Effects of psychosocial interventions on quality of life in adult cancer patients: meta analysis of 37 published controlled outcome studies

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Abstract

The present meta analysis summarized the results of 37 published, controlled studies that investigated the effectiveness of psychosocial interventions on quality of life (QoL) in adult cancer patients. The overall effect size of psychosocial interventions and the effect of potential moderating variables such as type and duration of intervention, sociodemographic and clinical parameters, characteristics of QoL measurement, and methodological quality of the selected studies were calculated using a meta analysis model suggested by Hunter and Schmidt. The overall effect size was 0.31 (correlation equivalent delta) which corresponds to a standardized mean difference of $d = 0.65$ ($N = 3120$ cancer patients). The most important moderating variable was duration of psychosocial intervention with durations of more than 12 weeks being significantly more effective than interventions of shorter duration. The meta analytical findings support the usefulness of psychosocial interventions for improving QoL in adult cancer patients.
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Keywords: Cancer; Quality of life; Subjective well-being; Psychological intervention; Meta analysis; Psychotherapy; Psychooncology

1. Introduction

There is considerable evidence suggesting that cancer patients suffer from substantial and long-term psychological distress associated with different forms of cancer and its medical treatment [1]. The psychosocial management of adjustment problems experienced by people with cancer seems to be an obvious requirement for a more effective treatment of the disease. Nevertheless, there is an ongoing debate about whether and to what extent psychooncological care can be effective in patients suffering from cancer. These questions were comprehensively addressed by narrative reviews in several previous investigations [2–9].

However, there are only a few studies that examined the overall effectiveness of psychosocial interventions quantitatively by means of meta analysis [10–12]. The small number of quantitative meta analyses might be due to the fact that the single intervention studies are difficult to compare. Differences in clinical characteristics and methodological design can easily obscure the investigated effects of psychosocial interventions on outcome measures. Potential confounding variables are for example, (1) the patients' clinical and demographic characteristics such as type of diagnosis, stage and course of the disease, medical treatment, age, gender, and educational level; (2) type and duration of psychosocial interventions; (3) selection and operationalization of outcome measures used to assess the effectiveness of psychosocial interventions; and (4) the methodological quality of intervention studies indicated by the choice of control groups, randomization status of treatment conditions, or documentation of experimental and statistical designs and procedures. Meta analyses can quantify the impact of such possible moderating variables in terms of correlational relationships, although causal explanations of these relationships cannot be provided.

The present meta analysis tried to reduce the problem of different outcome measures by restricting relevant criteria to subjective quality of life (QoL) excluding other outcome criteria such as psychiatric syndromes (fear, depression), survival time, relapse rate or side effects of medical treatment. QoL was chosen because of the clinical relevance of this concept [13], its multidimensional structure reflecting the impact of cancer on several areas of the patients' life [14], and its sensitivity to psychotherapeutically induced effects [2,6,9]. However, QoL is no well-defined homogeneous concept so that a possible significant impact of the different conceptualizations of QoL on outcome measurement should be controlled.

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The present meta analysis sought to address the following issues: (1) What is the overall effect size of psychosocial interventions on QoL in adult cancer patients? (2) Do various types of psychosocial interventions create different effects? (3) Does effect size vary as a function of duration of psychosocial intervention? (4) Do sociodemographic and clinical parameters moderate these effects? (5) Do different conceptualizations of QoL reveal a significant impact on the effect size? (6) Does the methodological quality of intervention studies modify the effect size?

2. Method

Following common practice the present meta analysis consisted of six phases [15]: (1) formulation of research hypotheses; (2) extensive literature review according to research hypotheses; (3) identifying and coding of conceptually and methodologically relevant aspects of each single study; (4) quantitative aggregation of single effect sizes; (5) interpretation; and (6) documentation of results.

