

Cancer patients' preferences for therapy decisions can be grouped into categories and separated by demographic factors

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Abstract

Purpose Shared decision-making is based on comparable understanding of decision criteria on both sides that requires knowledge about preferences, reception/prioritization of benefits and covariates influencing these criteria. We addressed identification of cancer patients' preferences for treatment decisions and covariates for preference patterns in certain patient cohorts.

Design Using preference surveys ordinal ranking of decisional preferences in life (PL) and during therapy (PT) were obtained and aggregated by factorial analysis. Demographic and clinical data enabled clustering of patient groups including non-malignant control group with distinct preference patterns. Covariates for these patterns were determined by multivariate ANOVA.

Results 1777 cancer and 367 non-oncological patients (≥ 18 years) were evaluable (response 56.0%). Patient-reported PT was grouped into distinctive categories: immediate treatment effectivity, long-term effects and survival, empathy, easy treatment and employability/healing. Gender, parenthood, family status, age and educational level mainly determine importance of PL (52.1% variance) and PT (55.1% variance) enabling discrimination of specific

preference patterns in patients: older males, non-single, younger males, non-single female with children and young, single patients without children that mainly significantly differed from non-cancer patients ($p < 0.001$).

Conclusion Relevance of decisional PL/PT appears to be cancer-specific and distinct between cancer patient groups. If patients recognize direct social responsibility, immediate treatment effects gain importance accompanied by reduced impact of employability, rehabilitation and financial security. For young and independent patients empathy has similar impact as treatment effects. Consequently, clinical research should consider age-specific endpoints and distinct decisional preferences to match patients' perspective by specific evidence.

Keywords Shared decision-making · Therapy preferences · Patient-reported decision criteria · Cluster analysis · Cancer

Introduction

For cancer patients, shared decision-making (SDM) has gained tremendous importance and combines various facets of the patient–physician relationship. In 1961, 88% of physicians would not inform patients about cancer diagnosis (Oken 1961) but currently 94% of patients require disease information (Laxmi and Khan 2013), such as expectable symptoms, risks and quality of life (Basch 2013). Physicians need suitable evidence to empower patients for SDM (Coulter 1997) which includes information that meets patient's expectations (Charles et al. 1999).

SDM has been mainly investigated towards patient–physicians relationship and how to include patients' aims, preferences and values resulting in actual shared decisions

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(Whitney et al. 2008). Known issues are merely driven by psychooncology and related to communication, shared information, comparable expression and understanding of decisional preferences (Elwyn et al. 2012). Barriers for SDM and patient centricity are right of non-knowledge (Joseph-Williams et al. 2014; Strull et al. 1984), time constraints (Légaré et al. 2008), number of therapeutic options, side effects, scientific evidence of efficacy (Müller-Engelmann et al. 2012), and different reflection of decisional preferences (Epstein and Gramling 2013). Although most patients appear to prefer SDM (Chewning et al. 2012), treatment efficacy and benefits are frequently differently reflected by patients and physicians (Thiel et al. 2012). Comparable understanding of decision criteria on both sides requires knowledge about these preferences, reception/prioritization of benefits and potential covariates influencing these criteria. This intensively relies on evidence that meets expectations regarding their suitability for SDM, such as available clinical trial endpoints. However, since clinical evidence is almost exclusively driven by physicians' criteria for treatment decisions, available endpoints may not fit with patients' decisional preferences.

SDM is strongly influenced by stakeholder plurality but also by information, personality, sociodemographic, treatment context, disease context, setting, cost and rationing, role preference and experience (Bowling and Ebrahim 2001). In this investigation, we, therefore, addressed identification of cancer patients' preferences for treatment decisions and covariates for preference patterns in certain patient groups.

Methods

Patient cohort

Patients were obtained from the Comprehensive Cancer Center Muenster (University Hospital Muenster, Germany) between April 2015 and June 2016. All consecutive patients actively treated for malignant diagnoses in two 3-month periods were included. Preference surveys (Suppl. 7) were mailed to 2144 consecutive patients (1777 cancer patients, 367 non-oncological patients) aged ≥ 18 years. Other eligibility criteria were not applied. 1069 cancer patients (56.0%) responded including informed consent (Joint Ethics Committee of Physicians Chamber Westfalen-Lippe and Wilhelms-University Muenster, Germany: 2014-636-f-S). Control patients (interventions for benign diseases, such as breast, gastrointestinal, urogenital and broad spectrum of inflammatory diseases) were selected during a quality assurance survey at the same departments and the same times.

Patient-reported preference items

Using a questionnaire (Suppl. 7) all patients were asked to ordinally (5—most important; 1—less important; 0—not mentioned as priority) list the five most important preferences for (a) general decisions in life (life preferences) and (b) SDM related to their cancer treatment (therapy preferences). To obtain unbiased answers we did not predefine criteria for selection (Mayring and Fenzl 2014).

This has been supplemented by the SF12 questionnaire. While information about gender, age and diagnosis was obtained from electronic patient records for all included patients, additional demographic data were part of the questionnaire. All subsequent analyses have been done using SPSS23 (IBM, Ehningen, Germany).

