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Quality of life of men treated with brachytherapies for prostate cancer

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Abstract

Background: Most studies of men undergoing treatment for prostate cancer examine physical symptoms as predictors of Quality of Life (QOL). However, symptoms vary by treatment modality in this population, and psychosocial variables, shown to be important to QOL, have rarely been examined. Litwin noted a need for analysis of QOL data in men treated for prostate cancer with different modes of therapy, as studies focusing on specific treatments will increase the homogeneity of research findings.

Methods: This cross-sectional study explored physical and psychosocial predictors of QOL in men receiving one of two types of radiation treatment for prostate cancer: Intensity Modulated Radiation Therapy (IMRT) + High Dose Rate (HDR) Brachytherapy or IMRT + seed implantation. Subjects completed a biographic questionnaire; quality of life measures, which were the eight subscales of the Medical Outcome Study Short Form Health Survey (SF-36); measures of physical symptoms including the Radiation Therapy Oncology Group and the European Organization for Research and Treatment of Cancer (RTOG/EORTC) and the Prostate Symptom Self-Report (PSSR); and measures of psychological factors, the Ways of Coping Scale (WOC), Perceived Stress Scale, the Anxiety Subscale of the SCL-90, and Strategies Used by Patients to Promote Health (SUPPH). Eight regression models including both physical and psychosocial variables were used to predict quality of life.

Results: Sixty-three subjects with complete data on all variables were studied. Treatment effect sizes were medium to large in predicting each of the quality of life subscales of the SF-36. Psychosocial variables were related to physical function, role function, bodily pain, general health, social function, emotional role, and mental health. Physical symptoms were related to subjects' perceived general health and mental health.

Discussion: The number of significant relationships among psychosocial variables and indicators of QOL exceeded the number of relationships among symptoms and QOL suggesting that psychosocial variables associate strongly with prostate cancer patients' reports of quality of life. Findings of the study may provide patients and families with knowledge that contributes to their understanding of quality of life outcomes of IMRT+ HDR and IMRT + seed implantation and their ability to make more informed treatment choices.

Background

Prostate cancer is the most common cancer and the second leading cause of cancer deaths in men in the United States <http://www.cancer.org>. It is estimated that in 2004, 230,110 men in the U.S. will be diagnosed with prostate cancer (PCa) and 29,900 will die of the disease. The 5-year overall relative survival rate for prostate cancer increased from 79.6% between 1983–90 to 98% in 2004. More than 75% of men diagnosed with prostate cancer are over age 65. In view of decreasing death rates, medical treatments for cancer patients are increasingly being evaluated by quality of life (QOL) issues as well as life extension [1]. Psychometric assessment and decision theory are the two main approaches used to study QOL [2]. The psychometric approach theorizes separate dimensions and measures for QOL, and the SF-36 is a tool frequently used in this approach. In the decision theory approach, various dimensions of health are weighted in order to provide a single holistic index of QOL. Health-related QOL is a multidimensional construct that reflects the impact of illness and treatment on physical, psychological, social and functional dimensions of well being [3].

Men undergoing treatment for prostate cancer report negative physiological and psychological health effects. The varied symptoms reported may be a function of the cancer itself, or the type of therapy received; or the symptoms may have been present prior to the development of prostate cancer and receipt of treatment. A recent study examined quality of life related to bowel, bladder and sexual symptoms in men receiving treatment for PCa. Participants were not examined by treatment type and psychological variables were not included in the study. Researchers found that the strongest predictors of poor QOL were bowel, sexual and urinary symptoms respectively [4].

Eton and Lepore [5] reviewed several studies of symptoms associated with treatment for localized PCa. Urinary and bowel dysfunction were found to be the result of treatment. Urinary function was most affected in men who were treated with radical prostatectomy compared to those receiving external beam radiation with or without brachytherapy, hormone therapy or those treated with observation alone. Bowel function was most affected by external beam radiotherapy and brachytherapy. In the same review, researchers reported that sexual problems were related to the disease and were exacerbated by treatment, particularly standard radical prostatectomy.

Although psychological variables have been shown to be more important than treatment morbidity to the QOL of patients with prostate cancer, most studies of patients with prostate cancer continue to focus on symptoms such as urinary, bowel and sexual dysfunction [6]. The ability

of prostate cancer patients to maintain psychosocial functioning and healthy psychological states (e.g., freedom from mood distress or excessive anxiety) has been less frequently considered [6]. The experience of living with cancer, from the time of diagnosis and treatment decisions, through treatment itself and survival is fraught with psychological distress. Increased attention to mood is reflected in chronic illness literature describing effects of mood on health related quality of life [7].

