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ORIGINAL ARTICLE

Identifying and predicting subgroups of information needs among cancer patients: an initial study using latent class analysis

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Abstract

Purpose Understanding how the information needs of cancer patients (CaPts) vary is important because met information needs affect health outcomes and CaPts' satisfaction. The goals of the study were to identify subgroups of CaPts based on self-reported cancer- and treatment-related information needs and to determine whether subgroups could be predicted on the basis of selected sociodemographic, clinical and clinician–patient relationship variables.

Methods Three hundred twenty-three CaPts participated in a survey using the "Cancer Patients Information Needs" scale, which is a new tool for measuring cancer-related information needs. The number of information need subgroups and need profiles within each subgroup was identified using latent class analysis (LCA). Multinomial logistic regression was applied to predict class membership.

Results LCA identified a model of five subgroups exhibiting differences in type and extent of CaPts' unmet information needs: a subgroup with "no unmet needs" (31.4% of the sample), two subgroups with "high level of psychosocial unmet information needs" (27.0% and 12.0%), a subgroup with "high level of purely medical unmet information needs" (16.0%) and a subgroup with "high level of medical and psychosocial unmet information needs" (13.6%). An assessment of sociodemographic and clinical characteristics revealed that younger CaPts and CaPts' requiring psychological support seem to belong to subgroups with a higher level of unmet information needs. However, the most significant predictor for the subgroups with

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unmet information needs is a good clinician–patient relationship, i.e. subjective perception of high level of trust in and caring attention from nurses together with high degree of physician empathy seems to be predictive for inclusion in the subgroup with no unmet information needs.

Conclusions The results of our study can be used by oncology nurses and physicians to increase their awareness of the complexity and heterogeneity of information needs among CaPts and of clinically significant subgroups of CaPts. Moreover, regression analyses indicate the following association: Nurses and physicians seem to be able to reduce CaPts' unmet information needs by establishing a relationship with the patient, which is trusting, caring and empathic.

Keywords Information needs · Cancer patients · Latent class analysis (LCA)

Introduction

Why is information so important for cancer patients?

The first goal outlined in the ASCO-ESMO Consensus Statement on Quality in Cancer Care is defined as "access to information" [1]. According to this goal, cancer patients (CaPts) should receive adequate information about their illness, possible interventions and the known benefits and risks of specific treatment options. Similarly, the National Cancer Institute recently stated that information exchange is one of the six core functions of clinician–patient communication [2].

The relevance of CaPts' access to information and the information exchange between CaPts and health care professionals is reflected in a growing body of literature suggesting that CaPts who are more informed are likely to experience reduced uncertainty, thereby alleviating concerns [3, 4] and improving health outcomes [2, 5–7]. Providing CaPts with information tends to increase their satisfaction, facilitate participation in the consultation, decrease anxiety and increase their ability to cope. Not only do CaPts often use their information resources to understand the disease but also to find hope [2] for a positive outcome.

What are the difficulties in delivering information to cancer patients?

CaPts are often unable to adequately satisfy their information needs as they frequently lack access to clear and sufficient information [2, 8, 9]. One possible reason for this may be the time constraints of physicians and other health care professionals. In addition, studies have shown that information provided by physicians is not always responsive to their patients' concerns [10, 11]. Patients also find it difficult to express their information needs. For example, during the initial shock of their diagnosis, they are often unaware of their information needs, are unable to understand the information provided to them [5, 12, 13] and are unable to say that they did not understand this information [14].

Concerning the type of information that CaPts look for, studies have consistently reported that the majority of CaPts desire detailed information on a variety of topics, including prognosis, treatment options, associated side effects, risks, benefits [14] and the psychosocial aspects of the illness [2]. In fact, it has been shown that the more information CaPts receive, the more satisfied they are. However, there are some CaPts who avoid information as a sort of coping mechanism [2].

Another difficulty in providing CaPts with information is that they are especially reluctant to disclose their psychosocial concerns. This is then reinforced by the reluctance of physicians to actively inquire about CaPts' concerns and feelings [2, 14]. Although the relevance and value of informing CaPts is widely recognised by physicians and other health care professionals [15], they do not always appreciate the complexity of these concerns and thus may not get to the "heart of the matter". Physicians' lack of perceptual skills for detecting patients' expressed needs may be a further explanation as to why many CaPts remain dissatisfied with the timing and the amount of information they are given by physicians or other health care providers [2]. According to Epstein and Street, physicians should realise that CaPts want information and should find ways of eliciting their information needs [2].

Why do we need to identify and predict subgroups of information needs among cancer patients?

Considering the positive influence that clinician–patient information exchange has on CaPts' health outcomes and the various information exchange difficulties (see Fig. 1), there is obviously a need for more in-depth study of and education on CaPts' information needs.

