

# Functional Quality-of-Life Outcomes Reported by Men Treated for Localized Prostate Cancer: A Systematic Literature Review

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Baker and Lavender contributed to the conceptualization and design. Baker completed the data collection. Lavender provided the statistical support. All authors contributed to the analysis and manuscript preparation.

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**Problem Identification:** To systematically evaluate the literature for functional quality-of-life (QOL) outcomes following treatment for localized prostate cancer.

**Literature Search:** The MEDLINE®, CINAHL®, EMBASE, British Nursing Index, PsycINFO®, and Web of Science™ databases were searched using key words and synonyms for localized prostate cancer treatments.

**Data Evaluation:** Of the 2,191 articles screened for relevance and quality, 24 articles were reviewed. Extracted data were tabulated by treatment type and sorted by dysfunction using a data-driven approach.

**Synthesis:** All treatments caused sexual dysfunction and urinary side effects. Radiation therapy caused bowel dysfunction, which could be long-term or resolved within a few years. Sexual function could take years to return. Urinary incontinence resolved within two years of surgery but worsened following radiation therapy. Fatigue was worse during treatment with adjuvant androgen-deprivation therapy, and some men experienced post-treatment fatigue for several years.

**Conclusions:** This review identified that QOL outcomes reported by men following different treatments for localized prostate cancer are mostly recorded using standardized health-related QOL outcome measures. Such outcome measures collect data about body system functions but limit understanding of men's QOL following treatment for prostate cancer. Holistic outcome measures are needed to capture data about men's QOL for several years following the completion of treatment for localized prostate cancer.

**Implications for Practice:** Nurses need to work with men to facilitate information sharing, identify supportive care needs, and promote self-efficacy, and they should make referrals to specialist services, as appropriate.

Prostate cancer is classified as localized in men with a prostate-specific antigen (PSA) level of 10–20 ng/ml, a Gleason score of 7 or less, and a suspected prostate tumor stage of T1–T2c on digital rectal examination (European Association of Urology [EAU], 2015). Primary outcomes of different treatments for localized prostate cancer are equivocal; consequently, in England and Wales, a standard protocol for “best treatment” does not exist (National Institute for Health and Care Excellence [NICE], 2014). Men with low- and intermediate-risk localized prostate cancer are offered one of several treatment modalities, including active surveillance, radical retropubic prostatectomy (RRP), external beam radiation therapy (EBRT), and brachytherapy. Men with high-risk localized prostate cancer are offered radical surgery or radiation therapy but not active surveillance (NICE, 2014). Men with intermediate- and high-risk localized prostate cancer may also be offered androgen-deprivation therapy as an adjuvant to radiation therapy to maximize treatment

efficacy (Shelley et al., 2009). Adjuvant androgen-deprivation therapy may be given neoadjuvantly, six months prior to radiation therapy, or six months to three years following radiation therapy (NICE, 2014).

NICE (2014) and the EAU (2015) have recommended that men with a 10-year life expectancy and who are potent at the time of diagnosis be offered nerve-sparing surgery to treat their localized prostate cancer. Minimally invasive surgical procedures, such as laparoscopic prostatectomy and robotic-assisted laparoscopic prostatectomy, have begun to replace open surgical techniques (EAU, 2015; Gandaglia et al., 2014; Ramsay et al., 2012). In addition, focal therapy treatments (e.g., cryotherapy, ablation, low-energy radiofrequency) are being evaluated in clinical trials (Valerio et al., 2014).

A systematic search of relevant databases identified a few reviews reporting outcomes following treatment for localized prostate cancer. However, none were systematic reviews that reported data about quality-of-life (QOL) outcomes that had been collected from men receiving surgical or radiation treatment for localized prostate cancer (Kendirci, Bejma, & Hellstrom, 2006; Nilsson, Norlén, & Widmark, 2004; Pagliarulo et al., 2012). A health technology assessment investigating the clinical and cost-effectiveness of robotic prostatectomy (Ramsay et al., 2012) found that no evidence exists to conclude better cancer-related, patient-driven, or erectile dysfunction outcomes from robotic surgery compared to other surgical prostatectomy techniques. Primary research studies have reported several side effects associated with localized treatment for prostate cancer, some of which may last several years (Resnick et al., 2013; Soderdahl et al., 2005).

The treatment decision-making process must include consideration of QOL outcomes associated with side effects during and following treatment. Therefore, a systematic literature review was conducted to identify QOL outcomes reported by men after receiving surgery or radiation therapy with or without androgen-deprivation therapy for localized prostate cancer to determine if the severity and duration of impaired QOL differed between treatments.

## Methods

### Literature Search

A systematic search of the literature was carried out. Using Boolean operators, medical subject headings (MeSH) for *cancer, prostate, surgery, radiotherapy, quality of life, incontinence, and side effects* were used to search the MEDLINE®, CINAHL®, EMBASE, British Nursing Index, and PsycINFO® databases. The authors restricted the publication language to English, and no date limitation was used. Systematic

searches of databases carried out in July 2011 have since been repeated, with the most recent search conducted in August 2014 to ensure that search results were up-to-date. The search was expanded by snowballing reference lists of articles included in the review and citation chaining using Web of Science™.

### Inclusion and Exclusion Criteria

Because of increased survival from improved treatment outcomes, assessment and management of QOL is paramount for providing optimal health care. QOL is a multidimensional concept that includes health, social, and mental domains (WHOQOL Group, 1998).