Perceived stress is based on the relationship between the person and environment. It is the degree to which the individual appraises events as unpredictable, uncontrollable, and overloading. Perceived stress drives the coping response [8]. Coping is defined as one's response to perceived external stressors. Two types of coping have been conceptualized: Problem-Focused Coping and Emotion-Focused Coping. Problem-Focused Coping refers to those actions taken to resolve the environmental stressor. Emotion-Focused Coping refers to efforts taken by the individual to mediate the emotional responses to the stressor [8].

Anxiety and the ability to cope with cancer are influenced by perceptions. These include the meaning men give to prostate cancer and its treatment and the way these factors impact their lives. Roth and associates [9] reported on a sample of men receiving treatment for PCa and screened for anxiety and depression using the Hospital Anxiety and Depression Scale. Thirty-two percent of patients with PCa scored at or above the anxiety cutoff score.

Bandura [10] asserted that psychosocial variables, such as self-efficacy, strongly influence the perceived quality of one's life. Self-efficacy is described as the coordinator of psychological change, operating by changing expectancies of personal mastery. Robust efficacy beliefs may help to marshal coping responses that reduce stress and anxiety. Peoples' self-efficacy may regulate their emotional states in several ways. People who believe they can manage threats are less distressed by them; those who lack self-efficacy are more likely to magnify risks. People with high self-efficacy lower their stress and anxiety by acting in ways that make the environment less threatening. People with high coping capacities have better control over disturbing thought.

Litwin [11] noted a need for the study of QOL and indicators of adjustment in men treated for prostate cancer. He suggested using three types of measures: a generic measure of health, a measure of symptoms specific to prostate cancer, and psychosocial measures. Litwin [11] also noted a need for the study of QOL in men receiving different treatments for PCa in order to improve the specificity of research findings.

Intensity Modulated Radiation Therapy (IMRT) is a new technology in radiation oncology that delivers radiation more precisely to the tumor and is more sparing of surrounding normal tissues. IMRT has wide application in most aspects of radiation oncology because of its ability to create multiple targets and multiple avoidance structures, to treat different targets simultaneously at different doses, as well as to weight targets and avoidance structures according to their importance. By delivering radiation with greater precision, IMRT has been shown to minimize acute treatment-related morbidity, making dose escalation feasible, which may ultimately improve local tumor control [12]. Furthermore, IMRT can be combined with brachytherapy and High Dose Rate (HDR).

Brachytherapy is a prostate cancer (PCa) treatment in which radioactive sources are implanted into the prostate gland. The most commonly performed brachytherapy treatment is permanent radioactive seed implantation. This out-patient, minimally invasive procedure is performed by inserting small needles through the perineum into the prostate gland under ultrasound visualization. Radioactive Palladium or Iodine seeds are then injected through the needles. These low energy radioactive sources have limited tissue penetration allowing for a sharp drop-off at the edge of the gland, thus limiting radiation delivery to normal tissues. The precision and conformation of the brachytherapy dose allows a much higher dose to be delivered to the prostate gland than can be delivered with external beam radiation (IMRT + seed implantation).

Another form of brachytherapy that has been used to treat PCa is high dose rate brachytherapy (HDR). Plastic catheters are temporarily inserted into the gland and are used as a delivery system for an Iridium source of high activity.

Patients receiving this therapy for PCa are treated 4 times over a 36-hour hospital stay [13,14].

Analysis of Medicare data shows that brachytherapy is replacing radical prostatectomy (RP) as the treatment of choice for early stage PCa [13]. An important component in the consideration of treatment options for PCa is the impact on QOL [5]. Ideally a patient would select a treatment modality that maximizes both survival and QOL. Evolving treatment options make such choices more complex. Because rates of tumor control appear to be remarkably similar across treatment approaches, studies comparing QOL outcomes are of great importance [15].

One hundred fifteen articles focused on IMRT were identified using the National Library of Medicine data-base <http://www.pubmed.com>; however, few studies focused on QOL in patients receiving IMRT for prostate cancer. Kupelian and colleagues [16] studied QOL of 51 prostate cancer patients treated with IMRT using the Expanded Prostate Cancer Index Composite to evaluate QOL. No other variables were measured; thus, predictors of QOL were not addressed. The objective of this article is to report physical and psychosocial predictors of QOL variables in men who are diagnosed with prostate cancer and receive radiation treatments including IMRT + HDR or IMRT + seed implantation. Figure 1 describes proposed relationships among study variables. The main research question is: What proportion of the variance in each dimension of quality of life (physical function, role performance-physical, role performance-emotional, bodily pain, vitality, social function, mental health and general health) is predicted by demographic variables, physical symptoms, coping style, perceived stress, anxiety, and self-efficacy in men receiving IMRT + HDR or IMRT + seed implantation?