Various studies already exist, which provide a range of measures and descriptions of CaPts' information needs [16]. Although these studies are significant in their own right, they do not analyse (1) how information needs *cluster* together within subgroups of CaPts to form distinct need profiles and (2) how these need profiles can be predicted. These two questions are not inconsequential because they provide an outcome-relevant key for physicians and other health care professionals to:

(a) Better understand the complexity of and variation in the information needs of CaPts
(b) To differentiate between high- and low-level information need subtypes of CaPts

(c) Recognise how psychosocial information needs are distributed across subgroups of CaPts (see Fig. 1)
(d) Understand how information needs vary among sociodemographic and clinical subgroups
(e) Understand how their relationship to the patient influence information needs

Aim of the study

In dealing with the two issues described above, we used latent class analysis (LCA):

1. To identify subgroups of CaPts with similar needs regarding to a range of cancer-related information: medical examination results, treatment options, side effects, medication, social issues and health promotion

If more than one latent class was present, we then conducted a multinomial logistic regression analysis

2. To predict the probability of CaPts belonging to a specific information need subgroup, based on selected sociodemographic and clinical variables as well as those reflecting the clinician–patient relationship

Methods

Study design and patients

This was a cross-sectional, retrospective study with 326 CaPts in Germany suffering from bronchial, oesophagus, colorectal, breast, prostate and skin cancer. Patients were eligible for participation in this study if they had one of these six cancer types and if they were between 18 and 75 years old.

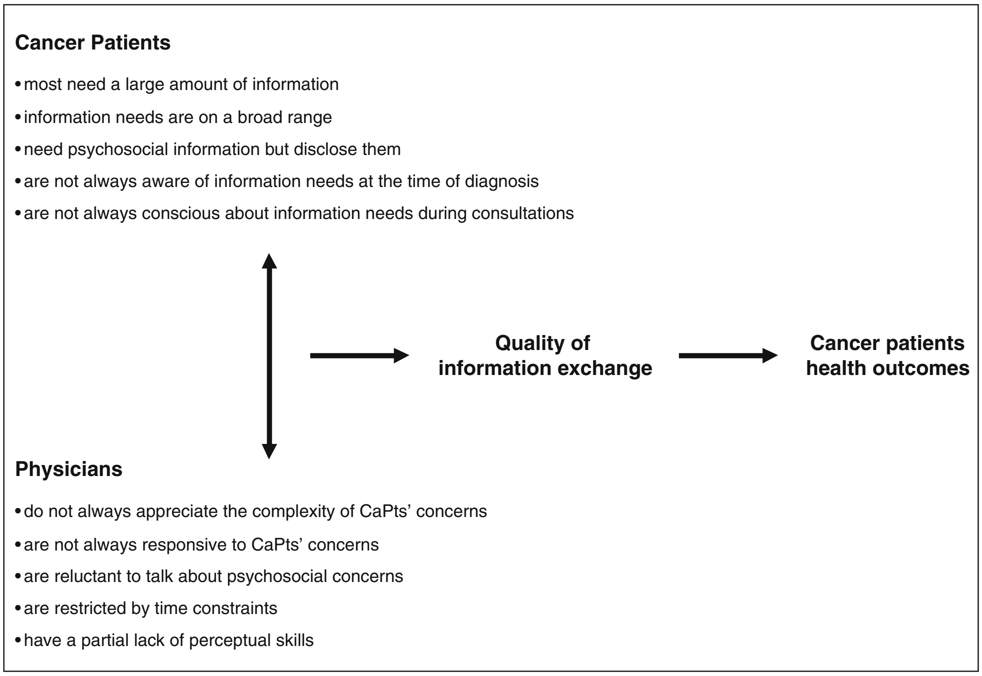
The study was reviewed and approved by the Ethics Committee of the Medical Faculty of the University of Cologne and the Protection Authority in North-Rhine Westphalia. A written questionnaire was sent to 710 cancer sufferers, who had been patients at the University Hospital Cologne between February and August 2005. The completely anonymous postal survey was conducted between September and November 2005. Examining the classical "Total Design Method" [17, 18] with three survey waves, a return rate of 49.5% (n=326) emerged. Of those, three respondents (0.9%) were excluded due to the limited data quality (missing values >30% in scale items).

The participants' mean age was 58.7 years (SD=11.2; range=19–76) with 64.5% of the patients above 50 years. Nearly 48% of the respondents were women, 78.6% lived with a partner and of those 69.4% were married. For 32.2%, the highest level of education was equivalent to grammar or high school. The disease-specific characteristics of this sample are reported in Table 1.

Measures

"Cancer Patients Information Needs" measure

A cancer-specific information needs measure suitable to the German health system did not yet exist. Therefore, we devised 23 questions with dichotomous response categories



Cancer Patients

- most need a large amount of information
- information needs are on a broad range
- need psychosocial information but disclose them
- are not always aware of information needs at the time of diagnosis
- are not always conscious about information needs during consultations

Physicians

- do not always appreciate the complexity of CaPts' concerns
- are not always responsive to CaPts' concerns
- are reluctant to talk about psychosocial concerns
- are restricted by time constraints
- have a partial lack of perceptual skills

Fig. 1 The information exchange difficulties between cancer patients (*CaPts*) and physicians and their influence on health outcomes

Table 1 Disease-specific characteristics of the sample (*N*=323)

