-1.14	0.96	0.75-1.22
Low Mini-Cog score	0.66	0.40-1.11	0.61	0.35-1.05
High comorbidity	0.81	0.41-1.41	0.83	0.41-2.50
Further or higher education	2.02	1.02-39.06	1.95	0.99-38.01

Abbreviations: OR Odds ratio; aOR adjusted Odds ratio; PPE Palmar Plantar Erythrodysesthesia.

*Only for patients receiving 5-fluorouracil (5-FU) or capecitabine.

**Only for patients receiving oxaliplatin, docetaxel, or nab-paclitaxel.

The age-dependent differences in the handling of side effects could be due to reduced recall, but also because some older patients do not want to be a burden to caregivers³⁰ or the health care system. Further research should focus on interviews illuminating causes and reasons for patterns of action among older patients. In the CARG score by Hurria et al³¹ hearing impairment in older patients is associated with a higher risk of toxicity, and may, therefore impact perception, recall, and handling of side effects.

The age-dependent differences seen could also be due to the poor health literacy and reduced health-related knowledge seen among older patients.³² Thus, improved knowledge

contributes to better health literacy and can compensate for small cognitive impairments like processing capacity.³³

In the present study, cognitive impairment was associated with the reduced recall of chest pain as a potential side effect and thus incorrect handling of it. Cognitive impairments were not identified in the oncological assessment prior to chemotherapy, and cognitive screening should be considered before chemotherapy is given to older adults with cancer.³⁴ The distress of being diagnosed with cancer can itself cause slow cognitive processing speed and reduced verbal memory³⁵ and have a negative influence on medical information recall.²⁸ Patients with cancer perform worse in cognitive tests including tasks

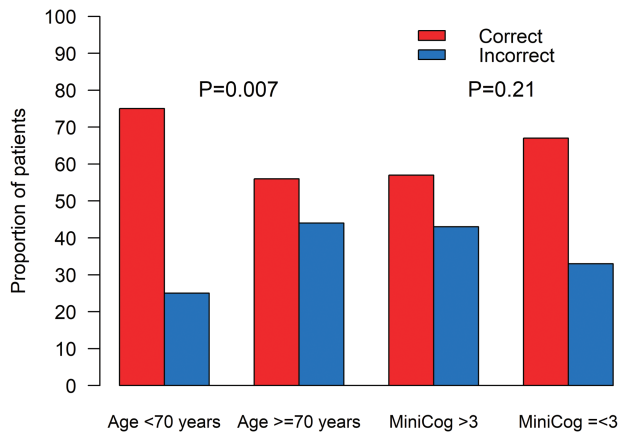


Figure 2. Ability to adequately handle chemotherapy related side effects depending on age and cognitive function.

Table 5. Association between correct handling of scenarios and baseline characteristics.

Characteristics	Crude		Adjusted for cancer diagnosis	
	OR	95%CI	aOR	95%CI
Older age	0.96	0.92-0.99	0.96	0.92-0.99
Low G8 score	0.97	0.86-1.09	0.98	0.87-1.11
Low Mini-cog score	0.74	0.56-0.98	0.76	0.57-1.01
High CCI	0.66	0.22-2.13	0.68	0.22-2.17
Further or higher education	1.00	0.97-1.02	1.00	0.97-1.02
Mini-cog*	0.70	0.50-0.95		

Abbreviations: OR Odds ratio; aOR adjusted Odds Ratio; CCI Charlson Comorbidity Index.
*Mini-cog score adjusted for all other factors.

requiring attention compared with healthy controls,^{35,36} especially older patients and those with low educational level.³⁷

Unsurprisingly, we found an association between poor cognitive screening scores and reduced recall of information and handling of side effects in older patients. But there was a tendency toward poorer cognitive screening scores in patients with PC compared with the other two groups, despite their younger median age. The differences seen might be due to the poorer prognosis and thus higher level of distress, which can affect cognitive functioning including memory^{38,39} and is also in accordance with a cross-sectional study where patients with a poorer prognosis were found to consistently remember less information from medical consultations than patients with a better prognosis.¹⁷ Thus, the poor cognitive screening with Mini-Cog in the present study might also be explained by distress due to of being diagnosed with cancer.