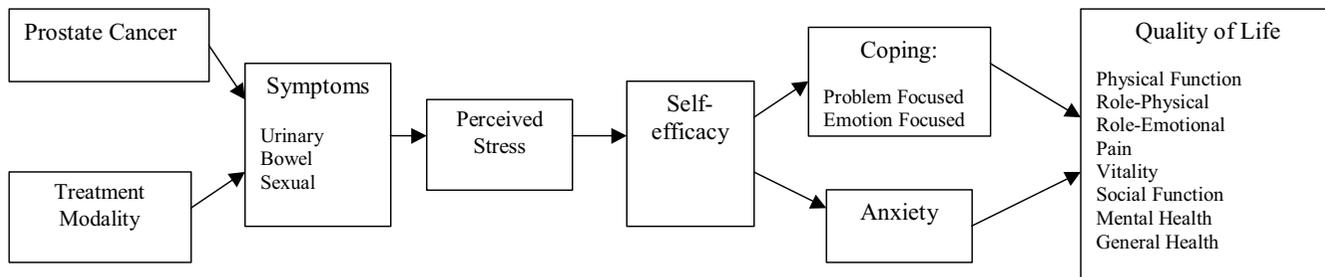


Figure 1

Methods

Sample and setting

Subjects were 122 men diagnosed with prostate cancer, who could hear, understand and speak English, and were receiving either (a) IMRT + HDR treatment ($n = 67$) or (b) IMRT + radioactive seed implantation ($n = 56$). Patients with organ confined prostate cancer (Stage: T1c-T2b; Gleason grade 6–9; PSA <20) were staged clinically by history, physical exam, digital rectal examination, and serum PSA measurement. Additional studies, including CT scan, bone scan, and endorectal MRI, were obtained as clinically indicated. Patients treated with brachytherapy received external beam therapy delivered to a limited field encompassing the prostate gland and seminal vesicles with 1.8 Gy fractions to a total dose of 50.4 Gy. IMRT was delivered with arc therapy using a multileaf modulating collimator (NOMOS Corporation, Sewickley, PA). Patients then received a 90 Gy palladium-103 interstitial implant using a modified peripheral loading technique. Those patients with a prior history of transurethral resection, those with glands >50 cc, and those with AUA scores >20 received a 20Gy HDR temporary catheter implant.

The setting, a medical center located in the mid-Atlantic region of the United States, has extensive experience in prostate interstitial brachytherapy and intensity modulation techniques. Patients were recruited during their regularly scheduled visits or follow-up appointments for radiation therapy for prostate cancer.

Instruments

Biographic questionnaire

Subjects completed a 12-item biographic questionnaire including questions about age, income, education, work status, race, medications, and health habits including smoking, alcohol use, and exercise. The date the patient began radiation therapy as well as the date the patient completed the questionnaire was noted in order to calculate the length of time since a patient began radiation therapy.

Quality of life

The Medical Outcome Study Short Form Health Survey (SF-36), a 36-item measure of health status that is rooted in psychometric theory, is commonly used to measure QOL in clinical populations [2]. The SF-36 measures 8 dimensions of current health-related QOL: Physical Function (limitations to activities); Role Performance with Physical Limitations; Role Performance (ability to work and accomplish daily activities) with Emotional Limitations; Bodily Pain and pain related limitations; Vitality (feelings of energy or fatigue); Social Function (interference with normal social activities); Mental Health (nervousness and depression); and General Health. In instrument standardization, Cronbach's alpha reliabilities

for the SF-36 ranged from .63 to .94 [17]. Higher scores indicate better health. In this study, reliability for the 8 dimensions of QOL ranged from .68 to .91.