Factorial analysis

Both types of preferences were included into separate factorial analysis procedures. To achieve optimal reduction of the number of factors that summarize primary preference items their extraction has been done using principal component analysis based on the correlation matrices, Eigenwert cut-off (Kaiser criterion) or predefinition for selection of numbers of extracted factors. Since scattering within the preference items is high and partial correlations cannot be ruled out oblique factor rotation has been performed using direct 'oblimin' SPSS procedure with Kaiser normalization ($\delta=0$). Factorial scores were obtained by regression and defined as novel variables (metric and steadily). To test suitability of the primary item matrices Kaiser–Meyer–Olkin Measure of Sampling Adequacy (KMO), anti-image covariance less than 25% and communalities larger than 0.5 were considered. For interpretation of obtained factors load of the respective component(s) of at least 0.5 were targeted, but loads >0.4 were also respected.

Comparison with demographic data

Cross tables were used for nominal or ordinal-scaled items. Differences were tested using Phi-coefficient or Kendall-Tau-c, respectively. All extracted factors and the identified patient clusters were compared for differences regarding the demographic description using unifactorial ANOVA for each demographic information. Bonferroni and Scheffé post hoc procedures were used for demographic items with more than two groups according to assumed equal variances of the factor distribution. Data were provided as mean \pm SEM and 95% confidential intervals (95% CI).

Cluster analysis

Partitioning cluster analysis has been done for identification of distinct patient groups who have similarities in their preferences for treatment decisions. Therefore, demographic data were used as categorical variables and therapy-preference factors were included as steadily values in a two-step cluster analysis procedure. Although rotated components were obtained in the factorial analysis with potential correlations between the extracted factors the chosen method for cluster analysis is robust against these influences. Patients with non-malignant diseases were excluded from this cluster analyses, but later used (cluster 0) for comparison with the identified patient clusters. The primary data set did not have any type of sorting to avoid a respective bias. Distances were calculated by the log-likelihood method. The number of clusters was tested according to the Schwarz's Bayesian Criterion (BIC) but also for predefined amounts. For final grouping cluster cohesion and separation as well as distinction of therapy preference factors were applied. Predictor importance of each input variable was used for relative weight of the distinct parameters.

Correlation analysis

Extracted preference factors were correlated using two-tailed Pearson correlation for quantitative values.

Results

Patient demographics

Patient data were available as shown in Supplementary Table 1. Patients with malignant diseases and patients with non-malignant diseases (comparison group) were comparable regarding their distribution of demographic parameters without any significant difference. This justified further inclusion of the non-malignant group into analyses for identification of cancer-specific decision preferences of patients. The group of non-responders was similarly distributed in their diagnoses and age spectrum with the exception that females with breast and gynecological cancers almost completely responded to the questionnaire (90.9%). In addition, patients with hematological (62.7%) and prostate cancer (69.0%) also had higher response rates. Overall, significantly more male patients responded compared to female patients (56.3 vs. 49.9%).

Patient-reported preference items

All patient-reported preference items were ascertained primarily without any categorization (20 different life

preference items and 23 therapy preference items). Some primary items were closely related and/or were found in very small subgroups of patients. Initial aggregation was done solely based on closely related contents of the items (e.g. "intact social relationship" and "social security") resulting in 16 aggregated life preferences and 12 therapy preferences that had preference values >0 in more than 50 patients. (Supplementary Table 2). To further reduce the complexity of the reported primary preference items a factorial analysis was subsequently performed for both types of preferences.

Factorial analysis

Based on the component loadings the obtained factors for life preferences (PL: explaining 52.1% of the total variance) and therapy preferences (PT: explaining 55.1% of the total variance) were defined (Table 1). Achieved separation of factorial load is visualized in Fig. 1. Sufficient distinction and grouping support usability of extracted PL and PT for further analysis.

The initial life preference item "Spiritual aspects" does not contribute to any of the extracted components for life preferences likely due to a small number of listings by the patients. The initial therapy preference item "Avoid hospital" contributes to the extracted factor 1 ("Immediate treatment effectivity") to lesser extent but this also supports the factor's context. In contrast, the item "Normal quality of life" does not show a specific, non-overlapping contribution to any of the extracted components for therapy preferences.

Comparison of extracted factors with demographic items

Univariate ANOVA was subsequently done to compare means of the extracted factors (PL and PT) for each demographic item (Table 2 for ANOVA p values). Demographic items were related to obtained PL and PT values to variable extent (Fig. 2 and Supplementary Fig. 1). Significant, but variable differences for both types of factors between various age groups, family status groups, educational levels, type of insurance and parenthood. Educational level and family status only correlated with few and insurance status with none PT factor(s). Age-dependent PT factor distributions were identified for most components except PT "Easy treatment". Comparably, patients with children differed highly significant in all PT factors from patients who are not parents. PL factors have significant variability regarding tumor entities for all components except PL "Personal values and recreation", esp. in gynecological cancer patients. All patients with malignancies were different from the non-malignant control group for PL "Physical and social health" (0.04 ± 0.02 vs. -0.19 ± 0.05), PL

Table 1 Pattern matrix of factorial load for life (PL) and therapy (PT) preferences