Numerous QOL measures are used in prostate cancer studies, such as the European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire–Core 30 (EORTC QLQ-C30) (McKenzie & van der Pol, 2009), the International Prostate System Score (IPSS) (Barry et al., 1992), and the SF-36® (Ware & Gande, 1994). QOL outcomes are also reported from qualitative research studies. To capture the breadth of research reporting QOL in men treated for localized prostate cancer, articles that reported primary data collected directly from men on the effects on QOL following radical prostatectomy, or following EBRT or brachytherapy with or without adjuvant androgen-deprivation therapy, for localized prostate cancer were included in the review. Articles were included in the review only if QOL outcomes could be assigned to a specific treatment type. Articles that did not present data on QOL outcomes collected from men (e.g., from healthcare providers, from retrospective studies of case notes) were excluded. Articles that collected data on treatment of men with locally spread or metastatic disease were also excluded.

### Appraisal and Exclusion Process

All articles were reviewed by the primary author. Articles with potentially relevant titles that did not include an abstract were obtained in full text. A deterministic sample of every fourth study was independently reviewed for exclusion decision by a second reviewer. All articles that had possibly relevant content were retrieved in full text to assess for inclusion. Exclusion of articles retrieved in full text were discussed and agreed on by the researchers.

The quality of articles was assessed using Critical Appraisal Skills Programme (CASP) tools that were relevant for the research design being appraised (Spencer, Ritchie, Lewis, & Dillon, 2003). Quality assessment and exclusion decisions of full-text articles were conducted by two independent researchers. Articles that achieved a CASP score of 8 out of 12 or greater were included in the review. The exclusion process is summarized using an adapted PRISMA (Preferred

Reporting Items for Systematic Reviews and Meta-Analyses) flowchart (Moher, Liberati, Tetzlaff, & Altman, 2009) (see Figure 1).

## Data Extraction and Analysis

Data were independently extracted by two researchers using data extraction criteria (see Table 1). Articles were ordered chronologically by publication date. Functional QOL outcomes were commonly reported as side effects of treatment and presented in terms of loss of function or impaired function of body systems, often described as “dysfunction.” Therefore, using a data-driven approach (Dixon-Woods, Agarwal, Jones, Young, & Sutton, 2005), terminology of dysfunction was used to sort reported functional QOL outcomes following different types of treatment for localized prostate cancer. The QOL outcomes were bowel dysfunction, sexual dysfunction, urinary dysfunction, effects of adjuvant androgen-deprivation therapy, and other findings, including fatigue (see Table 2). Findings from articles reporting qualitative and quantitative data were integrated in relation to functional QOL outcomes following each localized prostate cancer treatment.

## Results

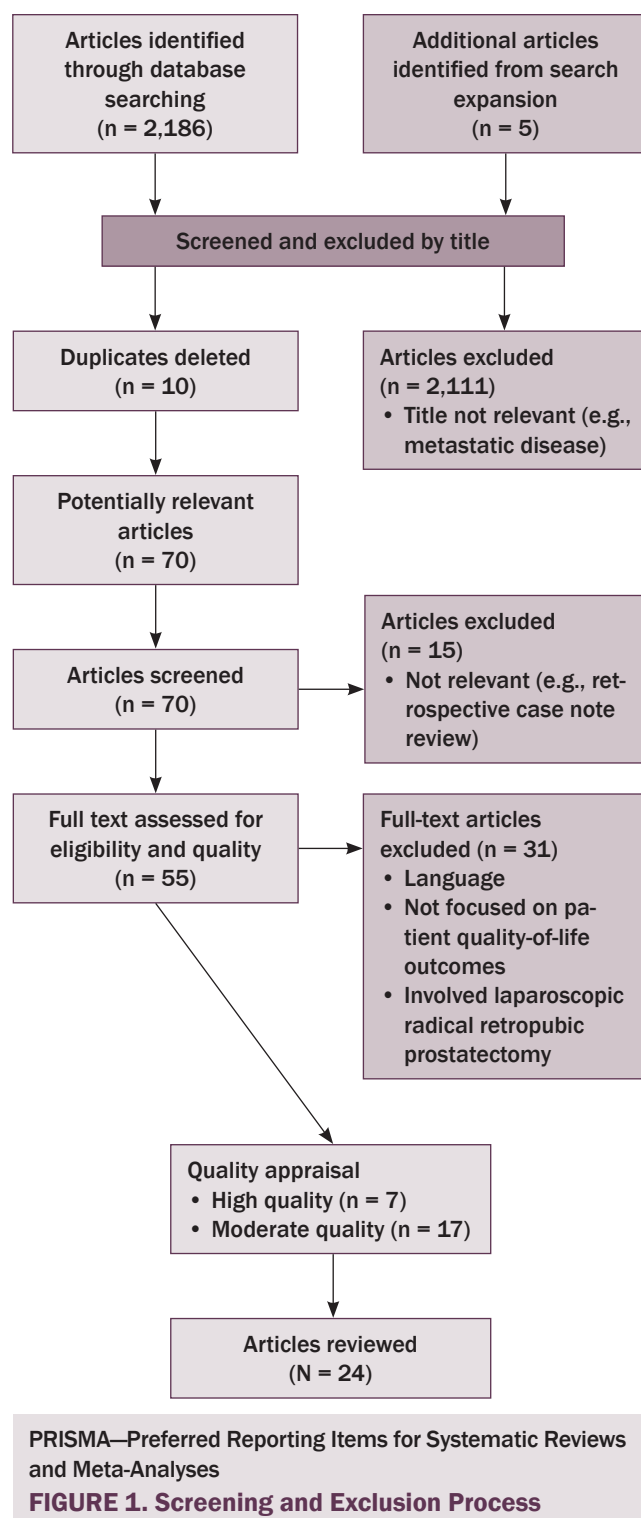
Of 2,191 articles retrieved, 70 potentially relevant articles were identified, 15 were not considered to be relevant, and 55 were retrieved in full text. Twenty-four articles reported data on the effects of prostate cancer treatment on QOL that could be extracted for review. The majority of articles reported studies conducted in the United States ( $n = 11$ ), with two each in Canada, Australia, Sweden, and Norway and one each in Switzerland, Spain, Holland, England, and Italy. The majority of articles reported cross-sectional studies; however, some qualitative studies were identified. The most common data collection tools used were the EORTC QLQ-C30, IPSS, SF-36, UCLA Prostate Cancer Index, and Expanded Prostate Cancer Index Composite.