Physical symptoms

Although the Radiation Therapy Oncology Group and the European Organization for Research and Treatment of Cancer (RTOG/EORTC) grading system [18] is currently used to measure symptoms in the setting where data were collected, the Prostate Symptom Self-Report (PSSR) was developed for this study and used to assess patients' perceptions of their symptoms. This was done in view of the reported low agreement between medical professional ratings and patient ratings of symptoms [18]. The PSSR is an 11-item symptom questionnaire that assesses the frequency, severity and amount of bother of urinary, bowel and sexual symptoms experienced during the past month. Frequency is expressed as number of days per week the symptoms occur. Subjects rate each question from 0 – never to 6-most or all of the time (5–7 days). Severity and bothersomeness are measured by a single item for each symptom cluster. The response set for bothersomeness and severity ranges from no bother (or not severe at all) = 0 to extremely bothersome (or extremely severe) = 4. Higher scores indicate more symptoms. Two open-ended questions assess the quality of symptoms, asking subjects to circle word descriptors of the symptom, and to list any other symptoms (bladder, bowel and sexual) they experienced. In addition, open-ended questions permit the addition of other symptoms and word descriptors for symptoms in these three domains. Validity of the scale was supported by its development based on a review of the literature describing symptoms reported by men during and following treatment for prostate cancer. Higher scores indicate increased symptoms. Cronbach's alpha reliabilities for the urinary, bowel and sexual symptom subscales were .85, .80 and .69 respectively.

Psychosocial factors

Mood is conceptualized as a fluctuating state of affect that includes the dimensions of tension-anxiety, depression-dejection, anger-hostility, vigor-activity, fatigue-inertia and confusion-bewilderment. The Profile of Mood States (POMS), assessing a person's perception of feeling and affect measures these six dimensions of mood [20]. Subjects are asked to read the list of words that describe feelings people have, then report how they have been feeling. Responses are scored from 0 (Not at all) to 4 (Extremely). Higher scores indicate greater mood disturbance. Areas of research that have provided evidence for the predictive and construct validity of the POMS include brief psychotherapy studies, drug trials, studies of response to emotion-inducing conditions and studies of concurrent validity coefficients and other POMS correlates [20]. Summing the subscales produced a Total Mood Disturbance

Score (TMDS) score. Cronbach's alpha reliability for the scale in this study was .93.

Coping was measured with the Ways of Coping Scale (WOC), a 66-item self-report scale that assesses thoughts and actions used to cope with stressful encounters of everyday living [8]. Two subscales, Problem-Focused Coping and Emotion-Focused Coping, were used in this study. Problem-Focused Coping is a composite of scores from four subscales: confrontive coping, seeking social support, problem solving, and positive reappraisal. Emotion-Focused Coping is a composite of scores from three dimensions: distancing, accepting responsibility, and escape-avoidance. Items are rated on a 5-point frequency scale indicating how often each strategy was used over the preceding 4 weeks and range from 0 = "does not apply" to 4 = "used a great deal." Higher scores indicate increased coping. In a community sample, Cronbach's alpha reliability coefficients for the subscales ranged from .61 to .79. Validity was supported by the scale's inclusion of strategies described by individuals as those used to cope with stressful situations [8]. Coefficient alpha of the subscales in the current sample was .89 for Problem-Focused Coping, and .82 for Emotion-Focused Coping.

The Perceived Stress Scale (PSS), a 14-item measure of the degree to which situations in one's life are appraised as stressful [21], was used to measure stress. Items are rated on a 5-point frequency scale ranging from 0 = "never" to 4 = "very often" for how often in the past month the subject has experienced stress-related feelings and thoughts. A total perceived stress score is obtained by reversing the scoring on the positive items and summing responses across the 14 items. Higher scores indicate more stress. Coefficient alpha reliabilities for the scale were .84 to .86 in three community samples [21]. Validity was supported in the scale's ability to predict depressive and physical symptoms, and utilization of health services. Cronbach's alpha estimate for the PSS data in the sample reported in this paper was .88.

Anxiety was measured with the SCL-90 Anxiety Subscale, a 10-item self-report scale, indicating the degree to which a person was distressed by a specific problem in the past week. The measure uses a 5-point response scale, ranging from "not at all" to "extremely." Higher scores indicate more anxiety. Cronbach's alpha coefficients for reliability of this subscale in a chronically ill population were .79 to .91. Good validity evidence has been reported [22]. Coefficient alpha of the SCL-90 anxiety subscale in our sample was .90.

Strategies Used by Patients to Promote Health (SUPPH), a 29-item self-report scale, has previously been used to measure self-care self-efficacy in patients with cancer

[23,24]. Confirmatory factor analysis supports three dimensions of SUPPH: Positive Attitude, Stress Reduction, and Making Decisions (Owen, SV & Lev, EL: Confirmatory factor evidence for the SUPPH. Presented at the 13th Annual Scientific Sessions of the Eastern Nursing Research Society. Atlantic City, NJ, 4/2/01). The subject is asked to rate the degree of confidence he has in carrying out specific self-care behaviors. Each item of the SUPPH is rated on a 5-point scale of confidence from 1 = "very little" to 5 = "quite a lot." Higher scores indicate greater self-care self-efficacy. The instrument is scored by calculating mean response across all items for each subscore. Estimates of internal consistency ranged from .94 to .96, and validity evidence has been reported [23]. In this study, Cronbach's alpha reliability for the positive attitude, stress reduction and making decisions subscales were .94, .88 and .77 respectively.