Life preferences	Extracted components					
	Physical and social health	Direct social relationships and health	Financial security and autonomy	Social and general security	Personal values and recreation	Sexuality and love
Life-pref. physical activity	0.741	0.206	0.086	−0.057	−0.125	−0.010
Life-pref. satisfaction	0.630	−0.102	0.112	−0.036	0.174	0.083
Life-pref. health	0.554	0.445	−0.022	0.096	0.013	−0.023
Life-pref. social aspects	0.530	−0.191	−0.328	0.106	0.110	0.221
Life-pref. self-confidence/self-respect	0.443	−0.228	−0.285	0.092	−0.113	−0.098
Life-pref. family	0.128	0.672	−0.141	0.198	0.002	−0.027
Life-pref. employment	−0.032	0.513	−0.376	−0.101	−0.100	0.075
Life-pref. financial security	−0.009	0.148	−0.737	−0.148	0.001	−0.090
Life-pref. patient autonomy	−0.036	0.017	−0.550	0.240	0.100	0.032
Life-pref. general security	0.018	0.034	−0.129	0.670	−0.073	0.101
Life-pref. friends	−0.032	0.487	0.234	0.553	−0.035	−0.095
Life-pref. spiritual aspects	0.123	−0.009	0.009	0.354	0.252	−0.160
Life-pref. personal values	0.010	−0.094	−0.076	0.001	0.839	−0.065
Life-pref. hobbies/recreation	−0.047	0.436	0.012	−0.144	0.478	0.174
Life-pref. sexuality	0.115	0.164	0.082	−0.166	−0.020	0.725
Life-pref. mutual love	−0.041	−0.200	−0.028	0.451	−0.008	0.660
Therapy preferences	Long-term effects and survival	Long-term effects and survival	Empathy	Easy treatment	Employability and healing	
Ther-pref. effectiveness	0.763	−0.325	0.271	−0.252	0.039	
Ther-pref. improve health	0.581	0.158	−0.168	−0.065	−0.121	
Ther-pref. side effects	0.580	−0.032	−0.042	0.298	−0.170	
Ther-pref. symptom control	0.443	0.145	−0.103	0.129	0.112	
Ther-pref. avoid hospital	0.373	0.120	0.092	0.106	−0.056	
Ther-pref. long-term effectivity	−0.006	0.805	0.126	−0.033	0.179	
Ther-pref. life extension	0.189	0.581	−0.168	−0.117	−0.170	
Ther-pref. normal QoL	−0.033	0.392	0.312	0.111	−0.390	
Ther-pref. empathy	−0.006	0.058	0.902	0.024	0.003	
Ther-pref. easy treatment	0.056	−0.136	0.041	0.933	0.034	
Ther-pref. employability	−0.109	−0.099	−0.083	−0.007	−0.846	
Ther-pref. healing	0.192	0.004	0.081	−0.027	−0.583	

Before factors were extracted for both groups of preference items the suitability of the row data matrices was investigated. The correlation matrix did not show any relevant correlations between the preference items, the KMO was well acceptable (life preferences: 0.697; therapy preferences: 0.731). Anti-image correlation was less than 25% for all items. Communalities were sufficient with high proportion larger than 0.5 (9/16 life preferences; 7/12 therapy preferences). Taken together the quality of the primarily aggregated data set was sufficient for factorial analysis and the extracted components are suitable to reflect relevant parts of the observed variances. The number of extracted factors was obtained by Eigenwert cut-off of 1.0 for PL. Using the Kaiser criterion to select the number of therapy preference factors a larger overlap and difficult assignment between various factorial loads was observed. Therefore, additional components were tested with Eigenwert values closed to 1.0 resulting in optimal factorial design by predefinition of 5 extracted factors. Extracted components were sorted by their factorial load. Determining factorial load for each extracted component were highlighted in bold (>0.400). Both groups of extracted factors were analyzed for correlations between the respective components and all of the coefficients were less than 0.2 ensuring absent or negligible correlations as prerequisite for further analysis

“Direct social relationships and health” (0.02 ± 0.02 vs. -0.10 ± 0.05) and PL “Social and general security” (0.02 ± 0.02 vs. -0.11 ± 0.04). PL “Physical and social health” (0.92 ± 0.33 vs. -0.77 ± 0.28) and PL “Social and general security” (0.95 ± 0.34 vs. -0.79 ± 0.27) had higher priority in female compared to male patients. PT factors were more significantly distinct between both groups and showed specific distribution for various cancer entities, esp. for patients with gynecological and prostate cancers.

Most impressive differences were observed for PT “Immediate treatment effectivity” and PT “Long-term effects and survival”.

Cluster analysis

Extracted PT factors and demographic data were used for two-step cluster analysis. Cluster names were chosen according to the major determinants of the included factors.

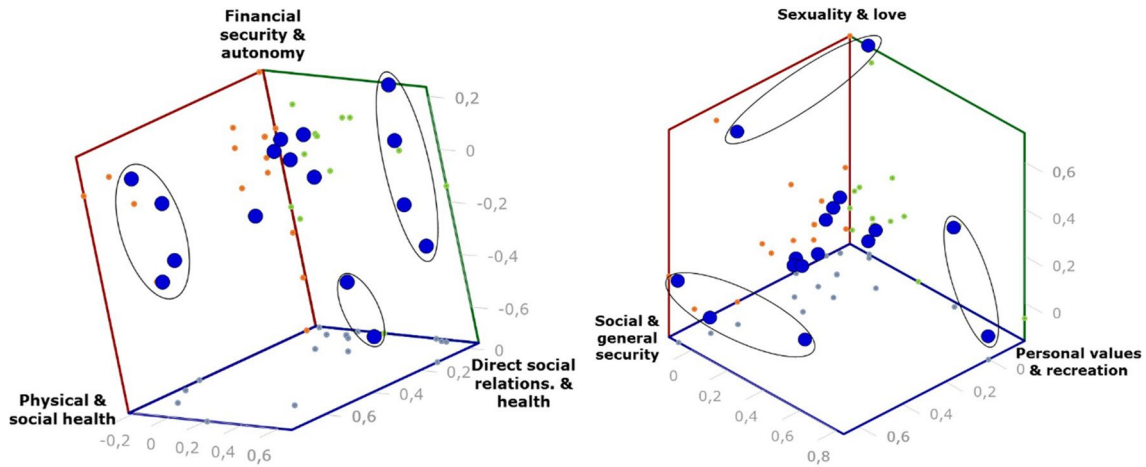


Fig. 1 Combined factorial load of the extracted life-preference factors. **a** “Physical and social health”, “Direct social relationships and health”, “Financial security and autonomy” and **b** “Social and general security”, “Personal values and recreation”, “Sexuality and love”. The factorial load of each primarily aggregated life-preference item rep-