In the present study, a further or higher level of education was only associated with better recall of information about diarrhea but not on the handling of side effects. Our results are in line with the results of Wagner et al who found educational level negatively associated with the recall of information from surgeons about histology and further treatment among patients with CRC.⁴⁰ Low socio-economical position, ie, educational level⁴¹ has a negative impact on cancer survival⁴² by influencing cancer outcomes through patients'

health behavior⁴³ and adherence to treatment.⁴⁴ Our relatively small study population was generally well educated, and a broader social and economic inequality might not have been captured in this study.

When investigating the recall of received information, applied methods should be carefully considered, as different methods can trigger different results. Jansen et al evaluated medical information recall among 69 older patients (≥65 years) with cancer³⁶ and found that the mean percentage of correctly recalled information was 80% for multiple-choice questions, but only 23% for open-ended questions.³⁶

Satisfaction with Given Information

Even though patients with PRC were the most satisfied with the given information, they were the group of patients demonstrating the most dangerous or insufficient handling of side effects. Patients with PC, who were the least satisfied with the given information were, however, more likely to handle potential side effects adequately. Thus, it is important to include not only satisfaction with the given information when investigating the quality of given medical information but also patients' recall and ability to handle side effects. Using questionnaires, Pollock et al⁴⁵ found high rates of satisfaction with medical information; however, data from qualitative interviews revealed more ambivalent and complex experiences regarding receipt of information.⁴⁵

This study has some limitations including study design with three different cancer diagnoses, which was adopted to secure a broad spectrum of cancer patients to make findings easier to interpret in daily practice. However, patients within the three cancer diagnoses found themselves in very different life situations, which made groups incomparable, and adjustments for diagnosis were needed. Sub-groups based on cancer diagnosis were too small to analyze separately. Further limitations included the uncertainty of delivered information by the medical oncologist and the assumption that given information about side effects was done according to departmental guidelines. Video or audio recordings of consultations would have given a more accurate picture. No validation of the hypothetical scenarios was made nor was the accuracy or evaluation of intra- personal differences in answers performed; thus, the results can only be hypothesis-generating. At the same time, over half the patients with possible cognitive impairment demonstrated dangerous or insufficient handling of side effects compared with only a third of patients with normal cognitive screening. However, the analysis did not meet statistical significance, probably due to the small number of patients with possible cognitive impairments. Totally, 286 patients were informed about and offered inclusion in this study; however, only 188 patients were included. Some patients felt overwhelmed by the diagnosis and treatment start and did not have the energy to participate, which is presumed to be the most frequent reason for unknown non-participation. There could be a selection bias, as we do not know whether patients who were not included were frailer and had greater trouble remembering. Finally, the present study did not include a validated assessment of distress, which might be the most important factor in recalling information. On the other hand, Mini-Cog did identify patients with poor recall and risk behavior, regardless of the reason.

In conclusion, we found older age and poor cognitive screening associated with decreased recall of information and incorrect management of side effects. Cognitive impairments

were not acknowledged at oncological assessment, and cognitive screening should be considered prior to chemotherapy. For older patients and patients with poor cognitive screening scores, current written and oral treatment-related information may be insufficient, and future focus on individualized information, including assessment of information recall and handling, is crucial.

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Conflict of Interest

The authors indicated no financial relationships.

Author Contributions

Conception/design: C.M.L., D.L.N., M.K.M., H.M., and L.S. Provision of study material or patients: H.M., M.K., and C.M.L. Collection and/or assembly of data: H.M., S.T., and M.K.M. Data analysis and interpretation: C.M.L., M.S., S.T., M.K.M., D.L.N., and L.S. Manuscript writing: All authors. Final approval of manuscript: All authors.

Data Availability

The data underlying this article will be shared on reasonable request to the corresponding author.