Procedures

Members of the interdisciplinary research team collaborated to develop and implement the study. IRB approval was granted by the University and Medical Center with which co-investigators are affiliated. Students in a college of nursing who were research assistants in the study attended an 8-hour training session given by the principal investigator to assure that procedures used were congruent with study protocol. They were familiarized with the method of obtaining informed consent, content of questionnaires, and how to answer participant questions. Role-playing was used to familiarize each research assistant with application of the protocol.

Initial recruitment was conducted by the physician, nurse, or social worker in the radiation oncology treatment area. Potential participants were identified, the study was briefly described and patients were asked about their interest in learning more about the study. A co-investigator or research assistant met with those who were interested and fully explained the study. Informed consent was obtained from those willing to participate. The participant then completed questionnaires in a private area of the treatment center. The co-investigator or research assistant remained available to assist or answer any questions and collected completed questionnaires. Participation occurred at one time point and lasted approximately one-hour.

Data analysis

Data were collected on 122 men, but some data were missing on 59 of those. Descriptive data analysis was performed on 122 subjects who received IMRT + HDR ($n = 66$) or IMRT + seed implantation ($n = 56$). Regression analyses were conducted on the 63 cases with complete data. Independent variables included age, income, RTOG/EORTC, PSSR, Problem Focused Coping and Emotion

Focused Coping subscales of the WOC, PSS, Anxiety Subscale of the SCL-90, and subscales of the SUPPH: Positive Attitude, Stress Reduction, and Making Decisions. Dependent variables were each of the eight SF-36 scales: Physical Function (limitations to activities); Role Performance with Physical Limitations; Role Performance (ability to work and accomplish daily activities) with Emotional Limitations; Bodily Pain and pain related limitations; Vitality (feelings of energy or fatigue); Social Function (interference with normal social activities); Mental Health (nervousness and depression); and General Health. Data were missing for a variety of items in several scales; therefore, subscale scores were created as means (rather than sums) for use in regression analyses.

Eight regression models were built to assess the degree to which the independent variables predicted each of the eight QOL indicators as measured by each of the SF-36 subscale scores. Because complete data were available on a small sample: IMRT + HDR ($n = 31$) and IMRT +seed implantation ($n = 32$), there was insufficient power for meaningful significance testing. However, Cohen [25] noted that effect size (e.g., R^2) is paramount in assessing intervention outcomes when small sample size shrinks the power of statistical tests. Cohen [25] suggested the following rough guidelines for R^2 effect sizes: small ($= .02$), medium ($= .13$), and large ($= .26$). Initial regressions showed that the Total Mood Disturbance Score, calculated from the POMS, was highly correlated with other predic-

tors. Because collinearity leads to undependable significance tests and unreliable regression coefficients [26] subsequent regression models did not include the POMS. Because of the small sample size, a liberal two-tailed α of .10 was used in interpreting predictor variables.

Results

There were no significant differences between treatment groups in age ($t = .55$; $p = .58$), race ($U = 1785$; $p = .50$), work status ($U = 1843$; $p = .97$), income ($U = 1006$; $p = .07$) or living together with a significant other ($U = 1811$; $p = .83$). There was a significant difference in education ($U = 1379$; $p = .02$), with 69% of the IMRT+HDR group having completed some college, compared to 51% of the IMRT+ seeds group.

The mean age of study participants was 72 years (range 51 – 84 years). The majority of participants was married ($n = 91$), white ($n = 112$), had some college education ($n = 74$), and was retired ($n = 94$). Median income was in the \$40,000 to \$49,000 range. The mean length of time since beginning radiation treatment for prostate cancer was 10 months (median 8 months), with a range of less than one month to 31 months.

Table 1 presents the means and standard deviations of both the scale scores and mean scores for independent variables and QOL subdimensions of patients receiving IMRT+HDR or IMRT + seed implantation.