resents one blue bubble. Each monofactorial load is shown by *dots colored* according to the respective axis. Items that separate specific factors are *circled*. Unmarked factorial loads did not contribute to the new factor distinctions

Table 2 ANOVA *p* values for correlation of extracted factors with demographic items

	Gender	Age	Insurance	Parenthood	Family status	Education	Cancer	Control group
Life preference factors (PL)								
Physical and social health	<0.0001	<0.0001	0.239	0.082	0.022	0.392	<0.0001	<0.0001
Direct social relations. and health	0.693	<0.0001	0.001	0.121	0.090	0.253	0.005	0.032
Financial security and autonomy	0.817	0.013	0.172	0.101	0.147	0.006	0.009	0.420
Social and general security	<0.0001	0.039	0.771	0.122	0.935	0.018	<0.0001	0.024
Personal values and recreation	0.580	0.385	0.202	0.019	0.275	0.014	0.157	0.141
Sexuality and love	0.537	0.002	0.814	0.197	0.005	0.001	0.022	0.354
Therapy preference factors (PT)								
Immediate treat. effectivity	0.086	0.011	0.225	0.006	0.292	0.064	<0.001	0.001
Long-term effects and survival	0.001	<0.001	0.626	0.088	0.196	0.023	<0.001	0.019
Empathy	0.289	0.049	0.701	0.032	0.293	0.101	0.014	0.052
Easy treatment	0.007	0.215	0.650	0.896	0.403	0.164	<0.001	0.051
Employability and healing	0.029	<0.001	0.993	0.013	0.032	<0.001	<0.001	0.011

Significances (*p* < 0.05) were highlighted. Post hoc corrections were performed if required

However, since these factors include component loading obtained from all patients clear group definitions, such as age borders, cannot be given by exact definition according to the factor analysis methodology. To provide rough definitions for all identified clusters the three major loadings are given. If obtained clusters were determined according to BIC criterion a two-cluster solution was provided. These clusters were almost exclusively determined by gender (>96% predictor importance) and PT-factors did not discriminate between both groups of patients (Supplementary Fig. 2). A predefined three-cluster solution resulted in distinction of (characteristics of most important determinants):

- A1. non-single males (gender: male; family status: ≠single; parenthood: with children; age group: >40 years)
- A2. non-single females with children (gender: female; family status: ≠single; parenthood: with children; age group: >40 years)
- A3. young, single patients without children (gender: equally distributed; family status: single; parenthood: no children; age group: 18–40 years)

Mainly attributed to demographic factors. In this three-cluster solution PT factors were very similarly distributed in clusters A1 and A2 (both genders non-single with

(a)