	Number	*M*	Percent	Range	SD
Type of cancer diagnosis					
Bronchial	28		8.7		
Colorectal	18		5.6		
Prostate	54		16.7		
Oesophagus	35		10.8		
Breast	109		33.7		
Skin	68		21.1		
Other	7		2.2		
Missing	4		1.2		
Cancer stage					
Initial diagnosis	199		61.6		
Relapse	29		9.0		
Second tumour	36		11.1		
Relapse and second tumour	17		5.2		
Cancer stage not known	27		8.4		
Other cancer stage	8		2.5		
Missing	7		2.2		
Therapy/treatment					
Surgical	283		87.6		
Chemo	143		44.3		
Radio	148		45.8		
Pain	24		7.4		
Anti-hormone	61		18.9		
Antibodies	6		1.9		
Complementary	17		5.3		
No therapy ("wait and see")	18		5.6		
Other	25		7.7		
Time since diagnosis					
Months		22.1		1–309	44.8

M mean, *SD* standard deviation

(yes/no) with the help of in-depth 60-min interviews with five CaPts. The instrument that was subsequently developed, the "Cancer Patients Information Needs" (CaPIN) measure (see Table 2), was used to find out if, when looking back on their hospital stay, CaPts wished they had received more information on the following issues: medical examination results, treatment options, side effects, medications, social issues and health promotion. The English translation of the items and their descriptive statistics can be found in Table 2.

Measures assessing clinician–patient relationship

To assess the nurse–patient relationship, we utilised two subscales from the "**C**ologne **P**atient **Q**uestionnaire", which is widely used in Germany [19–21]: "trust in nurses" and "caring attention from nurses" (see "Appendix" for English translation). Both measures can be rated on a four-point scale from 1 ("don't agree at all") to 4 ("completely agree") by the patients and show acceptable psychometric results [19–21].

Physician empathy was assessed using the German version [22] of the widely used Scottish "Consultation and Relational Empathy" measure (CARE) [23–25]. The one-dimensional CARE measure comprises ten items relating to patient perception of physician understanding of and response to their concerns and fears. Patients could rate the ten CARE items on a five-point scale from 1 ("completely") to 5 ("not at all"). The psychometric properties of the German version of the CARE measure are very satisfactory and reported elsewhere [7, 22].

Data analysis

Missing data

For the 323 patients included in the study, a maximum of seven (2.2%) missing values in the items of the CaPIN

Table 2 English translation and frequencies of the "Cancer Patient Information Needs" measure

Dimension	English translation	% yes (*N*)	% no (*N*)
Looking back on your hospital stay, would you have liked more information about...			
Information from the physician: medical examination results and treatment options	1. …the medical examination results?	47.7 (154)	52.3 (169)
	2. …the diagnosis and progress of your cancer?	43.3 (140)	56.7 (183)
	3. …the risks, advantages and disadvantages of treatment and/or the surgical procedure?	36.6 (118)	63.5 (205)
	4. …other treatment options?	41.2 (133)	58.8 (190)
Information from the physician: side effects and medication	5. …the side effects of treatment (e.g. hair loss) and/or the surgical procedure?	28.5 (32)	71.5 (231)
	6. …drugs and/or measures to reduce the side effects?	38.7 (125)	61.3 (198)
	7. …the medication (e.g. benefits, side effects)?	40.6 (131)	59.4 (192)
Information regarding social issues	8. …obtaining sick leave certification whilst suffering from cancer?	12.4 (40)	87.5 (283)
	9. …working whilst suffering from cancer?	15.5 (50)	84.5 (273)
	10. …advice regarding employment legislation problems?	13.9 (45)	86.1 (278)
	11. …advice regarding health insurance problems?	21.4 (69)	78.6 (254)
	12. …advice regarding financial problems?	16.4 (53)	83.6 (270)
	13. …application for an identity card for those who are severely handicapped?	26.6 (86)	73.4 (237)
	14. …a cure?	29.1 (94)	70.9 (229)
Information regarding health promotion	15. …psychological/psychotherapeutic support?	30.7 (99)	69.3 (224)
	16. …spiritual support?	9.0 (29)	91.0 (294)
	17. …self-help groups?	19.8 (64)	80.2 (259)
	18. …going on holiday whilst having cancer?	20.7 (67)	79.3 (256)
	19. …participating in sports whilst having cancer?	33.7 (109)	66.3 (214)
	20. …nutrition whilst having cancer?	45.2 (146)	54.8 (177)
	21. …methods and/or measures to promote health whilst having cancer?	54.2 (175)	45.8 (148)
	22. …in-course or at-home relaxation exercises?	38.1 (123)	61.9 (200)

Frequencies were estimated after missing value imputation (see "Missing data" section). The last item 23 "…other information" was not included because it was an open-ended question and we found only a very limited number of additional information needs

measure was observed. Prior to the main data analyses, these missing values were imputed using the expectation maximisation (EM) algorithm. The EM algorithm estimates missing data using an iterative maximum likelihood estimation procedure. It is one of the recommended methods for preventing bias caused by not entirely random missing data processes [26, 27]. The imputation was performed using the NORM software programme [28].

Latent class analysis

In approaching the first objective of our research, we used LCA [24]. Unlike LCA, commonly used statistical methods such as regression analysis, factor analysis, and structural equation modelling take a variable-centred approach to data analysis. In these methods, the focus is on the relationship between variables. However, many research questions require methods that also take a person-centred approach such as in LCA or cluster analysis. These methods focus on the relationships between individuals. The goal of the person-centred approach is to group individuals into categories according to patterns in their responses to items. As a result, each subgroup contains individuals who are similar to each other and different from individuals in other subgroups [29–33].