Table 1: Means and Standard Deviations for QOL Indicators of Patients with Prostate Cancer Receiving IMRT + HDR or IMRT + seed implantation

Treatment groups	HDR		seed implantation	
	Scale Sum Mean (SD)	Scale Mean Mean (SD)	Scale Sum Mean (SD)	Scale Mean Mean (SD)
Measure				
Stress	15.2 (9.3)	1.04 (.65)	15.4 (8.7)	1.20 (.72)
Mood	2.82 (5.0)	.42 (.63)	3.4 (5.8)	.48 (.78)
Anxiety	2.7 (5.3)	0.26 (.56)	2.6 (4.6)	0.30 (.54)
PFC	25.8 (12.5)	0.10 (.51)	24.7 (13.7)	1.06 (.56)
EFC	13.2 (8.7)	0.70 (.48)	14.3 (8.2)	0.79 (.45)
Positive attitude	52.5 (14.2)	3.63 (1.09)	49.8 (13.7)	3.51 (.98)
Stress Reduction	16.1 (6.7)	2.63 (.94)	15.7 (7.1)	2.82 (1.02)
Making decisions	10.0 (3.7)	3.23 (1.27)	9.6 (4.0)	3.20 (1.5)
Urinary symptoms	6.9 (.77)	1.67 (2.0)	5.8 (.40)	1.37 (3.1)
Bowel symptoms	4.0 (.56)	1.29 (1.3)	3.8 (.39)	1.25 (1.9)
Sexual symptoms	6.2 (.91)	2.03 (2.6)	6.8 (1.0)	2.12 (2.9)
Physical function	24.8 (5.8)		26.3 (3.4)	
Role-physical	7.0 (1.5)		6.7 (1.6)	
Role-emotional	5.5 (1.0)		5.4 (1.0)	
Bodily pain	10.2 (2.3)		10.0 (2.0)	
Vitality	16.8 (4.3)		16.3 (4.8)	
Social function	9.0 (1.7)		8.8 (1.5)	
Mental health	25.5 (3.9)		24.3 (4.6)	
General health	20.1 (3.4)		19.1 (3.4)	

PFC = Problem-focused coping; EFC = Emotion-focused coping

In arranging the regression models, an essential question was whether to combine the treatment samples or analyze them separately. To answer this question, Chow [27] tests were performed. The Chow [27] test asks whether two (or more) groups behave differently for a given regression model. For all eight SF-36 regressions, there were dramatic group differences, with effect sizes (R^2) ranging from .19 to .39. In other words, upwards of 39% of the variation in the regression models owed to differences between the two treatment groups. As can be seen in Table 3, there were sometimes large group differences in the amount of explained variation, and often important differences in which predictors were useful. For example, in predicting SF36 General Health, 54% of the variance was explained for the IMRT + HDR group, but 34% for the IMRT + seed group. Note also that significant predictors also differed: PSS and bowel symptoms for the IRMT + HDR group, and problem-focused coping for the IRMT + seed group. Despite the important group differences, all regression models showed strong effects, with the smallest R^2 of .24 (predicting SF36 Role Performance with Physical Limitations for the IRMT + seed group). This effect size is about the same as Cohen's suggestion about a "large" effect for a regression model. All other R^2 s were considerably higher, peaking at .85 (predicting SF36 Mental Health for the IRMT + seed group).

Discussion

Regression models were used to evaluate physical and psychosocial predictors of QOL as measured by the SF-36 for patients receiving IMRT + HDR or IMRT + seed implantation. Patterns of predictors of QOL variables differed between treatment groups. Large between-group treatment effect sizes on physical function, role performance (physical limitations), role performance (emotional limitations), bodily pain, social function and mental health were observed. Between-group treatment effect sizes resulted from different types of treatment: IMRT + HDR ($n = 31$) and IMRT + seed implantation ($n = 32$). Most physicians would be comfortable categorizing a moderately large effect as clinically important [28].

Urinary symptoms were related to seven of the eight quality of life subscales and bowel symptoms were related to six. Sexual symptoms were related only to physical function. The number of significant relationships between psychosocial variables and indicators of QOL exceeded the number of relationships among symptoms and QOL. Psychosocial variables were related to physical function, role function (both physical and emotional), bodily pain, general health, vitality, social function, and mental health. Physical symptoms were related to subjects' general health and mental health suggesting that psychosocial variables associate strongly with prostate cancer patients' reports of quality of life. These data supported

Bandura's [10] assertion that psychosocial factors may determine QOL.