## Quality Assessment

Using relevant CASP tools, seven articles had a CASP score of 10 or greater (Chapple & Ziebland, 2002; Crook et al., 2011; Fransson, 2008; Madalinska et al., 2001; Miller et al., 2005; Pardo et al., 2010; Resnick et al., 2013). The remaining articles had CASP scores of 8 or 9.

## Effects of Radical Prostatectomy on Quality of Life

Radical prostatectomy was associated with significant sexual dysfunction. In one study that recruited



302 men who had prostatectomy, no significant difference was noted in post-treatment sexual dysfunction between men who had nerve-sparing surgery compared to non-nerve-sparing surgery (Soderdahl et al., 2005). However, other large-scale, high-quality studies reported that men who had nerve-sparing surgery had better sexual function than those who did not have nerve-sparing surgery (Pardo et al., 2010;

**TABLE 1. Key Data Extracted From Included Studies Following Quality Appraisal Process**

Study and Country	Design and Purpose	Sample and Methods	Tools	Strengths and Limitations
Heathcote et al., 1998 Australia	Cross-sectional study to assess the QOL of Australian men post-RRP	140 men; mean age of 64 years; post-RRP with no disease recurrence at 1–6 years  The questionnaire was posted from July 1989 to June 1995. Men were sent one reminder if they did not reply after one month, and 112 men completed the questionnaire.	Study questionnaire that included HRQOL outcomes	<ul style="list-style-type: none"> <li>• Three surgeons (limited variation in surgical technique, and type of surgery not described)</li> <li>• Assumptions around the impact of comorbidities</li> <li>• Clear definition of incontinence and dysfunction</li> <li>• Developed own QOL tool that was not fully validated</li> <li>• Single time point</li> <li>• 80% response rate</li> </ul>
Lilleby et al., 1999 Norway	Cross-sectional study to assess morbidity, side effects, and QOL in men treated for prostate cancer with a curative aim	154 men had EBRT dose in a four-field box (64–66 Gy for seven weeks, given at 2 Gy five days a week; mean age of 66 years); 108 had RRP (mean age of 63 years); 38 men underwent active surveillance (control group; mean age of 66 years).  Questionnaires were issued from 1987–1995 at 31 and 41 months post-treatment.	EORTC QLQ-C30; Lower Urinary Tract Symptoms; IPSS; Psychosocial Adjustment to Illness Scale	<ul style="list-style-type: none"> <li>• Men recruited from one hospital</li> <li>• Multiple QOL tools</li> <li>• Comorbidities included</li> <li>• Confounding factors not clearly established</li> <li>• Median from treatment to questionnaire not equal</li> <li>• Included control group</li> <li>• Nonrandomized</li> <li>• Missing data substituted</li> <li>• <math>p &lt; 0.05</math> significant</li> </ul>
Clark & Talcott, 2001 United States	Prospective cohort study of the outcomes of RRP or EBRT	184 men (94 had RRP, 90 had EBRT); aged 60–70 years  Recruited in June and July 1994; QOL questionnaire was completed before treatment and at 3, 12, 24, and 36 months post-treatment	Medical Outcomes Study-Sexual Problems; SF-36®	<ul style="list-style-type: none"> <li>• Missing data explained</li> <li>• Pretreatment assessment included psychological and physical distress assessed together</li> <li>• Verified indexes as measurable</li> <li>• Data collected from 1994–1998</li> <li>• Not randomized</li> <li>• Missing data acknowledged</li> </ul>
Fransson et al., 2001 Sweden	Cross-sectional study between EBRT and active surveillance to compare QOL and side effects against age-matched control group	59 had EBRT; 49 deferred treatment; 68 age-matched controls; mean age of 72 years  Questionnaires were sent to men who received treatment from 1991–1998 at 40.6 months post-EBRT and at 30.4 months post-brachytherapy. Age-matched controls were sent the questionnaire in May 1995.	EORTC QLQ-C30; QUFW94 (later renamed Prostate Cancer Symptom Scale)	<ul style="list-style-type: none"> <li>• The outcome suggests that tools are valid to explore this topic.</li> <li>• Exploration very limited; not clear why questionnaire or area of exploration chosen</li> <li>• Both questionnaires validated</li> <li>• Use of control group</li> <li>• Data captured from 1991–1998</li> <li>• Where patient treatment took place was not explained.</li> </ul>

