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Role of patient characteristics in adherence to first-line treatment guidelines in breast, lung and prostate cancer: insights from the Nordic healthcare system

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ABSTRACT

Objectives This study investigates the influence of socioeconomic status, health literacy, and numeracy on treatment decisions and the occurrence of adverse events in patients with breast, lung, and prostate cancer within a Nordic healthcare setting.

Design A follow-up to a cross-sectional, mixed-methods, single-centre study.

Setting A Nordic, tertiary cancer clinic.

Participants A total of 244 participants with breast, lung and prostate cancer were initially identified, of which 138 first-line treatment participants were eligible for this study. First-line treatment participants (n=138) surpassed the expected cases (n=108).

Interventions Not applicable as this was an observational study.

Primary and secondary outcome measures The study's primary endpoint was the rate of guideline adherence. The secondary endpoint involved assessing treatment toxicity in the form of adverse events.

Results Guideline-adherent treatment was observed in 114 (82.6%) cases. First-line treatment selection appeared uninfluenced by participants' education, occupation, income or self-reported health literacy. A minority (3.6%) experienced difficulties following treatment instructions, primarily with oral cancer medications.

Conclusions The findings indicated lesser cancer health disparities regarding guideline adherence and treatment toxicity within the Nordic healthcare framework. A causal connection may not be established; however, the findings contribute to discourse on equitable cancer health provision.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Single-centre study with data from a restricted geographical location.
⇒ Medical records vary depending on charting of the healthcare provider.
⇒ Combine self-reported data with medical records and a longitudinal follow-up.
⇒ Analyse first-line treatment participants to minimise bias due to moderate response rate.
⇒ First-line treatment participants surpassed the expected cases, based on estimates from the Finnish cancer registry.

INTRODUCTION

Cancer remains a significant global health challenge, affecting a considerable proportion worldwide. The burden is unequally distributed, with notable disparities based on geographical location. In Nordic countries, public healthcare systems strive to provide equitable care, minimising the impact of socioeconomic status (SES) on treatment outcomes. To ensure equal care, SES and patient-related factors are aspects that need to be addressed. In a recent review, McMaughan *et al*[1] highlight a potential inverse relationship between low SES and healthcare accessibility, underlining the need for focused investigation in this area.

Patient-related factors are complex and often synonymous with socioeconomic factors and SES, which are determined by the social and economic environment in which people live in, work at or go to school.[2] The WHO defined health literacy in their 1998 health promotion glossary as 'The cognitive and social skills which determine the motivation and ability of individuals to gain access to understand and use information in ways which promote and maintain good health'.[3] The US Centers for Disease Control and Prevention defines health numeracy as 'person's ability to understand clinical and public health data'.[4] In a previous systematic review from 2019, low health literacy was related to low SES.[5]

In Sweden, the challenge of cancer health disparities was identified in 2007, later

resulting in implementation of national guidelines. In a follow-up, there were only modest improvements in prostate cancer care, suggesting the existence of impeding factors.[6] SES was found to affect cancer care, though the difference between counties was greater. It is shown in several studies that lower SES links to poorer overall outcome in cancer treatment.[7–9] Previous studies also suggest that patients with low SES are more prone to not receive guideline-adherent care, for example, in the USA, lower SES is shown to contribute to guideline non-adherent care in several studies.[10 11] Men with prostate cancer and high income and higher education had a higher probability to receive curative treatment in a study published in 2018.[8] In the Netherlands, SES affected treatment choice and overall survival in prostate cancer.[12] Contrasting these findings, studies also from the Netherlands indicate that SES is not associated with adherence to guidelines in hormone therapy or in surgery selection in breast cancer and only had a marginal effect on guideline adherence to chemotherapy.[13 14]

The role of SES and treatment toxicity, in the form of adverse events, has not been widely studied to our knowledge. Furthermore, the role of health literacy and numeracy has been mostly studied in screening processes, but not in overall treatment aspects.[15–17] Besides screening practices, other studies about health literacy focus on information needs and psychological aspects, for example, fear of progression.[18 19] The role of health literacy and numeracy in treatment choice and during treatment remains in most parts unresolved.[15 20]

In our study, we explore the complex relationship between patient and socioeconomic factors, guideline adherence and adverse events, suggesting that both adherence to guidelines and access to high-quality care play roles in patient outcomes. Our framework aims to elucidate how these elements interact, underscoring the study's importance in understanding and improving cancer care equity.