Perceived stress was related to subjects' physical function, role function, bodily pain, role performance with emotional limitations, and mental health. Positive attitude was related to subjects' mental health. Making decisions was related to role (emotional limitations), vitality and mental health. Roth and associates [9] examined the prevalence of anxiety and depression in a sample of 93 men with prostate cancer. They found that 32.6% scored above the anxiety clinical cutoff score and 15.2% scored above the cutoff for depression. Bandura [10] described self-efficacy as the exercise of control, and perceived control has been identified as a mediator of successful adjustment in cancer patients [29]. The importance of positive attitude and stress reduction for cancer patients has been documented [30,31]. Efficacy expectations – beliefs that one has some mastery over events and can meet challenges as they occur – are learned. Psychosocial interventions taught to cancer patients have reduced psychological distress and symptoms, enhanced QOL [31], and increased psychological adjustment and survival [31-36].

As shown in previous studies, we found that symptoms were negatively associated with QOL. We also found that the relationships between specific symptoms and subdimensions of QOL varied by treatment. In men who received IMRT + seed implantation, urinary, bowel, and sexual symptoms were negatively related to mental health. Urinary retention is a frequently reported complication following radioactive seed implantation of the prostate [37]. Unlike other studies that have reported no difference in QOL by type of treatment, we found large treatment effects for seven of the eight subdimensions of QOL measured in this study.

In men who received IMRT + HDR, sexual symptoms were negatively related to role function; bowel symptoms were negatively related to general health; and, urinary symptoms of men receiving HDR were negatively related to social function. Patients receiving different treatment modalities for prostate cancer experience different symptoms.

Although some researchers reported that hormonal therapy may result in decreased quality of life outcomes [38], other researchers noted that those treated by androgen deprivation were not significantly worse after treatment [39]. After a delay of 15 days after implantations, urinary morbidity was reported in 76% of patients who received brachytherapy [40]. This development of urinary morbidity was the highest 1–3 months after treatment before gradually decreasing at 6 months after treatment. Vincini and associates [40] assessed 161 patients with locally

Table 2: Multiple R², standardized regression coefficients and 2-tailed p values for predictors of QOL

Treatment groups		HDR	Beta	p	Seed implantation		
		R ²			R ²	Beta	p
Measure	Predictor				Predictor		
SF36-physical function		.48				.51	
	Age		-.39	.09	Income	.55	.02
	PSS		-.53	.07	EFC	-.42	.10
	PFC		-.54	.10			
	EFC		.78	.06			
	POSATT		.53	.06			
SF36-physical role	MAKDEC		-.49	.07			
	Sexual symptoms	.50		.33	.09	.24	
SF36-emotional role		.48				.51	
	Age		-.39	.09	Income	.55	.02
	PSS		-.53	.07	EFC	-.42	.10
	PFC		-.54	.10			
	EFC		.78	.06			
	POSATT		.53	.06			
SF36-bodily pain	MAKDEC		-.49	.07			
		.48				.51	
	Age		-.39	.09	Income	.55	.02
	PSS		-.53	.07	EFC	-.42	.10
	PFC		-.54	.10			
	EFC		.78	.06			
SF36-general health	POSATT		.53	.06			
	MAKDEC		-.49	.07			
		.54				.34	
	PSS		-.58	.04	PFC	.52	.10
	Bowel symptoms		-.59	.03			
		.37				.36	
SF36-vitality		.74			.71		
SF36-social function	Urinary symptoms		-.41	.04	Age	.43	.02
		.71				.85	
SF36-mental health	PSS		-.40	.07	Age	.26	.05
	Anxiety		-.5	.05	PSS	-.34	.10
					Anxiety	-.60	.01
					Urinary symptoms	-.28	.05
					Bowel symptoms	.39	.03
					Sexual symptoms	-.35	.01
				MAKDEC	.42	.02	

PSS = Perceived Stress scale; PFC = Problem-focused coping; EFC = Emotion-focused coping; POSATT = Positive attitude subscale of SUPPH; MAKDEC = Making decisions subscale of SUPPH.

advanced PCa treated with external-beam radiation therapy combined with HDR brachytherapy; 27% of patients developed impotence at a median interval of 1 year after treatment. Information on QOL outcomes of radiation therapy for patients with prostate cancer suggests that there are treatment related differences, thus health care

providers should more fully inform patients with prostate cancer regarding what to expect from their treatments.

Conclusions
Future research

This cross-sectional study was conducted with men diagnosed with organ confined prostate cancer who were

receiving or had completed radiation treatments with IMRT + HDR or IMRT + seed implantation. Therefore, no pre and post-treatment comparisons could be made between subjects' QOL. Researchers have noted that the best way of assessing post-treatment issues is the pre-morbid state of the patient himself; therefore longitudinal studies of QOL of prostate cancer patients should be conducted [6].