2.1. Phase 1: formulation of research hypotheses

The central hypothesis of the present study can be expressed as follows: cancer patients treated by an adjuvant psychosocial intervention (experimental group) experience a higher level of subjective QoL than those patients exclusively treated by routine medical and caring therapy without any additional psychosocial intervention (control group). Additionally, hypotheses concerning the impact of potentially moderating factors (Sections 2.1.1–2.1.4) were tested:

2.1.1. Type and duration of psychosocial intervention

For the purpose of the present study the various types of psychosocial interventions were categorized according to Cunningham's classification [16] suggesting a continuous transition from no or little personal contribution to the patients' active participation. Four categories ordered from low to high active patient involvement could be identified: first, patient education programs primarily provided medical or procedural information (16% of all included studies). When coping information was provided in these programs, active rehearsal of new behavior was not included. Second, social support (12%) referred to professionally guided support groups of cancer patients providing mutual help. The most important aspect of this type of intervention was probably the emotional support and the communication of shared experiences. Third, coping skills training (54%) consisted of cognitive, cognitive-behavioral, or behavioral methods supposed to modify cognitions or behaviors by active acquisition of specific coping skills. This category comprised techniques such as progressive muscle relaxation, systematic desensitization, biofeedback, behavior modification, or reinforcement schedules. Fourth, psychotherapeutic interventions (18%) included different kinds of psychotherapy and counseling such as psychodynamic, existential, supportive or eclectic therapeutic approaches and crisis intervention.

Furthermore, duration of psychosocial intervention was documented both as a continuous and a dichotomized variable. The latter one separated short-term (≤12 weeks) from long-term (>12 weeks) treatments.

2.1.2. Sociodemographic and clinical parameters

Age, gender (male, female, mixed populations), and tumor localization (breast versus other localization) were considered as potentially relevant patient characteristics. Other important features such as level of social support, coping style, or early versus late stage cancer could not be included because they were not consistently reported in the selected studies.

2.1.3. Quality of life assessment

According to the most relevant conceptual differentiations of QoL currently discussed in the literature [17], the following four aspects were considered for the present meta analysis: first, QoL instruments either focus on emotional adjustment (e.g. Profile of Mood States; [18]) or on functional adjustment (e.g. Functional Living Index for Cancer; [19]). Second, QoL instruments can either be classified as global (e.g. Psychological General Well-being Index; [20]) or disease-specific (e.g. EORTC Quality of Life Questionnaire; [14]). Third, QoL assessments can either be self-reports (e.g. Psychological Adjustment to Illness Scale; [21]) or made by the consultant physician or some other observer (e.g. Karnofsky Performance Status; [22]). Finally, QoL can either be conceptualized as a more stable trait condition (e.g. Cancer Inventory of Problem Situations; [23]) or as a short-term state (e.g. Affect Balance Scale; [24]) depending on the wording in the instructions. Thus, QoL instruments were classified as emotional versus functional, global versus specific, self-report versus observer rating, and trait versus state.

2.1.4. Methodological quality

The methodological quality of the selected studies was evaluated according to different validity criteria suggested by Cook and Campbell [25]: internal validity, external validity, construct validity and statistical conclusion validity. Each validity criterion was rated as fulfilled or not fulfilled, and the overall methodological quality was either estimated as low (<average number of fulfilled criteria) or high (≥average number).

2.2. Phase 2: search strategy

The following inclusion criteria were defined for the selection of psychosocial intervention studies: the overall design had to correspond to the central research hypothesis including at least one control group; studies had to be published between 1970 and July 1999 either in English or German language. Studies were selected from computer-