An important difference between, for example, standard cluster analysis techniques and LCA clustering is that the latter is a model-based clustering approach. This means that a statistical model is postulated for the population from which the sample under study is drawn. More precisely, it is assumed that the data are generated by a mixture of underlying probability distributions. Thus, similar to item-response models [34], the LCA approach estimates the response probabilities for all items rather than the manifest response patterns, in order to best predict the distribution of response patterns within the study sample. This approach avoids the flawed assumption of error-free observations. A further advantage of using a statistical model is that the choice of the cluster criterion is less arbitrary. Additional benefits of applying LCA arise from the relaxation of often constraining assumptions about linearity, normal distributions and homogeneity assumptions that might be violated when adopting traditional modelling and scale construction approaches, especially if dichotomous data are being analysed [35].

LCA describes how the probabilities of a set of observed categorical variables or indicators (here: information needs) vary across subgroups of individuals. It refers to the unobserved subgroups of individuals as latent classes. The object of LCA is to find the smallest number of latent classes that can describe the associations among a set of observed categorical variables. Associations are described appropriately if each association between variables can be explained by the assumption that each individual belongs to one of the identified latent classes (*criterion of local independence*). Latent Gold 4.0 software [35] performs parameter estimation by subsequently applying the EM algorithm and the Newton–Raphson algorithm. This approach makes it possible to fit latent class models and to estimate two sets of parameters, which include, for example, response probabilities for each class (see research aim 1 of "Aim of the study" section). After fitting the model to classes 1 to 10, the optimal number of classes was determined by using the Bayesian information criterion ($\mathrm{BIC} = \log(L) - 0.05 \times \log(n) - k$, where k is the number of parameters). The BIC is a global measure that weights the fit and parsimony of the model simultaneously. The lower the BIC, the better the data distribution is fitted by the model given the number of fit parameters [32, 36]. Item responses for the CaPIN measure were dichotomous (0 = no, "I would have liked no more information."; 1 = yes, "I would have liked more information.").

Further statistical analyses

After elucidating the underlying latent class structure, we then conducted a multinomial logistic regression analysis to characterise subgroups of (unmet) information needs with regard to sociodemographic and clinical variables as well as those variables reflecting the clinician–patient relationship. This information was then used to predict specific information need subgroup membership. Hypotheses associated with these variables can be found in Table 3. Hypotheses regarding the sociodemographic and clinical variables were based on our experience and practice [7, 37] obtained by observation of real-world behaviour of CaPts [38]. Deriving the clinician–patient relationship as a relevant predictor for unmet information needs is based on the "Conceptual framework of patient–physician communication and its influence on outcomes" [7], which can be extended to nurses as they also play a key role in caring for the patient. The model assumes that socioemotional care is a precondition for adequate information, participation and education in the clinician–patient relationship.

We used SPSS 15.0 for Windows to generate the descriptive statistics and Cronbach's alpha of the CaPIN measure and to conduct multinomial logistic regression.

Results

Basic psychometrics and descriptive statistics of the "Cancer Patient Information Needs" measure

CaPIN is a new measure which was pre-tested on five CaPts using the "think aloud" and "probing" techniques [39]. The results of these cognitive interviews demonstrated the high face validity of the CaPIN because all questions were judged as relevant, reasonable and comprehensible. We also conducted basic psychometrics of the CaPIN. A Cronbach's alpha of 0.90 for the whole CaPIN measure can be seen as adequate reliability. The four subscales of the CaPIN (see Table 2) also reported acceptable reliability indices: "information from the physician: medical examination results and treatment options" = 0.82, "information from the physician: side effects and medication" = 0.78, "information regarding social issues" = 0.78 and "information regarding health promotion" = 0.85.

Table 2 shows the distribution of the responses to the CaPIN measure. Excepting social issues, notable information gaps existed in all information need domains for a substantial proportion of CaPts.

Identification of subgroups sharing similar information needs

LCA identified a five-class model as providing the best fit to the data according to the BIC. More specifically, the five-class solution had the lowest BIC (five-class model: BIC=6,779.4007, L^2=2,932.1665, *df*=209; four-class model: BIC=6,796.7827, L^2=3,082.4345, *df*=232; six-class model: BIC=6,803.8333, L^2=2,823.7130, *df*=186). In this five-class model, the misclassification of 5.6% of the CaPts into manifest classes, based on model parameter estimates, is relatively small.

The class-specific response probabilities for each of the 22 information items derived from the five-class model are illustrated in Fig. 2. The identified classes differ in nearly all of the four CaPIN dimensions described in Table 2, and the subgroup sizes are well distributed in our sample. Consideration of the response probabilities for each item, along with class prevalence, provides a substantive interpretation of each of the five classes:

1. *No unmet information needs:* CaPts in class 1 (31.4% of the sample) have almost no unmet information needs (see Fig. 2).