This study aims to explore the impact of education, occupation, income and self-reported health literacy on first-line treatment decisions among patients with breast, lung and prostate cancer in a Nordic healthcare setting. Furthermore, it seeks to examine the relationship between SES and treatment toxicity in the form of adverse events, areas that remain largely unexplored in the current literature, to our knowledge. By addressing these gaps, the study aims to contribute insights into the ongoing discourse on healthcare equity in cancer treatment.

MATERIAL AND METHODS

Study design and participants

A cross-sectional, community-based, mixed-methods study was performed at Vaasa Central Hospital, Finland during 20 December 2021–18 March 2022. After informed consent was given by the participants, a questionnaire consisting of 21 questions on patient-related factors was given. The questionnaire consisted of phrasing adapted from previously validated studies.[21–26] The questions considered education, occupation, income/month, ability to afford a sudden payment of €1200, relationship status, health literacy, health numeracy, smoking status and pack-years among smokers. Environmental exposure patterns were assessed with exposures to secondhand smoke, asbestos, and vapours, gas, dust and fumes. Lifestyle patterns were assessed with daily portions of greens, alcohol habits, activity in hours/day and exercise according to recommendations. Occupation was classed using the International Standard Classification of Occupations. Questions addressing self-reported health literacy and numeracy were translated into Finnish and Swedish from a study conducted at Harvard Medical School.[20] The questions used were 'How difficult is it for you to understand medical forms and information?' and 'How difficult is it for you to understand medical statistics?', respectively, as previously described by McCleary *et al*.[27] The question was modified into a scale. The answers were asked to be reported as a number on a scale between 0 and 100, ranging from difficult to easy. Self-reported health literacy and numeracy were interpreted as low, when the reported number was within the lowest quartile (<42 respective <35).

During the initial meeting, questionnaires were handed by physicians and nurses to any participant attending the cancer clinic. The only criterion to be eligible to complete the survey was to be treated for a malignancy at the cancer clinic. Clinical data were added, by the treating physician, considering primary tumour origin, pathology report, tumour, node, metastases staging and WHO cancer stage.

The three biggest cancer groups identified in the study were selected for further analyses: lung cancer, breast cancer and prostate cancer. The rest consisted of smaller groups with differing treatment guidelines, making analysis not feasible. Further data collection from patient records was performed and analysed for clinical and patient-related data. The follow-up analysis of treatment data was made during September and October 2022. Treatment information was collected systematically in a database (MS Excel, Microsoft, Redmond, Washington, USA) and included WHO performance status (PS), choice of first-line treatment, guideline adherence, potential adverse events (grade 3 or higher), patient-related compliance with treatment and potential misunderstandings during treatment.

Patient and public involvement

No patients participated in the study design. Any patient treated at the cancer clinic was eligible for the study, regardless of treatment stage and intention. All patients at the cancer clinic were asked to participate and written informed consent obtained. Patients completed the survey during previously planned visits. Participation in the study did not affect the treatment of the participants. The public was informed of the study in local state news media. The results of the study are planned to be disclosed to the public through local state news media.

Table 1 Patient characteristics and self-reported data compared between cancer types, χ^2 analysis with Pearson correlation