ized data bases and retrieval systems (MEDLINE, Amed, CINAHL, CANCERLIT, PSYNDEX PLUS, PsycLIT, SER-LINE) and by informal inquiries using the medical subject headings (MESH) 'neoplasm(s)', 'psychotherapy' and 'quality of life'. Moreover, all references cited in identified studies and review articles were included. A number of 62 studies initially met the inclusion criteria. Twenty-five studies had to be excluded due to an incomplete documentation of outcome measures or results, or an insufficient realization of the control condition. Finally, 37 studies marked by an asterisk in the reference list were included in the present meta analysis [17,26-61]. Two studies were conducted in Canada, two in Italy, two in Sweden, three in Germany, seven in UK, and the remaining 21 in the US. The majority of studies was organized in university hospitals. All the studies were published journal articles except for one doctoral thesis. Sample sizes varied between $N = 13$ and 271 cancer patients. The average age of the total population was 54.1 years, and the samples were generally skewed towards whites and the well-educated. The female-to-male ratio was 2:1 corresponding to the high frequency of breast cancer which was diagnosed in 38.7% of all cases followed by neoplasms of lung and mediastinum (12.9%), and gastro-intestinal neoplasms (9.9%).

2.3. Phase 3: identification and coding of study characteristics

All essential information according to the research hypotheses and potential moderating factors was extracted from the selected studies: descriptive features of study context and research design, type and duration of psychosocial intervention, sociodemographic and clinical sample characteristics, type of QoL measurement, quantitative effects of intervention, and overall methodological quality of the study. Description and coding of the relevant information was based on classification sheets developed by Grawe et al. [62] and Matt [63]. Altogether, 51 features of the selected studies were documented on a modified version of the coding sheet [64]. All features were assessed independently by the two authors. Divergent assessments were discussed and a final consensus could be established in each case.

2.4. Phase 4: quantitative aggregation

The quantitative aggregation of results was based on the theory of meta analysis by Hunter and Schmidt [65]. We preferred this model to alternative approaches [66], because the underlying theory explicitly considers different reliabilities of the investigated variables. Cronbach's alpha was chosen to provide reliability information about the different QoL instruments. In case of missing or incomplete reliability information necessary corrections were based on artifact distributions described by Hunter et al. [67]. Reliabilities of the various treatment conditions were set to 1, because no

further information was available. The following steps 2.4.1–2.4.6 were taken to aggregate results of single studies:

2.4.1. Transformation of effect sizes

The equivalent of the correlation coefficient (symbolized by Δ) was chosen to express the overall relationship between psychosocial intervention and QoL. Therefore, the single effect sizes from the selected studies had to be transformed into correlation equivalent Δ in order to be averaged and weighted by sample size [65]. This was done by the use of meta analysis software developed at Freie Universität Berlin (available at www.fu.-berlin.de\gesund\statistiksoftware). Effect sizes were transformed when they were significant on an alpha level of 0.05. Those reported as non-significant were assumed to be zero providing a conservative estimate.

2.4.2. Tests of significance

There is no definite test to determine whether a population effect size differs significantly from zero. Two ways of handling this problem were suggested. First, the 95% confidence interval can be used to estimate the potential variation of the population effect size [65]. Second, the population effect size should be at least twice as high as the residual standard deviation [68].

2.4.3. Publication bias

A publication bias towards studies with statistically significant results that are more likely to be accepted for publication presents a considerable threat to the representativeness of meta analysis samples. This bias was estimated using Rosenthal's [69] 'fail safe n' which indicates the number of unpublished studies of effect size zero locked away in researchers' filing cabinets and which would be required to reduce the observed mean effect size to an insignificant level. The number of such studies can be interpreted as a further estimation of the significance of the overall effect size.

2.4.4. Specification of effect size calculation

To avoid overrepresentation of single studies that used multiple QoL measures, more than one treatment group, or several follow-up assessments, only one effect size per study was calculated. This selection was based on the following conventions: first, if several QoL instruments were applied within one study, only one instrument with the superior psychometric properties was included. Results based on other instruments were neglected. Second, if multidimensional QoL instruments were administered, only the effect on the total score or the average effect over all sub-dimensions was considered. Third, if QoL was assessed on several occasions, only the first occasion after the psychosocial intervention had been completed was chosen. Fourth, if several treatment conditions were realized, effect sizes were averaged over all comparisons with the control group. Treatment-specific effect sizes were only considered for the calculation of moderating effects of different types of psychosocial interventions.