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CI—confidence interval; EBRT—external beam radiation therapy; EORTC QLQ-C30—European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire—Core 30; EPIC—Expanded Prostate Cancer Index Composite; FACT—Functional Assessment of Cancer Therapy; HRQOL—health-related quality of life; IPSS—International Prostate Symptom Score; QOL—quality of life; RAP—robotic-assisted prostatectomy; RP—radical prostatectomy; RRP—radical retropubic prostatectomy; UCLA-PCI—UCLA Prostate Cancer Index



**TABLE 1. Key Data Extracted From Included Studies Following Quality Appraisal Process (Continued)**

Study and Country	Design and Purpose	Sample and Methods	Tools	Strengths and Limitations
Fulmer et al., 2001 United States	Prospective study to assess sexual and urinary function in men treated for localized prostate cancer	42 had nerve-sparing RP; 45 had brachytherapy and adjuvant androgen-deprivation therapy; 40 had EBRT (40–45 Gy), plus brachytherapy boost and adjuvant androgen-deprivation therapy; median age of 64 years  QOL was assessed pre- and post-treatment using questionnaires about urinary and sexual function. Data were collected from January to November 1999. Urinary function was assessed within 18 months of surgery and sexual function within 24 months of surgery or on initiation of adjuvant androgen-deprivation therapy.	American Urological Association Symptom Score; Sexual Function Both-er; UCLA-PCI	<ul style="list-style-type: none"> <li>Adapted questionnaire (validated and unvalidated questions)</li> <li>RRP either unilateral or bilateral nerve sparing</li> <li>Impact of bilateral nerve-sparing procedure on voiding function identified</li> <li>Adjusted for differences in models and analysis</li> <li>Validated analysis method used (CI high)</li> <li>Men in most severe category omitted, which was not explained</li> <li>Handling of missing data explained</li> </ul>
Madalin-ska et al., 2001 Holland	Prospective lon-gitudinal cohort study to com-pare the QOL outcomes after RRP or EBRT for localized pros-tate cancer	368 men recruited (119 had RRP, 180 had EBRT, 22 had active surveillance, 47 received treatment for advanced prostate cancer); younger than 76 years of age  Data were collected at diagnosis, six months post-treat-ment, and 12 months post-treatment from June 1996 to May 1998. At baseline, 278 responses were collected, compared to 271 at six months and 261 at 12 months.	SF-36; UCLA-PCI	<ul style="list-style-type: none"> <li>Variation in data collection times with different treatments</li> <li>Not clear if surgical and EBRT techniques remained constant across study and all four sites</li> <li>Dropout described</li> <li>Data collection period may not have captured full effects of EBRT</li> <li>Response rate of 88%–93%</li> <li>Age range not included</li> </ul>
Chapple & Ziebland, 2002 England	Qualitative study assessing effects of pros-tate cancer on men's bodies, their roles, and their sense of masculinity	52 men (7 had RRP, 20 had EBRT, 5 had brachytherapy, 32 had androgen-deprivation therapy, 4 had active surveillance)  Quotes from 18 participants, 7 of which reported treat-ment (3 RP or radiation therapy, 4 radiation therapy and adjuvant androgen-deprivation therapy); all were aged older than 50 years. Audio recorded long interviews were conducted in the men's homes either on their own or with their wives present; data were collected in late 2000 and early 2001.	–	<ul style="list-style-type: none"> <li>Purposive sampling used</li> <li>No explanation of how many men were invited to interview</li> <li>No acknowledgement that wife being present may have influ-enced interview</li> <li>Not clear how current findings and future research will affect healthcare delivery or patient support</li> <li>Only fully qualitative study</li> </ul>
Gotay et al., 2002 United States	Cross-sectional study of positive aspects of QOL and psychoso-cial well-being in men treated for localized pros-tate cancer	67 men; mean age of 69.3 years  Questionnaires about the experienced philosophy of life and existential changes as a result of prostate cancer were sent within 18–30 months or 60–74 months after diagnosis.	–	<ul style="list-style-type: none"> <li>Unclear which QOL questionnaire was adapted or how comments were captured</li> <li>No evidence of confounding factors considered</li> <li>Missing data acknowledged</li> <li>Lacks detail in results</li> <li>Response rate of 57.2%</li> <li>Limited sample size</li> </ul>

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**TABLE 1. Key Data Extracted From Included Studies Following Quality Appraisal Process (Continued)**