	Breast cancer N (%)	Lung cancer N (%)	Prostate cancer N (%)	All N (%)	P value
Number	68 (49.3)	28 (20.3)	42 (30.4)	138 (100.0)	
Sex					<0.001
Male	0 (0)	16 (57.1)	42 (100)	58 (42.0)	
Female	68 (100)	12 (42.9)	0 (0)	80 (58.0)	
Mean age, years	61	70	73	67	<0.001
Skill level					0.588
1–2	36 (52.9)	18 (64.3)	23 (54.8)	77 (55.8)	
3–4	32 (47.1)	10 (35.7)	19 (45.2)	61 (44.2)	
Education					0.055
Compulsory	15 (22.1)	14 (50.0)	14 (33.3)	43 (31.2)	
Upper secondary	19 (27.9)	7 (25.0)	14 (33.3)	40 (29.0)	
Tertiary	34 (50.0)	7 (25.0)	14 (33.3)	55 (39.9)	
Income per month					0.048
<€1200	11 (17.7)	11 (39.3)	7 (17.1)	29 (22.1)	
≥€1200	51 (82.3)	17 (60.7)	34 (82.9)	102 (77.9)	
Afford a payment of €1200					0.049
No	26 (39.4)	10 (35.7)	7 (17.1)	29 (22.1)	
Yes	40 (60.6)	18 (64.3)	34 (82.9)	102 (77.9)	
Health numeracy					0.395
Q1	14 (21.2)	9 (34.6)	10 (27.8)	33 (25.8)	
Q2–4	52 (78.8)	17 (65.4)	26 (72.2)	95 (74.2)	
Health literacy					0.102
Q1	13 (19.7)	11 (40.7)	9 (23.7)	33 (25.2)	
Q2–4	53 (80.3)	16 (59.3)	29 (76.3)	98 (74.8)	
Exercise					<0.001
No	23 (34.8)	21 (77.8)	17 (42.5)	61 (45.9)	
Yes	43 (65.2)	6 (22.2)	23 (57.5)	72 (54.1)	
Activity hours/day					0.18
1–2	34 (51.5)	8 (30.8)	19 (50.0)	61 (46.9)	
≥3	32 (48.5)	18 (69.2)	19 (50.0)	69 (53.1)	
Daily portions of greens					0.095
≤3	36 (53.7)	21 (77.8)	22 (57.9)	79 (59.8)	
4–6	31 (46.3)	6 (22.2)	16 (42.1)	53 (40.2)	
Smoking status					<0.001
Current smoker	2 (3.0)	8 (28.6)	3 (7.1)	13 (9.6)	
Ex-smoker	25 (38.5)	18 (64.3)	14 (33.3)	57 (42.2)	
Never smoker	38 (58.5)	2 (7.1)	25 (59.6)	65 (48.1)	
Alcohol					0.182
Consumes	38 (57.6)	14 (51.9)	28 (70.0)	80 (60.2)	
Does not consume	28 (42.4)	13 (48.1)	12 (30.0)	53 (39.8)	

Skill level as International Standard Classification of Occupations: low=level 1–2, high=level 3–4. In Nordic countries, skill level 1–2/occupation usually requires compulsory or vocational education, under 12 years.

Statistical analyses

Analyses were conducted using the SPSS statistics V.28.0 (IBM Corp, Armonk, New York, USA). Statistical significance was defined as a two-tailed p<0.05 and 95% CI was used. Demographical and descriptive statistics of categorical variables are shown as X^2 cross-tabulations, with Pearson correlation (tables 1 and 2). When the n-count was lower than 5, Fisher's exact test was used to calculate p

Table 2 Guideline adherence and adverse events among cancer types, X^2 analysis with Pearson correlation