2.4.5. Tests of homogeneity

Prior to the aggregation of 37 independent Δ-coefficients three tests of homogeneity were conducted to check whether the set of effect sizes could be regarded as a sample from one underlying population effect size δ. First, a χ^2-test of homogeneity was applied [65]. Second, Hunter et al. [67] suggested that at least 75% of the observed variance in effect sizes should be attributable to sampling error. Third, the absolute amount of residual variance should not exceed 25% of the population effect size [70].

2.4.6. Search for moderating variables

Heterogeneity of single effect sizes would imply the search for potential moderating variables. Therefore, separate meta analyses were computed for different sub-samples according to the characteristics outlined in the hypothesis section (phase 1). Two requirements had to be met for the identification of a significant moderating effect: the population effect size had to vary significantly between different subsets (a minimal difference of $d = 0.05$ was considered as clinically relevant), and the average residual variance in the subsets had to be lower than in the entire sample [67]. To

Table 1
Stem-and-leaf display for 37 single effect sizes

−0.9	
−0.8	
−0.7	
−0.6	
−0.5	
−0.4	
−0.3	
−0.2	
−0.1	
−0.0	00000000000000
+0.0	000000000000008
+0.1	01
+0.2	0589
+0.3	122335
+0.4	34456
+0.5	688
+0.6	56
+0.7	
+0.8	48
+0.9	

The y-axis represents the first figure of the correlation coefficient from −0.9 to +0.9 (stem); the x-axis represents the second figure of the correlation coefficient ordered by size (leaves).

Table 2
Results of subset analyses

	Correlation equivalent with 95% confidence interval $\bar{\Delta}$	Standardized mean difference (d)
Sociodemographic and clinical sample parameters		
Age (years)		
≤54	0.29 (−0.18 ≤ r < 0.75)	0.60
>54	0.32 (−0.20 ≤ r < 0.83)	0.67
Gender		
Male	0.45 (0.26 ≤ r < 0.72)	1.01
Female	0.25 (−0.15 ≤ r < 0.65)	0.52
Mixed	0.34 (−0.12 ≤ r < 0.80)	0.71
Localisation of cancer		
Breast cancer	0.31 (−0.07 ≤ r < 0.69)	0.65
Other than breast cancer	0.32 (−0.18 ≤ r < 0.81)	0.67
Characteristics of psychosocial intervention		
Intervention type		
Patient education	0.43 (0.07 ≤ r < 0.80)	0.96
Social support	0.28 (−0.27 ≤ r < 0.83)	0.58
Coping skills training	0.24 (−0.12 ≤ r < 0.59)	0.48
Psychotherapy	0.28 (−0.38 ≤ r < 0.93)	0.58
Duration of intervention		
Short-term intervention	0.23 (−0.12 ≤ r < 0.58)	0.47
Long-term intervention	0.51 (−0.33 ≤ r < 1.35)	1.19
Conceptualization of quality of life		
Self-report	0.32 (−0.14 ≤ r < 0.78)	0.67
Observer rating	0.25 (0.03 ≤ r < 0.46)	0.51
Global	0.31 (−0.05 ≤ r < 0.68)	0.66
Disease-specific	0.31 (−0.22 ≤ r < 0.83)	0.64
Functional adjustment	0.32 (−0.22 ≤ r < 0.85)	0.67
Emotional adjustment	0.26 (−0.14 ≤ r < 0.67)	0.54
State	0.22 (−0.15 ≤ r < 0.60)	0.46
Trait	0.34 (−0.10 ≤ r < 0.79)	0.73
Methodological quality		
High quality	0.33 (−0.03 ≤ r < 0.69)	0.70
Low quality	0.28 (−0.23 ≤ r < 0.79)	0.59

determine the impact of the different moderating variables simultaneously multiple classification analysis (MCA) was applied.