Study and Country	Design and Purpose	Sample and Methods	Tools	Strengths and Limitations
Wei et al., 2002 United States	Cross-sectional QOL survey between RRP, EBRT, brachytherapy, or age-matched controls	896 had RRP (median age of 63.5 years); 203 had three-dimensional conformal EBRT (55–80 Gy, given five days a week; median age of 70.9 years); 114 had brachytherapy (160 Gy by iodine-125 implant; median age of 67.2 years); 142 were in the control group (median age of 64.8 years). Questionnaires were sent to all men from 1995–1999.	SF-36; FACT-General; FACT-Prostate; EPIC; American Urological Association-Symptom Index	<ul style="list-style-type: none"><li>• Scores stratified by cohort</li><li>• Scores from each cohort initially compared with control</li><li>• No pretreatment</li><li>• HRQOL completed</li><li>• Analysis controlled for age and time from treatment</li><li>• Response rates from 72.4%–78.9% across four groups</li><li>• CI high</li></ul>
Rondorf-Klym & Colling, 2003 United States	Survey to examine physical and psychological factors affecting men's QOL 12–24 months post-RRP	88 men who were 12–24 months post-RRP; mean age of 66 years Postal questionnaire	UCLA-PCI; Rosenberg Self-Esteem Scale; Centre for Epidemiologic Studies Short Depression Scale; Internal Health Locus of Control Subscale; Anger Expression Scale; Personal Resource Questionnaire 85-Part 2	<ul style="list-style-type: none"><li>• Standard tools used</li><li>• Comprehensive reporting of statistical data</li><li>• Limited discussion of findings</li><li>• No discussion of limitations</li><li>• Practice recommendations explicit</li><li>• 73% response rate</li></ul>
Miller et al., 2005 United States	Cross-sectional survey of long-term QOL outcomes of a cohort of prostate cancer survivors four to eight years after treatment	964 men (665 had RRP, 147 had three-dimensional conformal EBRT, 84 had brachytherapy; 112 were in the control group); aged from 69–75 years Men previously evaluated at a median of 2.6 years post-treatment were sent questionnaires at a median of 6.2 years post-treatment.	EPIC-26; SF-12	<ul style="list-style-type: none"><li>• Large sample size; single site</li><li>• Longitudinal approach</li><li>• No baseline assessment</li><li>• Built on previous findings</li><li>• Adds new knowledge because of data collection period</li><li>• Limitations acknowledged (e.g., not able to distinguish between current and former use of androgen-deprivation therapy)</li><li>• Response rates from 66%–78%</li><li>• Treatments not randomized</li></ul>
Soderdahl et al., 2005 United States	Prospective longitudinal survey to compare QOL after treatment	186 had RRP; 116 had laparoscopic prostatectomy; 150 had brachytherapy; aged from 59–68 years QOL questionnaires distributed at pretreatment and at 1, 3, 6, 9, and 12 months after therapy from 2001–2003	SF-36; American Urological Association-Symptom Index; UCLA-PCI	<ul style="list-style-type: none"><li>• Sufficient sample size; studied at 4 time points over 12 months</li><li>• Limited number of surgeons at single medical center</li><li>• Suboptimal questionnaire used and validated</li><li>• Dropout and missing data not explored; treatments not randomized</li><li>• Addressed potential bias in methodology</li><li>• Treatments not randomized</li></ul>

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**TABLE 1. Key Data Extracted From Included Studies Following Quality Appraisal Process (Continued)**

Study and Country	Design and Purpose	Sample and Methods	Tools	Strengths and Limitations
Willener & Hantikainen, 2005 Switzerland	Content analysis to assess the QOL of men 3–4 months post-RRP	11 men post-RRP; mean age of 66 years Audio recorded interviews involving 55 areas of QOL divided into nine groups (i.e., health, activity, family, relationship with partner, autonomy, independence, hobby, financial security, sexuality)	Schedule for the Evaluation of Individual Quality of Life-Direct Weighting	<ul style="list-style-type: none"><li>• Interviews conducted by author</li><li>• 11 patients purposively sampled</li><li>• No data saturation</li><li>• First instance of tool's use in prostate cancer</li><li>• Results not generalizable and not sufficient evidence to make recommendations for practice</li></ul>
Weber et al., 2007 United States	Qualitative study to determine the effect of a dyadic support intervention on QOL for men after RRP	72 men post-RRP; aged 47–70 years Recruited six weeks postsurgery; randomized to control group (usual health care) and experimental group (usual health care and support from peers [dyads]). Data were collected at baseline and at eight weeks postsurgery via telephone interviews. The control group members received follow-up with their urologist, and the experimental group members were paired with men three years post-treatment who had experienced similar side effects.	SF-36; UCLA-PCI; Stanford Inventory of Cancer Patient Adjustment	<ul style="list-style-type: none"><li>• Randomization process not explained</li><li>• Results not clearly reported (graphs lacked detail and limited description provided)</li><li>• Age range of “younger” and “older” not defined</li><li>• Duration of benefit not explored</li><li>• Attrition was reported and, where possible, explained.</li></ul>
Fransson, 2008 Sweden	Prospective study to examine urinary function and QOL in men 15 years post-EBRT compared to age-matched control group	27 men treated with EBRT from 1986 to mid-1989; 37 age-matched controls; EBRT dose four-field box technique of an average of 64.8–70 Gy, given 2 Gy five days a week; mean age of 78 years Questionnaires were sent 15 years post-treatment.	EORTC QLQ-C30	<ul style="list-style-type: none"><li>• Small sample size</li><li>• Results not clearly reported (graphs lacked detail and limited description provided)</li><li>• Long-term follow-up at 15 years (same method used across study)</li><li>• Use of missing case analysis</li><li>• Response rates of 71% and 59%</li></ul>
Sanda et al., 2008 United States	Prospective comparative QOL study among RRP, laparoscopic prostatectomy, RAP; EBRT, or brachytherapy, with or without adjuvant androgen-deprivation therapy	1,201 men (603 had prostatectomy [includes RRP, laparoscopic prostatectomy, and RAP], 202 had EBRT, 90 had EBRT plus adjuvant androgen-deprivation therapy, 271 had brachytherapy, 35 had brachytherapy with or without EBRT and/or androgen-deprivation therapy); aged from 38–84 years Enrolled from March 2003 to March 2006; patient-reported outcome measures were collected by third-party telephone survey before treatment and at 2, 6, 12, and 24 months after starting treatment.	EPIC-26; Service Satisfaction Scale for Cancer Care; Service Satisfaction Scale for Cancer Care for Partners	<ul style="list-style-type: none"><li>• Multiple centers and large sample size</li><li>• Nine hospitals</li><li>• Men and partner evaluation</li><li>• Comparison between treatment types clearly reported</li><li>• Validated tools used</li><li>• Not clear if partner and men interviewed separately</li><li>• Unable to distinguish data reporting outcomes among different types of prostatectomy technique used</li><li>• Treatment not randomly assigned</li></ul>