	Breast cancer N (%)	Lung cancer N (%)	Prostate cancer N (%)	All N (%)	P value
Number	68 (49.3)	28 (20.3)	42 (30.4)	138 (100)	
Cancer stage					**<0.001**
1	24 (35.3)	2 (7.1)	7 (16.7)	33 (23.9)	
2	24 (35.3)	3 (10.7)	12 (28.6)	39 (28.3)	
3	17 (25.0)	8 (28.6)	9 (21.4)	34 (24.6)	
4	3 (4.4)	15 (53.6)	14 (33.3)	32 (23.2)	
WHO performance status					**<0.001**
0	47 (69.1)	5 (17.9)	21 (50.0)	73 (52.9)	
1	17 (25.0)	14 (50.0)	20 (47.6)	51 (37.0)	
2	2 (2.9)	9 (32.1)	1 (2.4)	12 (8.7)	
3	2 (2.9)	0 (0.0)	0 (0.0)	2 (1.4)	
Guideline-adherence chemotherapy					0.86
No	10 (19.6)	5 (20.8)	2 (28.6)	17 (30.1)	
Yes	41 (80.4)	19 (79.2)	5 (71.4)	65 (69.9)	
Guideline-adherence radiotherapy					0.109
No	3 (4.8)	2 (14.3)	0 (0.0)	5 (4.7)	
Yes	59 (95.2)	12 (85.7)	31 (100.0)	102 (95.3)	
Guideline-adherence surgery					**<0.001**
No	0 (0.0)	2 (40.0)	0 (0.0)	2 (2.5)	
Yes	67 (100.0)	3 (60.0)	8 (100.0)	78 (97.5)	
Guideline-adherence hormone therapy					**0.001**
No	0 (0.0)	0 (0.0)	3 (11.1)	3 (3.6)	
Yes	57 (100.0)	0 (0.0)	24 (88.9)	81 (96.4)	
Guideline adherence, all					0.365
Non-adherent	12 (17.6)	7 (25.0)	5 (11.9)	24 (17.4)	
Adherent	56 (82.4)	21 (75.0)	37 (88.1)	114 (82.6)	
Treatment duration, mean days	136	205	60	125	**0.035**
Any adverse event					**<0.001**
No	5 (7.4)	4 (14.3)	16 (38.1)	25 (18.1)	
Yes	63 (92.6)	24 (85.7)	26 (61.9)	113 (81.9)	
Grade 3 or higher adverse event					**0.010**
No	56 (82.4)	18 (64.3)	39 (92.9)	113 (81.9)	
Yes	12 (17.6)	10 (35.7)	3 (7.1)	25 (18.1)	
Able to follow treatment instructions					**0.045**
No	1 (1.5)	0 (0.0)	4 (9.5)	5 (3.6)	
Yes	67 (98.5)	28 (100.0)	38 (90.5)	133 (96.4)	

value. Continuous variables with skewed distribution such as age were compared between groups with Kruskal-Wallis test. To evaluate independent patient-related variables for guideline non-adherent care, binary logistic regression was used and results based on multivariate binary regression analyses. We recoded the non-adherent variable for all cancer types by stage and current guideline and recommendation from multidisciplinary meeting. ORs are shown with 95% CI. Grade 3 or higher adverse event depended on variable in univariate analysis and patient-related factors as independent variables.

RESULTS

In total, 244 participants diagnosed with breast, lung and prostate cancer participated in the study, of which 138 were participants in first-line treatment (figure 1). Of the participants included, 68 had breast cancer, 28 had lung

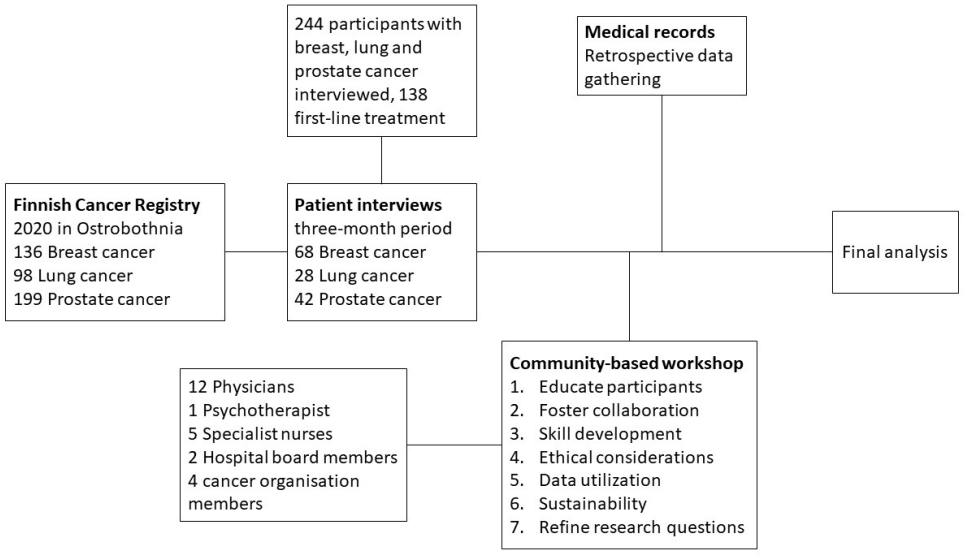

Figure 1 Flow chart of the study.

cancer and 42 had prostate cancer. To give context to the numbers, during 2020, the cancer clinic of Vaasa Central Hospital had 136 new breast cancer cases, 98 lung cancer cases and 199 prostate cancer cases. During the recruitment period, there were 710 treatment periods among all indications. Vaasa Central Hospital treats malignancies among all indications in Ostrobothnia. The vast majority of patients (>95%) in Ostrobothnia are treated within the catchment area of the hospital.