Further study of physical and psychosocial predictors of QOL should be conducted with homogeneous groups of patients receiving treatments for prostate cancer. Analyses of Medicare data show that brachytherapy is replacing radical prostatectomy as the treatment of choice for early stage prostate cancer [13]. QOL plays an important role in the consideration of treatment options for PCa. Selecting a treatment for prostate cancer that maximizes both survival and QOL is complex. Because rates of tumor control appear to be similar across different treatment approaches, studies comparing QOL options are of great importance [15]. Longitudinal studies are needed to compare patients receiving radiation therapies for prostate cancer with those receiving radical prostatectomy. Data indicating whether or not patients have received hormonal therapy should be included. Larger sample sizes are also needed to explore predictors of QOL by testing how well a hypothesized model fits empirical data [41].

The sample size of the study reported here was greatly reduced due to the amount of missing data. Knapp [41] noted that the best way to handle missing data is to plan in advance how to prevent the data from being missing. Telephone interviews have been used as a mechanism for assessing patients after radiotherapy treatment [42]. Future research conducted by telephone interviewers who enter data directly into the computer as they conduct the telephone interview may prevent much of the missing data noted in the current study, in which respondents filled out surveys by themselves.

Stegina and associates [43] identified informational needs as a priority for men with prostate cancer. In a context where there is uncertainty or ambiguity about treatment, men may experience a high need for informational support. Informational resources for men with prostate cancer are relatively new, and still emerging. Thus, research is suggested that compares QOL of men receiving radiation therapies for prostate cancer with those receiving radical prostatectomy in order to inform decision-making by patients and their families.

Active coping, which includes activities such as problem solving, expression of emotion, participation in health enhancing behaviors, and information seeking, is thought to have beneficial health effects [10]. Previous studies

revealed that cancer patients use coping strategies to adjust to their diagnosis and treatment. Patients with breast cancer who were given an intervention to increase self-efficacy had decreased perceived stress, decreased self-reported symptoms, and perceptions of increased QOL [44]. Graves conducted a meta-analysis of 38 studies evaluating QOL outcomes after psychosocial interventions based on self-efficacy were given to cancer patients and reported overall improvement in QOL outcomes for adult cancer patients [36]. Providing efficacy-enhancing interventions for patients receiving cancer treatment may decrease patients' perceived stress and self-reported symptoms, and increase patients' positive perception of QOL.

Relevance to practice

Psychological variables were strong predictors of all domains of quality of life examined in this study. Researchers reported that 38% of prostate cancer patients who seek support reported psychological distress [45]. Psychological variables had a greater effect on prostate cancer patients' quality of life and distress than disease status but were less frequently treated [46,47]. Psychological problems present issues beyond merely poor QOL. Cancer patients with previous emotional problems faced a 2.6 times greater hazard of dying within the first 19 months after diagnosis than patients without prior problems [47]. Although prostate cancer is known to be associated with psychological distress, such as anxiety and depression, many patients with these symptoms fail to meet criteria for a psychiatric disorder [48]. Patients may be reluctant to bring up their distress, leading physicians to underestimate them and thus reduce optimal symptom control. Early detection of such distress may permit psychosocial interventions that may have a substantial impact on preventing more serious psychological problems [48].

Significant between-treatment differences were observed in this study for all dimensions of QOL. With better information on physical and psychosocial predictors of QOL, health care providers may be better able to educate patients who are contemplating receiving IMRT + HDR or IMRT + seed implantation therapy for prostate cancer. Learning theory suggests that people are interested in information that will improve their well being, help them to understand their immediate problems, and anticipate their future [49]. Findings of this study may guide health care providers who provide patients and families with information that enables them to understand QOL outcomes of IMRT with either HDR or seed implantation and make more informed treatment choices.

List of Abbreviations

European Organization for Research and Treatment of Cancer EORTC

High Dose Rate HDR

Intensity Modulated Radiation Therapy IMRT

Mann-Whitney U-test U

Perceived Stress Scale PSS

Prostate Cancer PCa

Prostate Symptom Self-Report PSSR

Quality of Life QOL

Radiation Therapy Oncology Group RTOG

Strategies Used by Patients to Promote Health SUPPH

The Medical Outcome Study Short Form Health Survey SF-36

The Profile of Mood States POMS

Total Mood Disturbance Score TMDS

Ways of Coping Scale WOC

Authors contributions

E.L. was the PI of a small grant used to fund the study. LE developed the PSSR measure used in this study. Team members, E.L., L.E., G.G., and P.L., met periodically to design the study, monitor implementation, and discuss results. S.O. provided statistical consultation. M.W and N.N. were student research assistants who collected data and participated in team meetings.

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