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**TABLE 1. Key Data Extracted From Included Studies Following Quality Appraisal Process (Continued)**

Study and Country	Design and Purpose	Sample and Methods	Tools	Strengths and Limitations
Gilberti et al., 2009 Italy	Compared oncologic and functional outcomes after RRP or brachytherapy	Men randomized into two groups of 100: group 1 (RRP) and group 2 (brachytherapy); aged from 51–74 years Recruited from May 1999 to October 2002; post-treatment assessed at 1, 3, 6, and 12 months, and then every six months in the second year and annually afterward; mean follow-up of 68.2 months; at five years' follow-up, 74 in group 1 and 85 in group 2	IPSS; International Index of Erectile Function; EORTC QLQ-C30/Prostate Cancer Model	<ul style="list-style-type: none"> <li>• Small sample size</li> <li>• Combined physical assessment and QOL</li> <li>• 174 of 200 completed five-year follow-up</li> <li>• Single-center recruitment with standardized treatments</li> <li>• Evaluated at multiple time points</li> </ul>
Smith et al., 2009 Australia	Prospective cohort study to quantify negative effects on long-term QOL with three-year follow-up after RRP, EBRT with or without adjuvant androgen-deprivation therapy, or low- or high-dose brachytherapy	1,642 men with prostate cancer; 495 age-matched controls; aged younger than 70 years (37–69 years) Recruited from October 2000 to October 2002 and notified to the population-based New South Wales Central Cancer Registry by May 2003 and no more than 12 months postdiagnosis; prostate cancer group received telephone interviews 1–12 months after diagnosis (often after primary treatment had begun) and at one, two, and three years post-treatment; controls were asked to recall baseline health status after the standardized recall period of three months before the interview date and at one, two, and five years after the first interview.	SF-12; IPSS	<ul style="list-style-type: none"> <li>• Men identified from national register to limit bias</li> <li>• Large sample size across multiple centers</li> <li>• Control group included</li> <li>• Limited to men aged younger than 70 years</li> <li>• Clinical and QOL data collected</li> <li>• Surgical characteristics described</li> <li>• CI of 95%</li> </ul>
Toren et al., 2009 Canada	Pre- and post-treatment study to assess how urinary incontinence affects QOL after nerve-sparing RRP	253 men (159 had bilateral nerve-sparing surgery, 32 had unilateral nerve-sparing surgery, 62 had non-nerve-sparing surgery) Recruited from 2003–2007; the questionnaire was distributed preoperatively and at each follow-up clinic.	Patient Oriented Prostate Utility Scale	<ul style="list-style-type: none"> <li>• Suggests 100% recruitment</li> <li>• Single center</li> <li>• Longitudinal study</li> <li>• Only focused on urinary continence and surgery</li> <li>• No restriction on age; age group not defined</li> </ul>
Pardo et al., 2010 Spain	Prospective longitudinal study to compare the impact on QOL of RRP, EBRT, and brachytherapy	435 men (123 had RRP, 127 had EBRT, 185 had brachytherapy); three-dimensional conformal EBRT mean dose of 73.7 Gy, 1.8–2 Gy given five days a week; brachytherapy dose of 144 Gy Telephone interviews were done before treatment and at 1, 3, 6, 9, 12, 24, and 36 months post-treatment.	SF-36; EPIC; IPSS	<ul style="list-style-type: none"> <li>• Sufficient sample size</li> <li>• Clinical and QOL measurements</li> <li>• Validated tools</li> <li>• Standard categorization of effect size applied</li> <li>• Prospective design</li> <li>• Age range and median not included</li> <li>• Results presented for nerve-sparing and non-nerve-sparing surgeries, but treatment selection not explained</li> </ul>

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**TABLE 1. Key Data Extracted From Included Studies Following Quality Appraisal Process (Continued)**