Phases 5 (documentation) and 6 (interpretation) of the meta analytical procedure will be presented in the next two sections on results and discussion.

3. Results

The overall average effect size was $\bar{\Delta} = 0.31$ ($N = 3120$ cancer patients) with a 95% confidence interval defined by $-0.13 \leq 0.31 \leq 0.75$. The effect sizes of each study are presented as a stem-and-leaf display in Table 1. The residual standard deviation of the single effect sizes was $\hat{\sigma}_e = 0.22$. Thus, both criteria indicated that the observed overall effect size must be handled cautiously when generalized to a population effect size. The effect size of 0.31 was equivalent to a standardized mean difference between experimental group and control group in terms of QoL of $d = 0.65$. According to Cohen [71] this could be regarded as a moderate effect size.

Applying Rosenthal's 'fail safe n' indicates that 70 undetected studies of effect size zero are required to reduce the observed effect size to 0.10, which is conventionally regarded as a clinically weak to negligible effect for psychological interventions.

Because all three tests of homogeneity (χ^2-test, 75% rule, and amount of residual variance) consistently indicated a lack of homogeneity of the single effect sizes a search for moderating variables was conducted (Table 2). A minimal difference of $d = 0.05$ in QoL outcome could be observed for the following sub-samples: effect sizes increased when (1) only male patients ($\Delta = 0.45$) were treated (versus mixed (0.34) versus female (0.25) samples); (2) the psychosocial intervention type was characterized by a patient education program (0.43) (versus social support (0.28), coping training (0.24) and psychotherapy (0.28)); (3) a long-term intervention of at least 12 weeks was conducted (versus short-term interventions less than 12 weeks, 0.51 versus 0.23); (4) the measurement of QoL was based on self-reports (versus observer ratings; 0.32 versus 0.25); (5) QoL referred to functional adjustment (versus emotional adjustment; 0.32 versus 0.26); (6) QoL referred to trait characteristics (versus state characteristics; 0.34 versus 0.22); and (7) the methodological quality of studies was better than average (0.33 versus 0.28).

To investigate the different moderating variables in a multivariate context MCA was conducted with all significant moderators as predictor variables. Duration of intervention was the only predictor that remained significant when the effects of all other variables were simultaneously controlled ($F = 5.089$, $P = 0.038$). This observation was supported by a significant correlation between the continuously estimated duration of intervention and effect size (Pearson's $r = 0.63$; $P < 0.001$).

4. Discussion and conclusion

Results clearly confirmed the overall hypothesis that psychosocial interventions reveal a positive impact on QoL in adult cancer patients. The observed effect size of $\bar{\Delta} = 0.31$ ($d = 0.65$) was slightly higher than those reported in previous meta analyses [10,11]. This might be partly due to the application of the meta analysis model proposed by Hunter and Schmidt [65], whereas in previous studies the model of Hedges and Olkin [66] was preferred. The former one explicitly considered different reliabilities of QoL instruments resulting in a more adequate estimation of population values. The overall result is consistent with accumulating evidence that psychosocial interventions could make an important difference for patients suffering from cancer [2,9].

However, the overall effect size was moderated by several confounding factors. Duration of psychosocial intervention emerged as the most important moderating variable. It was the only one that remained significant when the influence of all other moderators was simultaneously controlled. These findings suggest that psychosocial interventions should be planned for at least 12 weeks. This conclusion is consistent with research in related areas. Stability and trustfulness of the relationship between patient and therapist are probably the most influential factors for psychotherapeutic treatment success [7], and a duration of at least 12 weekly sessions seems to be necessary to establish such a relationship. The quality of the relationship between patient and therapist was also found to be one of the best predictors for success rates of psychological treatment in general [62].

Some other factors should also be considered, although their impact was less clear. Psychosocial interventions seemed to be more profitable for men than for women or mixed samples. This was probably the case because women are usually psychosocially better adjusted and are more used to ask for social support. The psychological consequences of unexpectedly experiencing a life-threatening disease might be more difficult to handle for someone who was previously less dependent on social support.