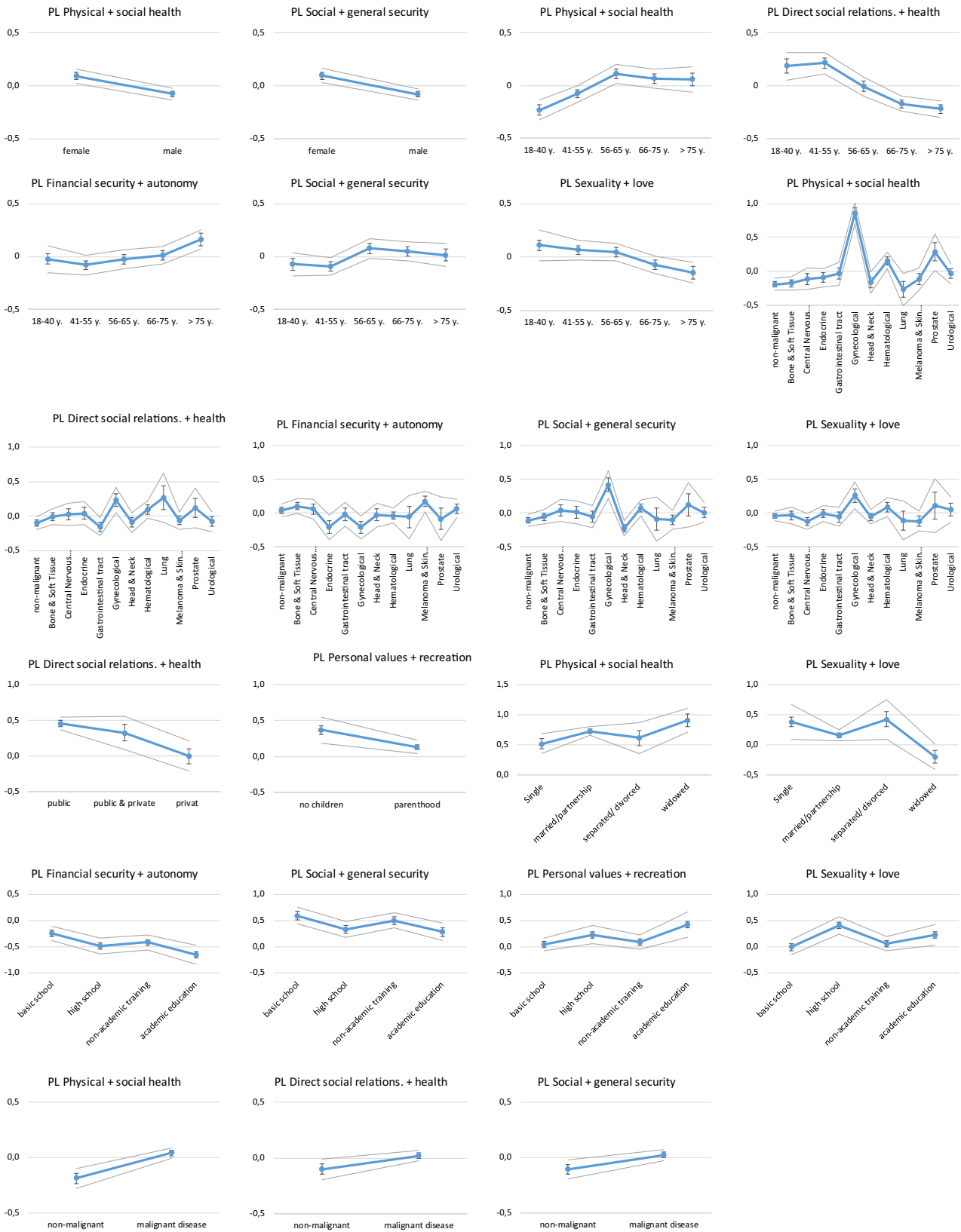


Fig. 2 Means \pm SEM and 95% CI for **a** PL and **b** PT factor distribution between various demographic characteristics

(b)

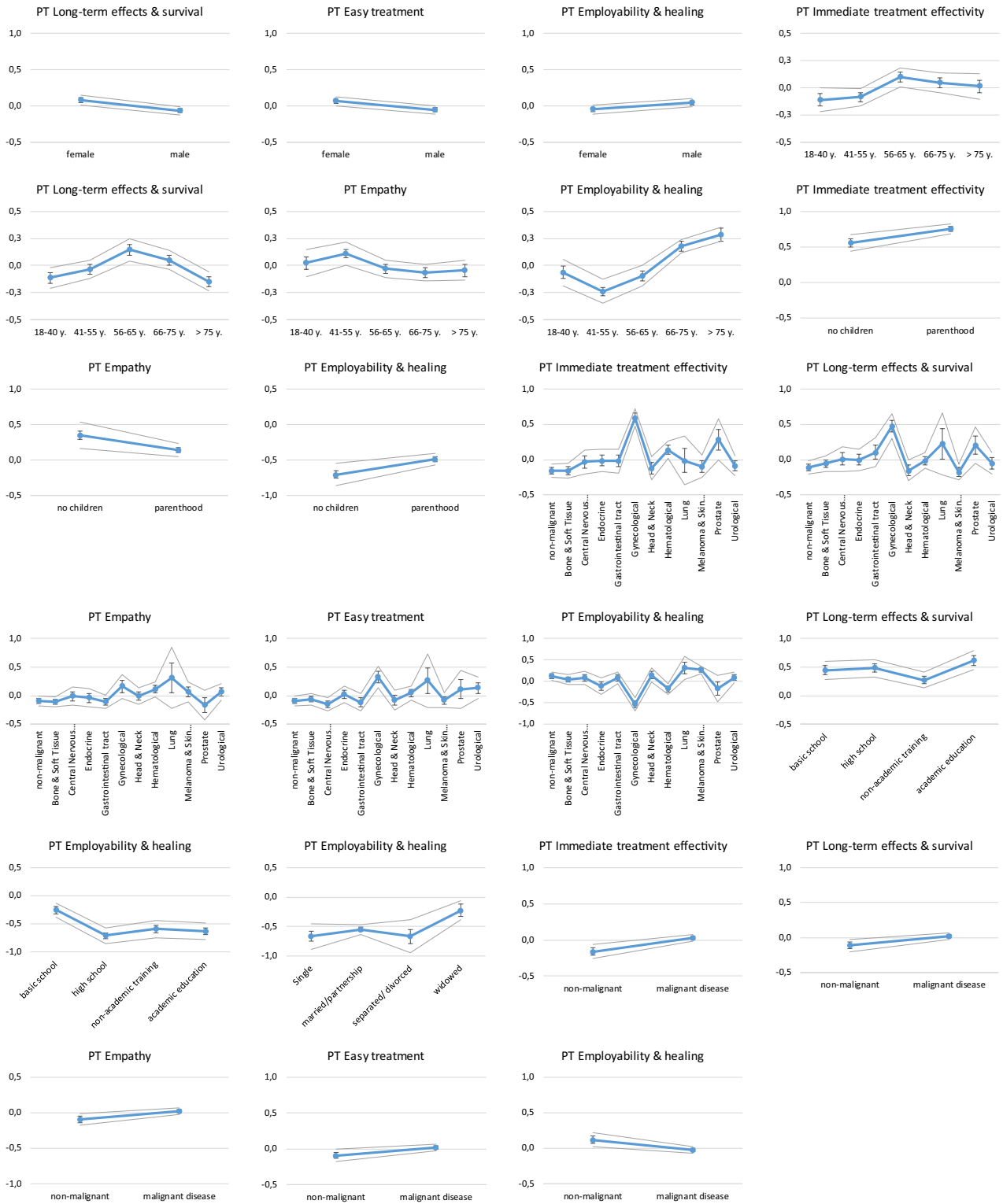


Fig. 2 (continued)

children), whereas young, single patients without children (A3) very much differed in preference priority and impact.