Study and Country	Design and Purpose	Sample and Methods	Tools	Strengths and Limitations
Alemozafar et al., 2011 United States	Longitudinal study of whether sexual outcomes after RRP, EBRT, or brachytherapy can be predicted with baseline characteristics and treatment planning	1,027 men (524 had RRP, 241 had EBRT, 262 had brachytherapy) Telephone interviews before treatment and at 2, 6, 12, and 24 months after treatment	EPIC-26; UCLA-PCI	<ul style="list-style-type: none"> <li>• First multicenter inquiry (nine centers)</li> <li>• Large sample size</li> <li>• Analysis clearly described</li> <li>• Developed and validated new QOL tool for measuring erectile function</li> <li>• Potential selection bias because of treatment choices</li> <li>• Different QOL tools used in different cohorts</li> <li>• 86% response rate</li> <li>• Age not reported</li> </ul>
Crook et al., 2011 Canada	Cross-sectional study 5.3 years post-treatment assessing the QOL of men treated with RRP or brachytherapy	168 men; after multidisciplinary education session, men either chose treatment (62 chose RRP [median age of 59.4 years] and 94 chose brachytherapy [median age of 61.4 years]) or were randomly assigned treatment (n = 12); treatment was from September 2002 to July 2005. Questionnaire posted at the median of 5.2 years post-treatment	EPIC; SF-12	<ul style="list-style-type: none"> <li>• Medium sample size</li> <li>• Only study where treatment randomly selected but too small a group to avoid bias</li> <li>• Validated tools used</li> <li>• Baseline not measured using same HRQOL</li> <li>• Patient choice of treatment may have affected satisfaction</li> <li>• One clinician administered all brachytherapy</li> <li>• Multiple surgeons but surgical technique not discussed</li> </ul>
Resnick et al., 2013 United States	Cross-sectional study to compare urinary, bowel, and sexual function 15 years following RRP or EBRT with or without adjuvant androgen-deprivation therapy	1,655 men (1,164 had RRP, 491 had EBRT with or without adjuvant androgen-deprivation therapy within one year of diagnosis); aged 55–74 years Baseline assessment 6 months post-treatment; surveyed at baseline and at 2, 5, and 15 years post-treatment	–	<ul style="list-style-type: none"> <li>• Large sample size</li> <li>• Missing data described</li> <li>• No control group</li> <li>• Treatment option related to disease and comorbidities, which may influence outcomes</li> <li>• Longitudinal design a strength but treatment was more than 15 years ago</li> <li>• Response rate of 88% at 2 years, 83% at 5 years, and 60% at 15 years</li> <li>• At the time of the 15-year survey, 322 of the RRP group and 247 of the EBRT group had died.</li> </ul>
Nicolaisen et al., 2014 Norway	Cross-sectional survey of long-term QOL outcomes and satisfaction with information from healthcare provider	143 men (38 had RRP [mean age of 67 years], 59 had EBRT [mean age of 71 years], 46 had postoperative EBRT [mean age of 69.6 years]) Recruited from October 2011 to May 2012; invited to participate in the study for 3–4 years post-treatment through mailed questionnaires	SF-12; EPIC-50	<ul style="list-style-type: none"> <li>• One hospital site over 12 months</li> <li>• Standardized QOL tools used</li> <li>• Significance level of 0.05 and 95% CI</li> <li>• Reproducible</li> <li>• Linked information giving with QOL but did not look at clinical outcome</li> <li>• 81% response rate</li> </ul>

CI—confidence interval; EBRT—external beam radiation therapy; EORTC QLQ-C30—European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire—Core 30; EPIC—Expanded Prostate Cancer Index Composite; FACT—Functional Assessment of Cancer Therapy; HRQOL—health-related quality of life; IPSS—International Prostate Symptom Score; QOL—quality of life; RAP—robotic-assisted prostatectomy; RP—radical prostatectomy; RRP—radical retropubic prostatectomy; UCLA-PCI—UCLA Prostate Cancer Index

Sanda et al., 2008; Smith et al., 2009). Many studies did not control for potential confounding factors (e.g., comorbidities); however, pretreatment sexual function, PSA level, and size of prostate were reported as confounding factors of sexual function after prostatectomy (Alemozaffar et al., 2011; Sanda et al., 2008).

Side effects reported in these studies include relative loss of libido, erectile dysfunction, inability to sustain a functional erection sufficient for penetrative intercourse, and associated psychological distress at loss of the ability to have intercourse. Heathcote et al. (1998) reported that only 14 of 99 men who had erections presurgery were able to have erections after treatment. Some studies reported that men were able to restore sexual function following medical intervention; however, Fulmer, Bissonette, Petroni, and Theodorescu (2001) reported that no men returned to their normal presurgery erectile functioning, despite treatments for erectile dysfunction or nerve-sparing surgery. Larger-scale studies that used validated data collection tools found that some normal sexual function resumed over time (Alemozaffar et al., 2011; Pardo et al., 2010), but the degree to which sexual function was restored in men recruited to participate in these studies was not specified.

Some men reported that sexual dysfunction affected their feelings about sexual intimacy and relationships (Clark & Talcott, 2001). Men complained of a change in sensation and loss of penile length, which affected their manhood and self-esteem and caused loss of identity, resulting in anger (Rondorf-Klym & Colling, 2003). However, qualitative studies reported by Chapple and Ziebland (2002) and Weber et al. (2007) did not find men's masculinity to be affected by their sexual function. Such findings may be attributed to a positive perception men had about their treatment as a whole, prioritizing the importance of overall health and survival over sexual function (Chapple & Ziebland, 2002; Willener & Hantikainen, 2005).

Radical prostatectomy was also reported to cause urinary dysfunction. Some men had pretreatment urinary dysfunction, which was worsened by surgery (Heathcote et al., 1998; Toren et al., 2009). Toren et al. (2009) found no significant difference in urinary incontinence among 253 men who had nerve-sparing surgery, non-nerve-sparing surgery, or laparoscopic prostatectomy. Immediate post-treatment side effects were urgency and frequency of micturition; longer-term side effects were mainly moderate to severe incontinence. Several studies that reported incontinence following RRP also reported a resumption of pretreatment continence within 12 months (Clark & Talcott, 2001; Madalinska et al., 2001). Gilberti, Chiono, Gallo, Schenone, and Gastaldi (2009) reported that men with severe incontinence six months following

radical prostatectomy were treated with an additional surgical intervention for incontinence. Urinary leakage and incontinence one year after treatment was more common in men treated with radical prostatectomy than with EBRT (Madalinska et al. 2001; Pardo et al., 2010) or with brachytherapy (Crook et al., 2011). Some men needed surgery for hematuria or bladder outflow obstruction after radical prostatectomy (Lilleby, Fosså, Waehre, & Olsen, 1999). Lilleby et al. (1999) also reported that, after radical prostatectomy, men had impaired QOL because of fatigue.