Baseline characteristics

Distribution between sexes was 58 (42.0%) female and 80 (58.0%) male participants. Mean age in the total population was 66.8 years (table 1). Skill level 1–2 was reported by 77 (55.8%) and skill level 3–4 by 61 (44.2%). Of all participants, 43 (31.2%) reported compulsory education as the highest attained educational level. A sudden payment of €1200 was not affordable to 43 (31.9%) participants and 29 (22.1 %) had an income under €1200 per month. For self-reported health literacy and health numeracy, there were no statistical differences between the cancer types, but patients with lung cancer showed a trend having the highest proportion of patients in the lower quartile. Further distribution and differences between patient-related factors among cancer types are presented in table 1.

Guideline adherence

In total, 24 (17.4%) participants among all treatment groups and all three cancer types received guideline non-adherent care. Guideline non-adherent rate among all three cancer types was 17 (30.1%) for chemotherapy, 5 (4.7%) for radiotherapy, 2 (2.5%) for surgery and 3 (3.6%) for endocrine cancer therapy (table 2). The reasons for non-adherence to chemotherapy were cognitive, neurological or mental health issues (N=7), immediate problems with treatment that did not allow the treatment to continue (N=6) and patient refusal (N=4). Non-adherent radiotherapy was due to previous radiotherapy, complications with wounds and patient refusal. The reason for non-adherent surgery was limited lung function and in hormone therapy, the reasons were patient refusal or not reported (table 2).

No statistical relationship between patient-related factors and non-adherent treatment was found. In binary regression analyses, age, sex, language, cancer type, PS, education, skill level, being able to afford a sudden payment, alcohol, smoking and exercise habits were all analysed, and no significance was found (all p>0.05 and insignificant 95% CI) (not all shown in table 3). Multivariate analyses adjusted for age, sex and cancer type did not affect significance.

Adverse effects and treatment compliance

Any adverse events were reported by 133 (81.9%) participants and grade 3 or higher by 25 participants (18.1%). In X^2 analysis with Pearson correlation between the three cancer types, patients with breast cancer reported the most any adverse events (92.6%) and patients with prostate cancer the least (61.9%) (p<0.001). Patients with lung cancer had the most grade 3 or higher adverse events (35.7%) (p<0.01; table 2). No statistical significance between patient-related factors and grade 3 or higher adverse events was observed. In crude binary regression analysis, income under €1200/month displayed statistical significance (OR 3.05, 95% CI 1.19 to 7.83); however, when adjusted for age, sex and cancer type, statistical significance was lacking (table 4).

Five participants (3.6%) did not follow given instructions. Challenges occurred mostly with per oral medication: ending treatments early, not starting treatment as prescribed or mixing medications (table 2).

DISCUSSION

This study aimed to evaluate whether SES and patient health knowledge, in the form of self-reported health

Table 3 Binary logistic regression analysis on how patient-related factors affect non-guideline-adherent care

	Crude		Model 1		
Variable	OR	95% CI	AOR	95% CI	C-statistics
Education					
Compulsory	1.78	0.64 to 4.99	1.34	0.40 to 4.47	
Secondary	1.04	0.33 to 3.26	0.89	0.27 to 2.94	
Tertiary, ref	1		1		
Occupation ISCO-08					
Skill level 1–2	0.92	0.38 to 2.24	0.71	0.27 to 1.85	
Skill level 3–4, ref	1		1		
Income/month					
<€1200	1.10	0.37 to 3.25	1.34	0.42 to 4.34	
≥€1200, ref	1		1		
Afford payment of €1200					
Unable to afford	0.92	0.35 to 2.44	0.80	0.29 to 2.22	
Able to afford, ref	1		1		
Health literacy					0.67
Low, Q1	1.64	0.63 to 4.28	1.24	0.45 to 3.44	
Moderate-high Q2–4, ref	1		1		
Health numeracy					0.53
Low, Q1	1.58	0.61 to 4.13	1.36	0.50 to 3.71	
Medium-high Q2–4, ref	1		1		