If a four-cluster solution was calculated cluster A2 and A3 remained almost unchanged (now B3 and B4, respectively). A1 cluster (non-single, younger males), however, was split into two clusters with distinct age and education (B1 and B2) (Supplementary Table 3).

- B1. older males (gender: male; family status: ≠single; parenthood: with children; age group: >65 years)
- B2. non-single, younger males (gender: male; family status: equally distributed; parenthood: equally distributed; age group: <65 years)
- B3. non-single females with children (gender: female; family status: ≠single; parenthood: with children; age group: >40 years)
- B4. young, single patients without children (gender: equally distributed; family status: single; parenthood: no children; age group: 18–40 years)

In all solutions PT and PL values differed significantly between clusters and compared to non-malignant control patients (defined as separate cluster) (ANOVA: $p < 0.001$ – 0.01), but female and male clusters were similar for all preferences (Fig. 3).

Life preferences

In all solutions non-malignant patients differed significantly regarding PL “Physical and social health”, PL “Social and general security”, PL “Financial security and autonomy” and PL “Direct social relationships and health” from cancer patient clusters ($p < 0.005$ – 0.001). Overall, PL “Financial security and autonomy” was of very low importance in all cancer patient groups. Considering 4 clusters “non-single females with children” were characterized by a specific PL pattern. ($p < 0.05$ – 0.001).

“Young, single patients without children” reported significantly higher importance for most PL compared to non-cancer patients ($p < 0.001$). These cancer patients showed significantly higher importance of PL “Sexuality and love”, PL “Direct social relationships and health” and PL “Personal values and recreation” compared to other clusters ($p = 0.050$). Furthermore, “non-single females with children” attribute higher impact to PL “Physical and social health” compared to other cancer patients ($p < 0.007$ – 0.001). “Older males” (four-cluster solution) reported comparable life preferences to other cancer patient groups, except PL “Sexuality and love” that was significantly less important compared to “non-single, younger males” and “young, single patients without children” ($p = 0.026$ – 0.001). “Non-single females with children” attributed very high importance of PL “Physical and social

health” compared to “non-single, younger males” and “young, single patients without children” ($p = 0.026$ – 0.001) as well as of PL “Social and general security” compared to “non-single, younger males” ($p = 0.021$). They also reported less importance of PL “Sexuality and love” compared to “young, single patients without children” ($p = 0.036$).

Therapy preferences

Similarly, all PT factors were significantly different ($p < 0.01$ – 0.001) between patients with malignant and non-malignant diagnoses (except PT “Empathy” for “non-single females with children” and PT “Easy treatment” for “young single patients without children”). “Young single patients without children” differed in PT “Immediate treatment effectivity” ($p = 0.025$ – 0.033), PT “Empathy” ($p = 0.010$ – 0.025) and PT “Employability and healing” ($p = 0.002$ – 0.029). “Non-single, younger males” and “non-single females with children” were not different in any PT factor. Interestingly, further cluster discrimination resulted in various changes in PT distinction and highly specific patterns for all patient groups. Similarities were observed between non-malignant patients and the new subgroup of “older males”, esp. for PT “Long-term effects and survival”, PT “Empathy” and PT “Employability and healing” as well as with “non-single females with children” (PT “Empathy”) and “non-single singles without children” (“Easy treatment”). Especially for PT “Immediate treatment effectivity” and PT “Empathy” pronounced differences were observed.

PT “Immediate treatment effectivity” was lowest in “non-single singles without children” and “non-single, younger males” ($p < 0.027$ – 0.001). PT “Long-term effects and survival” was of equal importance for all cancer patient groups (except “older males”). PT “Empathy” had significantly more importance in “non-single singles without children” ($p = 0.033$ – 0.044), but not in “non-single females with children” and “non-single, younger males”. In all cluster solutions PT “Employability and healing” plays very low roles regarding cancer patients’ therapy decision which was lowest in “non-single singles without children” ($p = 0.019$).

Correlation between life and therapy preferences

PL and PT were cross-correlated for all included patients (Table 3). Specifically, PL “Physical and social health” was highly correlated with PT “Immediate treatment effectivity” and PT “Employability and healing” (Supplementary Fig. 3). In contrast, PL “Personal values and recreation”, PL “Sexuality and love”, PT “Empathy” and PT “Easy