Table 3 Hypotheses of unmet information need subgroup membership with regard to sociodemographic, clinical and clinician–patient relationship variables

Variable	Hypotheses
Demographic variables	
Gender[a]	There are no gender differences
Age[b]	Younger CaPts have more unmet information needs in all areas
Academic degree[c]	CaPts with an academic degree have fewer unmet information needs
Work status[d]	CaPts who are still working have more unmet information needs, especially regarding social issues and health promotion
Religion[e]	There are no differences between CaPts who belong to a religious group and those who do not
Clinical variables	
Stage of cancer[f]	CaPts in the early stages of cancer have more unmet needs for information on medical examination results and treatment options, whereas CaPts in more progressive stages have more unmet needs for information on social issues and health promotion
Type of cancer therapy[g]	CaPts who only had surgery, differ from those CaPts who had both surgery and other therapies in that they have a particular need for information regarding medical examination results, treatment options, side effects, medication and health promotion
Number of secondary diseases[h]	CaPts with one or more secondary disease have more unmet information needs regarding treatment options, side effects, medication and health promotion
Duration of the hospital stay[i]	CaPts staying in hospital short-term have more unmet needs for information on medical examination results and treatment options, whereas CaPts staying in hospital longer-term have more unmet needs for information on social issues and health promotion
Requiring psychological support[j]	CaPts, who require psychological support or who are still in psychotherapy, have more unmet information needs regarding social issues and health promotion
Clinician–patient relationship	
Trust in nurses[k]	CaPts, who trust their nurses highly, have fewer unmet information needs
Caring attention from nurses[k]	CaPts, who get caring attention from their nurses, have fewer unmet information needs
Physician empathy	CaPts, who have been treated empathically by their physician, have fewer unmet information needs

[a] Male $N=153$, female $N=165$, missing values $N=5$

[b] Less than or equal to 60 years $N=129$, >60 years $N=134$, missing values $N=60$

[c] Academic degree $N=74$ (university degree $N=41$, university of applied sciences degree $N=37$), no academic degree $N=218$, missing values $N=31$

[d] Working $N=105$ (full time $N=65$, of which $N=42$ have a sick note from their physician; part time $N=31$; on an hourly basis $N=4$, as a vocational trainee $N=1$, on maternity leave $N=4$); not working $N=202$ (retired $N=162$, unemployed $N=12$, housewife $N=27$, student $N=1$ or military service/alternative civilian service $N=0$); missing values $N=14$

[e] Religious $N=244$, not religious $N=69$, missing values $N=10$

[f] Early stage of cancer $N=199$, progressive stages $N=92$ (relapse $N=29$, second tumour $N=36$, relapse and second tumour $N=17$); not included in the groups are the answer categories "I don't know which stage of cancer" ($N=27$) and "Other stage of cancer" ($N=8$), missing values $N=7$

[g] Surgery $N=108$, surgery and other therapies $N=215$ (chemotherapy $N=143$, radiotherapy $N=148$, pain therapy $N=24$, anti-hormone therapy $N=61$, antibody therapy $N=6$, complementary therapies $N=17$, no therapy ("wait and see") $N=18$, other therapies $N=25$); missing values $N=0$

[h] Missing values $N=8$

[i] 1 to 10 days $N=167$, 11+ days $N=149$, missing values $N=7$

[j] "Yes, I need psychological support." and "I am already in psychological therapy/psycho-oncological care." $N=90$, "No, I do not need psychological support." $N=227$, missing values $N=6$

[k] Items see "Appendix"

2. *High level of psychosocial unmet information needs:* CaPts in class 2 (27.0%) have a high level of information needs concerning health promotion and a moderate level of need for information from their physician regarding medical examination results, treatment options, side effects and medication.
3. *High level of purely medical unmet information needs:* CaPts in class 3 (16.0%) have a great need for information from their physician regarding medical examination results and treatment options, along with a moderate need for information on side effects and medication.
4. *High level of medical and psychosocial unmet information needs:* CaPts in class 4 (13.6%) have a very high level of need for information from their physician about medical examination results and treatment options,