Model 1: adjusted for age, sex and cancer type.
AOR, adjusted OR; ISCO-08, International Standard Classification of Occupations.

literacy, affect first-line treatment guideline adherence in patients with breast, lung and prostate cancer in a Nordic country with assumed equal access to care. The results suggest that patient-related factors did not affect guideline adherence. Second, the results of this study indicate no significant correlation between adverse events and SES of the participant. We believe these results provide insights into the impact of SES on cancer treatment outcomes in the Nordic public healthcare framework.

When studying SES, patient-related factors and their relationship to treatment according to guidelines, it is important to consider the differences between healthcare systems, tax-funded versus private insurance-driven systems. In Finland, healthcare is publicly reimbursed and should be universal and accessible to everyone according to national law,[28] addressing the challenge identified by McMaughan *et al*.[1] 10 years ago, Wong *et al*[29] concluded that private insurance-based healthcare increased disparities in cancer care, due to differences in income. In several studies, guideline adherence has been linked to patient-related factors, where lower SES led to higher rate of guideline non-adherent care.[30–32] Contrasting results are reported by Hsieh *et al*,[33] suggesting adherence to guidelines after adjusting for sociodemographic variables. Our results confirm the latter, suggesting cancer treatment being offered without regard to socioeconomic factors. The authors consider this as the advantage of the Nordic healthcare system as patients receive the same treatment, regardless of their SES. Interestingly, lung cancer studies in Sweden, during recent years, revealed that high education was associated with a better outcome in both small cell lung cancer and non-small cell lung cancer.[34 35] The role of guideline adherence in reducing treatment disparities was discussed. Attention to these recent studies may have increased adherence to guidelines, and therefore alleviated disparities in cancer treatment.

Unrelated to SES and health literacy, 17.4% of all participants did not receive guideline-adherent care. Internationally, non-adherence rate has varied between 22% and 39%,[10 13 30] suggesting the observed non-adherence rate in our study being in the lower range. The clinical significance of guideline adherence is demonstrated in several studies. Lindqvist *et al*[36] observed increased overall survival when lung cancer treatment was given according to guidelines. In breast cancer, non-adherence was associated with an increased risk of death.[37] Comparable results in breast cancer are reported by Miller *et al*[38]; however, the study was limited to inconsistent definitions of adherence. Contrasting results were reported by Jacke *et al*,[39] suggesting increased survival when guidelines were deviated from. The authors concluded this originated from using guidelines as a starting point, and deviations being a result of individualised therapy. To conclude, guideline adherence relates to improved overall survival. The low

Table 4 Binary logistic regression analysis on how patient-related factors relate to grade 3 or higher adverse events

	Crude		Model 1		
Variable	OR	95% CI	AOR	95% CI	C-statistics
Education					
Compulsory	1.76	0.65 to 4.73	1.93	0.55 to 6.78	
Secondary	0.73	0.23 to 2.37	0.76	0.22 to 2.58	
Tertiary, ref	1		1		
Occupation ISCO-08					
Skill level 1–2	1.01	0.42 to 2.42	0.90	0.34 to 2.36	
Skill level 3–4, ref	1		1		
Income/month					
<€1200	3.05	1.19 to 7.83	2.76	0.98 to 7.73	
≥€1200, ref	1		1		
Afford payment of €1200					
Unable to afford	0.86	0.33 to 2.25	1.44	0.52 to 3.96	
Able to afford, ref	1		1		
Health literacy					0.51
Low Q1	1.53	0.59 to 3.95	1.24	0.44 to 3.49	
Moderate-high Q2–4, ref	1		1		
Health numeracy					0.40
Low, Q1	0.71	0.24 to 2.10	0.63	0.20 to 1.95	
Moderate-high Q2–4, ref	1		1		

Model 1: adjusted for age, sex and cancer type.
AOR, adjusted OR; ISCO-08, International Standard Classification of Occupations.

non-adherence rate in our study is likely not explained by universal and equal healthcare alone. The study and community-based aspect could have improved guideline adherence and acted as an intervention. When non-adherence was observed, the reasons were related to comorbidities, treatment contraindications and patient refusal, rather than with patient-related factors.