References

- Papadakos JK, Hasan SM, Barnsley J, et al. Health literacy and cancer self-management behaviors: A scoping review. *Cancer*. 2018;124(21):4202-4210.
- Siegel RL, Miller KD, Jemal A. Cancer statistics, 2020. *CA Cancer J Clin* 2020;70(1):7-30.
- Parry C, Kent EE, Mariotto AB, Alfano CM, Rowland JH. Cancer survivors: a booming population. *Cancer Epidemiol Biomarkers Prev*. 2011;20(10):1996-2005.
- DeSantis CE, Lin CC, Mariotto AB, et al. Cancer treatment and survivorship statistics, 2014. *CA Cancer J Clin*. 2014;64(4):252-271.
- Bellizzi KM, Mustian KM, Palesh OG, Diefenbach M. Cancer survivorship and aging: moving the science forward. *Cancer*. 2008;113(12 Suppl):3530-3539.
- Siegel RL, Miller KD, Jemal A. Cancer Statistics, 2017. *CA Cancer J Clin*. 2017;67(1):7-30.
- Scher KS, Hurria A. Under-representation of older adults in cancer registration trials: known problem, little progress. *J Clin Oncol*. 2012;30(17):2036-2038.
- Outlaw D, Williams GR. Is the lack of evidence in older adults with cancer compromising safety? *Expert Opin Drug Saf*. 2020;19(9):1059-1061.
- Hernandez Torres C, Hsu T. Comprehensive geriatric assessment in the older adult with cancer: a review. *Eur Urol Focus*. 2017;3(4-5):330-339.
- Li D, Soto-Perez-de-Celis E, Hurria A. Geriatric assessment and tools for predicting treatment toxicity in older adults with cancer. *Cancer J*. 2017;23(4):206-210.
- Wildes TM, Ruwe AP, Fournier C, et al. Geriatric assessment is associated with completion of chemotherapy, toxicity, and survival in older adults with cancer. *J Geriatr Oncol*. 2013;4(3):227-234.
- Coates A, Abraham S, Kaye SB, et al. On the receiving end—patient perception of the side-effects of cancer chemotherapy. *Eur J Cancer Clin Oncol*. 1983;19(2):203-208.
- Pearce A, Haas M, Viney R, et al. Incidence and severity of self-reported chemotherapy side effects in routine care: A prospective cohort study. *PLoS One*. 2017;12(10):e0184360.
- Akin S, Can G, Aydinler A, Ozdilli K, Durna Z. Quality of life, symptom experience and distress of lung cancer patients undergoing chemotherapy. *Eur J Oncol Nurs*. 2010;14(5):400-409.
- Lorusso D, Bria E, Costantini A, et al. Patients' perception of chemotherapy side effects: Expectations, doctor-patient communication and impact on quality of life—an Italian survey. *Eur J Cancer Care*. 2017;26:1365-2354. doi:10.1111/ecc.12618.
- Mazzotti E, Antonini Cappellini GC, Buconovo S, et al. Treatment-related side effects and quality of life in cancer patients. *Support Care Cancer*. 2012;20(10):2553-2557.
- Jansen J, Butow PN, van Weert JC, et al. Does age really matter? Recall of information presented to newly referred patients with cancer. *J Clin Oncol*. 2008;26(33):5450-5457.
- Oken MM, Creech RH, Tormey DC, et al. Toxicity and response criteria of the Eastern Cooperative Oncology Group. *Am J Clin Oncol*. 1982;5(6):649-655.
- Charlson M, Szatrowski TP, Peterson J, Gold J. Validation of a combined comorbidity index. *J Clin Epidemiol*. 1994;47(11):1245-1251.
- Arraras JI, Greimel E, Sezer O, et al. An international validation study of the EORTC QLQ-INFO25 questionnaire: an instrument to assess the information given to cancer patients. *Eur J Cancer*. 2010;46(15):2726-2738.
- Bellera CA, Rainfray M, Mathoulin-Pélissier S, et al. Screening older cancer patients: first evaluation of the G-8 geriatric screening tool. *Ann Oncol*. 2012;23(8):2166-2172.
- Decoster L, Van Puyvelde K, Mohile S, et al. Screening tools for multidimensional health problems warranting a geriatric assessment in older cancer patients: an update on SIOG recommendations. *Ann Oncol*. 2015;26(2):288-300.
- Winther SB, Österlund P, Berglund Å, et al. On behalf of the Academy of Geriatric Cancer Research (AgeCare). Randomized study comparing full dose monotherapy (S-1 followed by irinotecan) and reduced dose combination therapy (S-1/oxaliplatin followed by S-1/irinotecan) as initial therapy for older patients with metastatic colorectal cancer: NORDIC 9. *BMC Cancer*. 2017;17(1):548.
- Borson S, Scanlan JM, Chen P, Ganguli M. The Mini-Cog as a screen for dementia: validation in a population-based sample. *J Am Geriatr Soc*. 2003;51(10):1451-1454.
- Borson S, Scanlan JM, Watanabe J, Tu SP, Lessig M. Improving identification of cognitive impairment in primary care. *Int J Geriatr Psychiat*. 2006;21(4):349-355.
- Tsoi KK, Chan JY, Hirai HW, Wong SY, Kwok TC. Cognitive tests to detect dementia: a systematic review and meta-analysis. *JAMA Intern Med*. 2015;175(9):1450-1458.
- Hillen MA, de Haes HC, van Tienhoven G, et al. Oncologists' non-verbal behavior and analog patients' recall of information. *Acta Oncol*. 2016;55(6):671-679.
- Nguyen MH, Smets EMA, Bol N, et al. Fear and forget: how anxiety impacts information recall in newly diagnosed cancer patients visiting a fast-track clinic. *Acta Oncol*. 2019;58(2):182-188.
- Lehmann V, Labrie NHM, van Weert JCM, et al. Tailoring the amount of treatment information to cancer patients' and survivors'