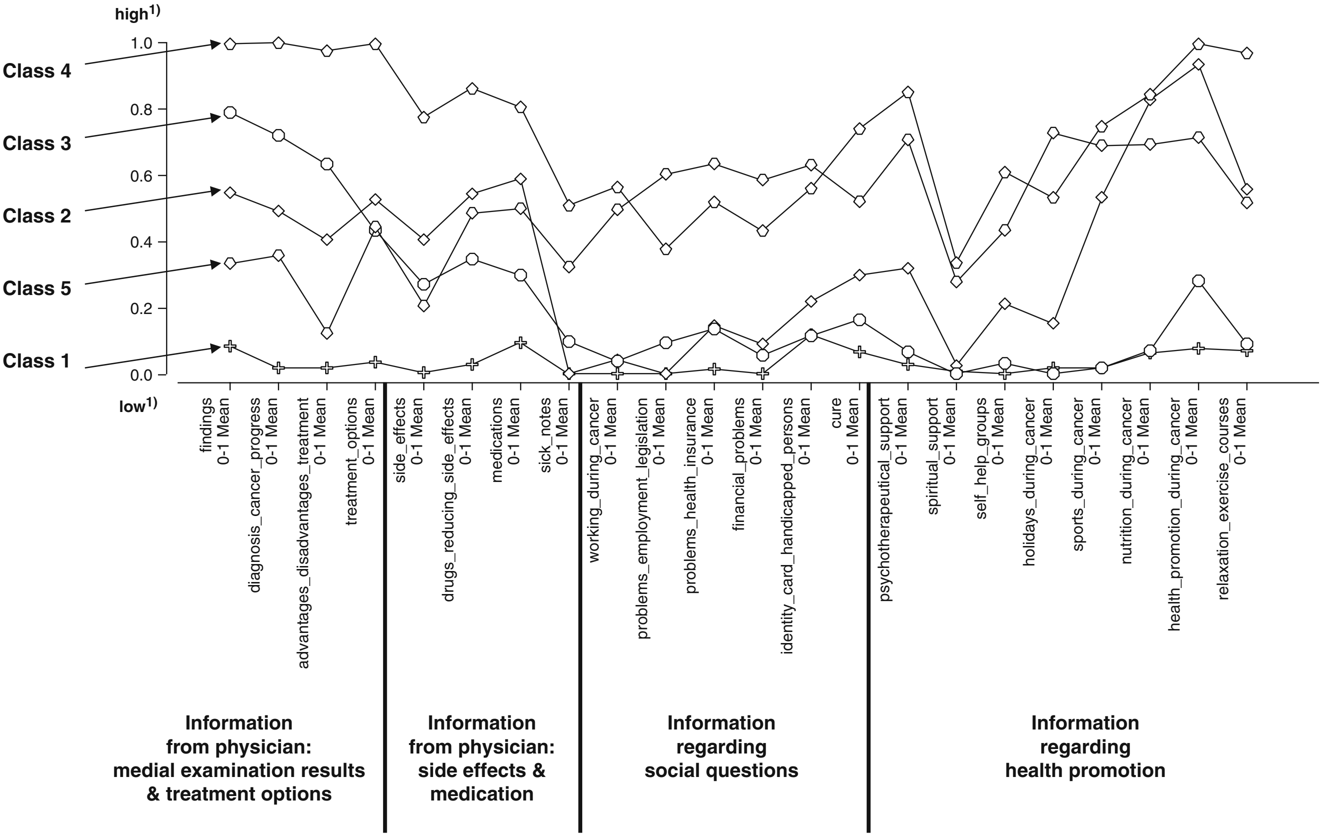


Fig. 2 The latent class profiles and response probabilities of information needs among patients with cancer. Note: *1)* response probabilities

along with moderate to high level of need for information regarding side effects and medication. They also exhibit a moderate to high level of need for information on social issues and health promotion.

5. *High level of psychosocial unmet information needs*: CaPts in class 5 (12%) experience a high to moderate level of information needs, especially regarding social issues and health promotion. They also experience a moderate need for information with regard to medical examination results and treatment options.

Predicting cancer patients' membership to information need subgroups based on sociodemographic, clinical and clinician–patient relationship variables

We attempted to better understand the composition of the five latent classes by comparing them using data not entered into the LCA, including sociodemographic, clinical and clinician–patient relationship variables [40].

The results of the three multinomial logistic regression models are summarised in Tables 4, 5 and 6, which show the odds ratios (OR) describing the odds of each of the sociodemographic (Table 4), clinical (Table 5) and clinician–patient relationship variables (Table 6) applicable to members of each class, relative to members of class 1 (almost no unmet information needs). The results indicated that the predictors, as a set, can be used to reliably distinguish between classes (sociodemographic variables: $\chi^2_{df=24} = 52.88$, $p=0.001$, Nagelkerke $R^2=0.21$; clinical variables: $\chi^2_{df=20} = 50.184$, $p<0.001$, Nagelkerke $R^2=0.17$; clinician–patient relationship variables: $\chi^2_{df=12} = 117.87$, $p=0.000$, Nagelkerke $R^2=0.32$). Using class 1 as a reference group, we found that a significant predictor of membership in class 5 is being under 60 years of age (see Table 4: OR=6.22, $p=0.014$, likelihood ratio $p=0.010$).

When analysing the clinical variables (Table 5) as potential predictors of class membership, we can see that "requiring psychological support" was significantly higher for members of class 2 (OR=6.1), class 5 (OR=8.40) and especially class 4 (OR=11.51; likelihood ratio $p<0.001$ relative to members of class 1).

However, the most significant predictors of class membership are having trust in nurses (likelihood ratio $p=0.006$), receiving caring attention from nurses (likelihood ratio $p=0.013$) and perceiving physicians as empathic (likelihood ratio $p=0.000$; see Table 6).