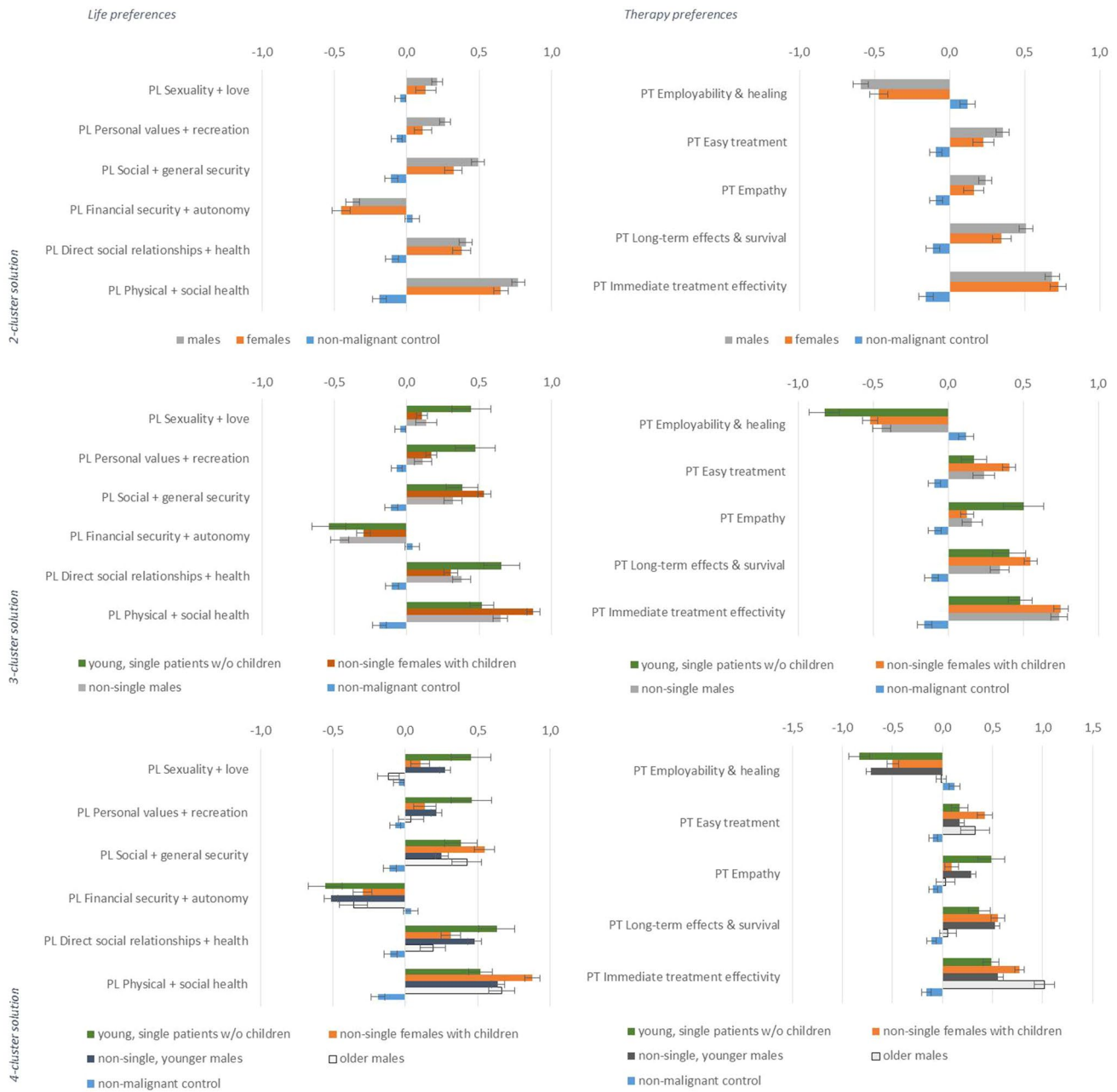


Fig. 3 Means \pm SEM of the impact of PL (left lane) and PT (right lane) factors for different patient subgroups according to the two-, three- and four-cluster solutions (rows). Major differences were found in most preferences between cancer and non-cancer patients. Patient

groups with and without malignant diseases were similar regarding their demographic data and, therefore, suitable for identification of cancer-specific decision preferences

treatment” did not show any important correlation to the other preference factors.

Discussion

Shared decisions during treatment planning can only be based on common understanding of decisional criteria and

available evidence providing information that is suitable for these preferences. This investigation was able to identify decisional preferences of cancer patients and to discriminate patient groups with distinct treatment related preference patterns. Subsequently, preferences could be grouped according to 6 PL and 5 PT factors as decision criteria. Both groups of preference factors are clearly distinctive and mainly determined by high load of certain components.

Table 3 Pearson correlation between extracted life and therapy preference factors

	PL physical + social health	PL direct social relationships + health	PL financial security + autonomy	PL social + general security	PL personal values + recreation	PL sexuality + love
PT immediate treatment effectivity	0.621**	0.287**	-0.358**	0.363**	0.105**	0.145**
PT long-term effects and survival	0.349**	0.151**	-0.262**	0.265**	0.145**	0.131**
PT empathy	0.115**	0.094**	-0.074**	0.102**	0.149**	0.050*
PT easy treatment	0.247**	0.115**	-0.088**	0.189**	0.084**	0.049*
PT employability and healing	-0.404**	-0.303**	0.343**	-0.209**	-0.074**	-0.156**

(* $p < 0.05$; ** $p < 0.01$) Due to the high number of included patients significance was found for all cross-correlations between both groups of factors. However, relevant correlations ($R \geq 0.3$ were highlighted) were only found for few preference factors

Obtained PL factors discriminate between health and social aspects, financial and general security as well as individual freedom and autonomy. Although the respective questions expressively addressed preferences not related to the diagnosis, their level of importance for personal decisions were highly distinct between cancer patients and patients with non-malignant diseases. For cancer patients financial aspects became much less important whereas health, social relationships and security dramatically gain decisional impact. The implication of PL factors is closely related to various patient characteristics, esp. age, parenthood and educational level. Interestingly, gender specific preferences were determined by social and health aspects, but not financial security and autonomy which were themselves mainly influenced by patients' educational levels. Cancer diagnosis alone appears to induce an intensive shift of treatment related preferences but also for the entire personal value system as reflected by PL factors.