The relationship of SES and treatment toxicity, in the form of adverse events, has not been widely studied, to our knowledge. The role of SES and bowel toxicity after radiotherapy was discussed and the authors identified low statuses as an independent risk factor for adverse events after radiotherapy.[40] Hershman *et al*[41] concluded that lower SES was associated with less use of bevacizumab. Among patients with no contraindication, bevacizumab was associated with increased toxicity. Our results suggest SES and patient-related factors not being associated with adverse events. There is, however, a gap in reported adverse events between cancer types. Grade 3–4 adverse events were more common in patients with lung cancer. This is likely explained by cancer characteristics and treatment choice. Lung cancer presents at advanced stages,[42] and platinum-based chemotherapy is the first-line treatment choice.[43] Ben Ayed *et al*[44] concluded that metastatic disease was associated with increased cisplatin-related toxicity.

The present study is limited to being a single-centre study, with a study population from a restricted geographical location. The information gathered from medical records also varies depending on the charting of the healthcare provider, and thus could provide falsely missing data. The strengths of this study were to combine self-reported interview data to medical records and longitudinal follow-up. To minimise bias caused by moderate response rate, we only analysed first-line treatment patients. The first-line treatment patients (n=138) were over-represented as they exceeded expected cases (n=108). The estimation was based on new cancer cases for the area for 3 months, for the three cancer groups included in the study, according to the Finnish Cancer Registry.[45] Therefore, we believe the results to represent Finnish cancer care well. The results of the study provide insights specific to the Nordic healthcare context. These results are not applicable to areas with different healthcare systems. We acknowledge that the pathways linking adherence and adverse effects, as well as the influence of patient characteristics on adverse effects, could be impacted by unmeasured systemic factors, including socioenvironmental and regional characteristics.

The authors of this study consider, based on interviews and workshop, an existing communication gap between healthcare professionals and patients. The most common

reasons for guideline non-adherence were cognitive issues and patient refusal. Importantly, for treatment safety, almost 1 in 20 patients face challenges regarding following treatment instructions. These questions should be studied further with objective interventions, in community-based settings, to properly establish clinical improvement of care and to provide adjusted information on the need of the individual. Further academic discussion is needed for the interpretation of the results, and how guideline adherence could improve clinical practises. The present study does not consider later treatment lines and whether it is affected by patient-related factors. These findings could encourage further research into the mechanisms by which the Nordic healthcare system might mitigate the impact of socioeconomic factors on cancer treatment, potentially guiding policy development.

To conclude, guideline adherence was high, suggesting effective implementation of treatment guidelines for the common cancer types. Socioeconomic factors and self-reported health literacy appeared not to affect guideline adherence or the occurrence of adverse treatment events. The results suggest a mitigating effect of the Nordic public healthcare system on socioeconomic disparities. The limited association between SES and health literacy with adverse events could indicate equitable healthcare provision within the study context; however, we acknowledge the possibility for type II errors. Our findings underscore the potential effectiveness of public healthcare systems in achieving health equity in cancer care.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Consent obtained directly from patient(s).

Ethics approval The study was approved by Vaasa Central Hospital (VKS_2021_42_JYL). All individual participants provided written informed consent. The Southwest Finnish Ethics Committee approved the study because the study does not involve interventions, acknowledged by study subjects. General Data Protection Regulation (EU) 2016/679 was followed. The study was conducted according to the 1964 Helsinki Declaration and its later amendments. The study design was community-based research, and it was approved by both the community and the Cancer Association of Ostrobothnia. In a conducted workshop, the research questions were found to be in the interest of the community.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement No data are available. Due to its proprietary nature and Finnish General Data Protection Regulation, data cannot be made public; request should be addressed to Heidi Andersén.

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