To summarise our findings from the three multinomial regression analyses, we can confirm five of the derived hypotheses found in Table 3. That is, apart from age and requiring no psychological support, a good socioemotional

Table 4 Multinomial logistic regression of the five information preference groups in relation to sociodemographic variables serving class 1 as reference group

	Class 2			Class 3			Class 4			Class 5			Likelihood ratio	
	OR	Wald[a]	*p*	OR	Wald[a]	*p*	OR	Wald[a]	*p*	OR	Wald[a]	*p*	$\chi^2_{df=4}$	*p*
Constant		0.118	0.731		5.215	0.022		4.574	0.032		11.240	0.001		
Male	1.079	0.039	0.843	3.007	5.422	0.020	0.984	0.001	0.975	0.872	0.058	0.809	6.961	0.138
Age 60 or less	2.006	2.162	0.142	0.400	1.631	0.202	2.258	1.592	0.207	6.221	6.071	0.014	13.185	0.010
No academic education	1.314	0.267	0.605	3.396	3.335	0.068	1.568	0.412	0.521	4.288	4.523	0.033	7.176	0.127
Working	0.579	1.250	0.264	2.486	1.637	0.201	1.416	0.335	0.563	1.434	0.360	0.549	6.066	0.194
Religious	0.873	0.105	0.746	1.045	0.006	0.936	0.830	0.130	0.718	2.186	1.657	0.198	2.959	0.565

OR odds ratio

[a] *df*=1

Table 5 Multinomial logistic regression of the five information preference groups in relation to clinical variables serving class 1 as reference group

	Class 2			Class 3			Class 4			Class 5			Likelihood Ratio	
	OR	Wald[a]	*p*	OR	Wald[a]	*p*	OR	Wald[a]	*p*	OR	Wald[a]	*p*	$\chi^2_{df=4}$	*p*
Constant		1.234	0.267		1.361	0.243		7.394	0.007		11.640	0.001		
Early stage of cancer	0.865	0.154	0.695	0.663	1.007	0.316	0.784	0.287	0.592	1.083	0.029	0.865	1.420	0.841
Requiring psychological support	6.057	16.338	<0.001	2.214	2.126	0.145	11.512	23.692	0.001	8.399	18.080	<0.001	39.673	<0.001
Duration of the hospital stay 1–10 days	0.872	0.168	0.682	0.979	0.003	0.956	1.369	0.558	0.455	1.681	1.500	0.221	3.108	0.540
No secondary disease	1.277	0.522	0.470	0.972	0.005	0.941	0.679	0.809	0.368	1.278	0.346	0.557	2.765	0.598
Surgery only	0.781	0.465	0.495	0.944	0.020	0.887	0.915	0.039	0.842	0.797	0.253	0.615	0.578	0.966

OR odds ratio

[a] *df*=1

clinician–patient relationship seems to be the most statistically significant and clinically relevant predictor for having no unmet information needs (subgroup 1).

Discussion

Main findings

The LCA approach detected five different subgroups of unmet information needs within a heterogeneous sample of German CaPts. The latent class structure exhibited differences in the type and extent of CaPts' information needs. An assessment of the sociodemographic, clinical characteristics and variables of the clinician–patient relationship not entered into the LCA provided further insight into the types of CaPts in each class. Taken together, our descriptive findings (Table 2) from observations of CaPts' high level of need for information, especially regarding medical examination results, treatment options, side effects, medication and health promotion, confirm the results of previous studies (for an overview, see [2]).

The main finding of our study is that five distinct information need subgroups could be identified by applying an LCA approach, whereby four subgroups show high to moderate unmet information needs in nearly all areas. Study and interpretation of the different subgroups can enhance researchers' and health care professionals' understanding of how CaPts' unmet information needs vary and increase their sensitivity to these unmet needs. In our sample, we are clearly confronted with subtypes of CaPts who experience extreme information needs. Whereas we identified class 1 as having almost no unmet information needs or perhaps some information needs in the process of being met, we also identified classes 2, 3, 4 and 5, which have a relatively high level of unmet information needs in nearly all areas, except for information about social issues. These findings might indicate that there is a problem with CaPts being particularly reluctant to disclose their concerns and information needs during consultations, which may, in turn, be reinforced by physicians' reluctance to speak about concerns (see Fig. 1 and "What are the difficulties in delivering information to cancer patients?" section). This hypothesis might be explained by our main finding in the third multinomial regression analyses that an excellent socioemotional, nurse–patient and physician–patient relationship is the most significant predictor for having no unmet information needs. These results also correspond to the "Conceptual framework of patient–physician communication and its influence on outcomes" [7], assuming that socioemotional care is a precondition for providing adequate information, participation and education in the clinician–patient relationship. Furthermore, a recent review

Table 6 Multinomial logistic regression of the five information preference groups in relation to variables of clinician–patient relationship serving class 1 as reference group

	Class 2			Class 3			Class 4			Class 5			Likelihood Ratio	
	OR	Wald[a]	*p*	OR	Wald[a]	*p*	OR	Wald[a]	*p*	OR	Wald[a]	*p*	$\chi^2_{df=4}$	*p*
Constant		0.655	0.418		0.577	0.448		0.250	0.617		3.421	0.064		
Trust in nurses	3.76	9.311	0.002	2.552	4.747	0.029	2.592	4.133	0.042	4.146	10.074	0.002	14.577	0.006
Caring attention from nurses	3.328	10.315	0.001	1.326	0.409	0.522	1.918	1.825	0.177	1.132	0.072	0.788	12.599	0.013
Physician empathy	0.360	5.288	0.021	0.116	20.530	0.000	0.058	30.974	0.000	0.569	1.029	0.310	50.604	0.000

OR odds ratio

[a] $df=1$

on oncology nursing sciences underlines the importance of good communication skills in cancer care so that health care professionals can appropriately tailor their information giving, advice, treatment and planning of care [41]. In addition, two previous studies [6, 7] could demonstrate in different health care settings (mixed sample of hospital patient and CaPts) that physician empathy is a significant predictor of information exchange and unmet information needs.