- preferences: effects on patient-reported outcomes. *Patient Educ Couns*. 2020;103(3):514-520.
- 30 Delgado-Guay MO, De La Cruz MG, Epner DE. 'I don't want to burden my family': Handling communication challenges in geriatric oncology. *Ann Oncol: Off J Eur Soc Med Oncol/ESMO* 2013;24 Suppl 7:vii30-35.
 - 31 Hurria A, Togawa K, Mohile SG, et al. Predicting chemotherapy toxicity in older adults with cancer: a prospective multicenter study. *J Clin Oncol*. 2011;29(25):3457-3465.
 - 32 Ashida S, Goodman M, Pandya C, et al. Age differences in genetic knowledge, health literacy and causal beliefs for health conditions. *Public Health Genom*. 2011;14(4-5):307-316.
 - 33 Chin J, Madison A, Gao X, et al. Cognition and health literacy in older adults' recall of self-care information. *Gerontologist* 2017;57(2):261-268.
 - 34 Mohile SG, Dale W, Somerfield MR, et al. Practical assessment and management of vulnerabilities in older patients receiving chemotherapy: ASCO Guideline for Geriatric Oncology. *J Clin Oncol*. 2018;36(22):2326-2347.
 - 35 Kaiser J, Dietrich J, Amiri M, et al. Cognitive performance and psychological distress in breast cancer patients at disease onset. *Front Psychol*. 2019;10:2584.
 - 36 Jansen J, van Weert J, van der Meulen N, van Dulmen S, Heeren T, Bensing J. Recall in older cancer patients: measuring memory for medical information. *Gerontologist*. 2008;48(2):149-157.
 - 37 Visovatti MA, Reuter-Lorenz PA, Chang AE, Northouse L, Cimprich B. Assessment of cognitive impairment and complaints in individuals with colorectal cancer. *Oncol Nurs Forum*. 2016;43(2):169-178.
 - 38 Papanastasiou A, Seliniotaki T, Rizos E, et al. Role of stress, age and adjuvant therapy in the cognitive function of patients with breast cancer. *Oncol Lett*. 2019;18(1):507-517.
 - 39 Skaali T, Fosså SD, Andersson S, et al. Self-reported cognitive problems in testicular cancer patients: relation to neuropsychological performance, fatigue, and psychological distress. *J Psychosom Res*. 2011;70(5):403-410.
 - 40 Wagner JY, Wuensch A, Friess H, Berberat PO. Surgeon-patient communication in oncology. *Eur J Cancer Care (Engl)*. 2014;23(5):585-593.
 - 41 Gallo V, Mackenbach JP, Ezzati M, et al. Social inequalities and mortality in Europe—results from a large multi-national cohort. *PLoS One*. 2012;7(7):e39013.
 - 42 Woods LM, Rachtel B, Coleman MP. Origins of socio-economic inequalities in cancer survival: a review. *Ann Oncol*. 2006;17(1):5-19.
 - 43 Williams-Brennan L, Gastaldo D, Cole DC, Paszat L. Social determinants of health associated with cervical cancer screening among women living in developing countries: a scoping review. *Arch Gynecol Obstet*. 2012;286(6):1487-1505.
 - 44 Gast A, Mathes T. Medication adherence influencing factors—an (updated) overview of systematic reviews. *Syst Rev*. 2019;8(1):112.
 - 45 Pollock K, Moghaddam N, Cox K, Wilson E, Howard P. Exploring patients' experience of receiving information about cancer: a comparison of interview and questionnaire methods of data collection. *Health (London)*. 2011;15(2):153-172.