Moreover, our findings suggest that particular characteristics of QoL measurement are more able to reflect the effectiveness of psychosocial interventions than others [72]. Self-report instruments, and scales that refer to stable and functional features were more adequate than expert ratings and scales that refer to states of shorter duration such as emotional adjustment. This is consistent with other studies showing that the patient her- or himself is the most relevant person to evaluate her/his QoL [73]. Cancer patients who suffer from long-term functional deficits after surgical treatment can obviously express their problems more adequately on scales designed to measure exactly these deficits. Short-term mood changes might be less adequate to reflect psychosocial adjustment problems of cancer patients. This observation corresponds with the finding that even terminally ill cancer patients did not

differ significantly from healthy controls in emotional adjustment measures [74].

It was less obvious why the intervention type of educational programs was more effective than the other three types ranked higher in regard to active patient involvement. There were no significant differences between the effects of social support, coping skills training and psychotherapy on QoL in adult cancer patients. This is not consistent with single intervention studies [58,75] favoring coping skills programs in comparison to social support groups. However, Frischenschlager et al. [76] reviewed the relevant literature on intervention type and found the highest treatment success rates for structured short-term educational programs supporting our meta analytical findings. This superiority might be due to the fact that educational programs are the most structured and widely established form of psychosocial intervention in cancer patients. The other intervention types consisted of heterogeneous techniques and strategies making an effect more difficult to detect. Thus, there is a need for studies that define the type of intervention more thoroughly and in other terms than suggested by Cunningham [16] in order to attribute the effects more clearly to particular intervention techniques.

Finally, the methodological quality of an intervention study could be important to prove the effectiveness of psychosocial interventions. Studies of higher methodological standard with randomized patient selection, adequate control conditions, reliable and valid QoL measurements, and appropriate statistical techniques had a higher probability of detecting a significant effect.

4.1. Discussion

Several limitations of the present study should be noted. First, reported results refer to short-term effectiveness of psychosocial interventions on QoL, because only the first occasion after the intervention had been completed was considered for the meta analysis. Thus, the stability of the effects could not be evaluated. Second, there was an over-representation of patients with breast cancer. The generalizability of results to more rarely diagnosed types of cancer might be difficult to justify, although there were no significant differences between breast cancer patients and a heterogeneous sample composed of all other tumor localizations. Third, there are some general limitations of meta analytical procedures inherent in the methodology. There is no definite test for determining the statistical significance of the overall effect size. On the one hand, the tests chosen for the present study both revealed a limited generalizability of results to population parameters. On the other hand, there are at least three strong arguments in favor of the generalizability of the reported effect: Rosenthal's 'fail safe *n*' of 70 undetected studies of effect size zero indicated the clinical significance and robustness of the reported average effect size. Moreover, it should be noted that the selected studies differed substantially in regard to experimental design,

treatment conditions and outcome measurement. These differences might add high amounts of error variance reducing the probability of detecting a significant effect. Finally, non-significant results in the single studies were conservatively considered as zero effect sizes.

4.2. Practice implication

Although the mechanisms by which psychosocial interventions can modify the course of the disease or even the disease itself still remain unknown, a multidisciplinary approach including psychosocial treatment is obviously more effective than medical treatment alone. Therefore, some kind of psychosocial intervention should be routinely included in standard treatment programs for cancer patients completing conventional medical intervention. Particularly, male patients should be encouraged to participate in such programs.

Attempts to curtail health expenditures have resulted in pressure to demonstrate treatment effectiveness in most areas of health. The benefit of psychosocial interventions can be expected to be high, because the costs for implementation are relatively low in relation to the expected effect on QoL. To guarantee continuous psychosocial treatment after hospital discharge for at least 12 weeks it is important to improve the ambulant network of psychosocial care facilities and to educate health care professionals in psychooncological treatment skills.

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