The assessment of CaPts' sociodemographic and clinical characteristics merely resulted in two main findings. Firstly, age (<60 years) was the only significant predictor of membership in subgroup 5 (high level of psychosocial unmet needs) with class 1 (no unmet information needs) as reference group. These results correspond to a wide range of other studies demonstrating that an increase in age is associated with fewer requests for information (for an overview, see [2]). Secondly, CaPts requiring psychological support have higher odds of falling into three of the five information classes (2, 4, 5), which show high level of information counselling needs, particularly concerning health promotion and social issues. Thus, their need for psychotherapeutic support should be more recognised in cancer care.

A possible intervention to decrease unmet information needs in CaPts is the structured use of prompt sheets by patients before and/or during the clinical encounter [42–47]. A prompt sheet is a structured list of questions that serves as a prompt for patients to consider questions to ask their physician. Prompt sheets have been shown to enhance patient participation during initial oncology consultations [42].

Limitations of the study

The main limitation of our explorative study is that it was a retrospective survey. Therefore, we cannot be certain if CaPts with almost no unmet information needs (e.g. class 1: no unmet information needs) really had no information needs or if their information needs were still being met by health care professionals. Thus, further replication and cross-validation within the context of a prospective design are needed in order to test whether the five information need subgroups truly reflect the information needs of CaPts. In such a study, an assessment should be made both of information needs at the beginning of the hospital stay as well as of those remaining at the end of the stay.

The second limitation of our study is that our cancer sample (six cancer types, different stages of cancer, wide range of time lapse since the diagnosis) suffers from heterogeneity and as a result from subgroups, which are too small to be analysed in the multinomial regression. As we know from previous studies (see "What are the difficulties in delivering information to cancer patients?" section), information needs can differ among CaPts, change over time, vary depending on the type and stage of cancer and persist throughout the cancer care continuum. This limits the scope for generalising the findings to other populations of cancer patients. Beyond that, the needs of the closer relatives of CaPts are not taken into consideration in this study.

Thirdly, the LCA solution depends on the input dataset; a different set of input data is likely to produce different class patterns. It is reassuring, however, that many of the classes we identified were similar to subgroups reported by other studies conducted among different CaPt populations. Nevertheless, a cross-validation within a larger study sample would be helpful to further investigate the generalisation of our study findings.

Fourthly, the psychometric properties of the CaPIN measure could have been insufficiently verified in this study. Therefore, future research should complement the present psychometric findings, especially with information about the construct validity of the CaPIN.

Future research

As mentioned in the previous section, future research should replicate our results in prospective studies with homogenous and large samples of CaPts with respect to the cancer type and stage. In doing so, LCA provides further useful applications. For example, using conditional probabilities generated by LCA, we would be able to compile a brief set of questions, allowing us to identify a CaPt as belonging to a specific information need subgroup. If the resources were available to give the patient a short survey or prompt sheet on a touch screen in the waiting room, for example, physicians or other health care professionals could then assign CaPts to an information need subgroup with an even higher degree of certainty. Such a questionnaire could be employed as a screening instrument. Consequently, knowing to which preference group a patient belong may be useful information for physicians, it may sensitise them to potential information need structures and allow them to address CaPts' specific information needs and to focus on these needs within the limited consultation time (see the "information exchange problems" in Fig. 1).

Prospective studies with homogenous and large samples of CaPts would also make it possible to generate typical information need profiles with respect to the type and stage of their cancer. Based on these profiles, a tailored information exchange strategy could then be developed to support health care professionals by using specific information methods and issues to meet the specific types of information needs.

Conclusion

The results of our study can be used by health care providers in oncology—i.e. physicians, nurses, oncologists, psychologists, social workers and so on—to increase their awareness of the complexity and heterogeneity of CaPts' information needs. Furthermore, regression analyses indicate the following association: Nurses and physicians seem to be able to reduce CaPts' unmet information needs by establishing a relationship with the patient, which is trusting, caring and empathic.

Researchers in the field of cancer care and health communication could use the applications and advantages of the LCA approach introduced in this article for further studies on CaPts' information needs, focusing, for example, on developing an information needs screening instrument and/or a tailored information exchange strategy for addressing different types of information needs.

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We confirm all patient/personal identifiers have been removed or disguised so the patients/persons described are not identifiable and cannot be identified through the details of the article.

Conflict of interest The authors indicated no potential conflict of interest.

Appendix

Translation of the German measures

Measure	English translation
Trust in nurses	The nurses were open and honest with me.
	I completely trusted my nurses.
	The nurses did not interrupt me while I was talking.
	I had the impression that the nurses are very competent.
	With the nurses in this hospital, one is in good hands.
Caring attention from nurses	The nurses showed feeling in their discussion with me.
	The nurses conducted regular discussions with me.
	I had a dedicated contact person assigned to me from the nursing staff.
	One could personally confide in the nurses.
	The nurses gave me time to think when important decisions had to me made.

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