However, it has to be pointed out that some of the preference groups, such as financial security and recovery of employability, might be intensively affected by the German social system with limited comparability to other countries.

The analytical methods used in this investigation (factor and cluster analysis) do not allow definitions of exact determinants for each group. Instead, patterns of component impacts and factorial loads characterize obtained PL/PT values and the identified clusters. For example, cluster A1 and A2 are very intensively determined by the absence of young age (18–40 years group) but equal distribution in all other age groups. In contrast, cluster A3 is intensively, but not exclusively determined by the presence of this age group.

Preferences for patients' decisions about treatment options, such as for SDM, can also be grouped according to main factorial loads. Immediate treatment effects vs. long-term effectivity and survival, burden of current treatment and recovery of employability mainly determine component compositions of the PT factors. Unexpectedly, the highest single load of PT factors was solely characterized by empathy of the medical team pointing to their

overwhelming importance for patients' decisions during cancer treatment. Age and integration into a family environment (parenthood, partnership) are the most important PT determinants and embedding in intact family structure [esp. marriage and parenthood (Croft et al. 2014; Goetze et al. 2006)] has been similarly found as predictor of psychoeducational requirement (Harden et al. 2009; Peleg-Oren and Sherer 2001), quality of life (Eom et al. 2013; Leung et al. 2014; Ramadas et al. 2015) and recreational activity (Bang Hyun et al. 2015; Barber 2012) during and after cancer treatment. This is even associated with a survival advantage as demonstrated for different cancer entities (Aizer et al. 2013; Keegan et al. 2014; Lutgendorf et al. 2012; Marshall and Funch 1983; Tominaga et al. 1998). Overall, for younger patients empathy is the most important decisional criterion, which has also been reported for a small lung cancer group (Brown et al. 2015) whereas all other factors are of less importance. In contrast, beginning in the group 56–65 years disease-related factors including immediate and long-term effects, manageable treatment and healing become more important. As expected impact of long-term effects drops in old patients. In contrast, these effects are highly important in patients with children (parenthood) whereas gender specificity is only very mild. Again, some of the demographic covariates, such as absent importance of the health insurance status, might be influenced by the socio-cultural system in Germany and can have more importance in other socio-cultural systems.

Life and therapy preferences are in part related to each other, but this is mainly limited to health aspects. If health plays a major role in life successful treatment and recovery from the disease are also very important for the cancer patients.

For the first time a stepwise discrimination of patients identified major groups where immediate social environment including marriage and parenthood are major determinants of decisional preferences which likely impact potential undertreatment, treatment compliance (Forsythe et al. 2014) and survival. Young single patients w/o children reported very high impact of personal values

and direct social relationships for their decisions in life, whereas low importance was attributed to financial aspects and social security. However, this might be affected by social regulations in various countries (Amir et al. 2012). This prioritization was combined with very low consideration of similar preferences for treatment decision, such as employability and rehabilitation. In contrast, this group of patients heavily relies on empathy of the medical team for decisions about therapy options. A second patient group includes females with children for whom disease and health related aspects are the most important SDM determinants, which is even more pronounced in older age groups. If males in older age groups are integrated into a family environment (partnership, children) their PL profile is similar to the respective females, esp. regarding immediate and long-term treatment success. However, independent of their family status and parenthood younger males with higher educational levels have preference profiles comparable to the single young patient group. Supporting our observations Rabin et al. (2013) found that young cancer survivors reflect (dis)advantages of interventions in an age-specific manner.

Conversely, older cancer patients differ on information satisfaction for preferences during treatment decisions (Watson et al. 2015).

This study was not limited to specific diagnoses enabling to include various demographic characteristics. Our data suggest that differences between diagnoses mainly reflect age and gender distribution; and only malignancy itself has a specific and very high importance.

However, performance as a single-center study and the regional socio-cultural environment, such as financial backup and health insurance availability, may limit the comparability of some cofactors in other countries. This study was limited to a 3-month period after discharge from cancer-specific hospital treatment and was not limited to specific stages, but this has been at least in part addressed by the type of statistical analysis. Furthermore, a selection bias may have occurred due to limited response and refused participation, but comparison of available aggregated data suggests representative response data. This analysis did not consider potential influences of long-term treatments, such as continuous drug therapy and potential cognitive long-term side effects as cofactors of the decisional value system. Future investigations have to look at preference dynamics during the various periods of treatment including long-term effects.

In summary, both types of preferences underlie an intensive shift in cancer patients compared to patients with non-malignant diseases towards disease-related and social aspects and away from financial security. Age and immediate social responsibility (children, spouses) are major determinants for patients' distinction of decisional preferences

with high importance of immediate treatment effects, but reduced impact of employability, rehabilitation and financial security. For young and independent patients empathy of the medical personnel has similar impact as treatment effects that should be addressed with specific evidence for SDM. Consequently, clinical research and treatment guidelines should consider cluster-specific endpoints and decisional opportunities to match the distinct preferences towards immediate effects or long-term effectivity by specific evidence. Further investigations should focus research endpoints that particularly meet the patients' decisional criteria and to figure out if a preference shift occurs during follow-up after cancer-specific treatment.

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Compliance with ethical standards

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