### Effects of External Beam Radiation Therapy on Quality of Life

Wei et al. (2002) reported that the total dose of EBRT given ranged from 55–80 Gy. In other studies that reported total EBRT doses, the mean dose given to men was lower than the now recommended minimum total dose of 74 Gy (NICE, 2014). All studies that assessed bowel function in men treated with EBRT reported that EBRT caused short-term bowel dysfunction. Side effects of short-term bowel dysfunction reported in qualitative and large-scale cross-sectional studies included diarrhea, frequency and urgency of passing stool, flatulence, intestinal cramps and pain, rectal pain and bleeding, mucus discharge, and radiation proctitis (Fransson et al., 2001; Lilleby et al., 1999; Madalinska et al., 2001). Several studies found that men had bowel dysfunction for many years after treatment (Chapple & Ziebland, 2002; Miller et al., 2005; Nicolaisen, Müller, Patel, & Hanssen, 2014; Resnick et al., 2013), highlighting the importance of longitudinal studies that assess patient outcomes for years after radiation treatment. A rare incidence of a patient requiring colostomy for treatment of radiation proctitis was reported by Lilleby et al. (1999).

Gotay, Holup, and Muraoka (2002) reported equivalent incidence of sexual dysfunction between men treated with EBRT or radical prostatectomy; however, this study was small and had some methodologic limitations. Larger-scale studies that used validated data collection tools reported a lower incidence of sexual dysfunction in men treated with EBRT compared to radical prostatectomy (Clark & Talcott, 2001; Madalinska et al., 2001; Pardo et al., 2010). Still, what remains evident is that sexual dysfunction is experienced by men treated with EBRT for localized prostate cancer; this side effect is worsened by the use of adjuvant androgen-deprivation therapy, older age, larger prostate, and higher pretreatment PSA level (Sanda et al., 2008). In addition, with the exception of Gotay et al. (2002), sexual function was not reported to improve with time.

Several studies reported irritative and obstructive lower urinary tract side effects that develop immediately

post-EBRT (Chapple & Ziebland, 2002; Clark & Talcott, 2001; Fulmer et al., 2001; Lilleby et al., 1999; Nicolaisen et al., 2014; Resnick et al., 2013), which mostly resolved with time. However, Fransson (2008) conducted a 15-year follow-up study and found that men had long-term urinary side effects of EBRT, which were stress and urge incontinence, as well as pain on micturition. In addition, fatigue and a decline in energy levels occurred 3–12 months post-treatment and can be attributed to adjuvant androgen-deprivation therapy and side effects of EBRT (Lilleby et al., 1999).

### Effects of Brachytherapy on Quality of Life

Men treated with brachytherapy experienced bowel dysfunction, which was reported to be worse than after EBRT (Pardo et al., 2010; Wei et al., 2002). Because of methodologic limitations in studies that compared sexual dysfunction in men treated with RRP, EBRT, or brachytherapy (Alemozaffar et al., 2011; Crook et al., 2011; Wei et al., 2002), determining which treatment would result in better sexual function is difficult; however, RRP and brachytherapy result in sexual dysfunction that may continue for many years. All studies that evaluated urinary dysfunction following brachytherapy reported irritative symptoms (Crook et al., 2011; Fulmer et al., 2001; Miller et al., 2005; Pardo et al., 2010; Sanda et al., 2008; Soderdahl et al., 2005; Wei et al., 2002). Lower urinary tract symptoms, obstructive outflow, and incontinence were also reported (Miller et al., 2005; Sanda et al., 2008).

### Effects on Quality of Life of Androgen-Deprivation Therapy Adjuvant to Radiation Therapy

A variety of endocrine function-related side effects were noted in men treated with EBRT or brachytherapy in combination with androgen-deprivation therapy, which resulted in a higher side effect profile. These included loss of energy, reduced masculinity, altered body morphology, hot flushes, breast pain, and emotional disturbances.

## Discussion

Most studies reviewed reported functional QOL outcomes following treatment for localized prostate cancer. These outcomes were commonly evaluated in terms of the range, frequency, severity, and duration of physical side effects.

This review found that many men treated with radical prostatectomy experienced impaired sexual dysfunction immediately after surgery; their sexual function returned over time, but this could take several years. Sexual dysfunction was also reported in men treated with EBRT and brachytherapy but, overall,

was a more significant side effect in men treated with radical prostatectomy. When baseline sexual function and other variables (e.g., age, PSA level, tumor volume, adjuvant androgen-deprivation therapy) were reported, the dependency of post-treatment sexual function on these variables was evident. Some men needed penile implants to be able to resume sexual activity. Sexual dysfunction was also reported to affect some men's perception of their masculinity.

Radiation therapy caused irritative urinary symptoms, pain on voiding, and a decline in voiding function, which affected men's QOL. Irritative symptoms and pain on voiding improved within months of treatment. Radical prostatectomy is associated with worse urinary dysfunction than EBRT or brachytherapy; however, urinary function often improves within two years of treatment. Conversely, men treated with EBRT or brachytherapy developed urinary incontinence over time.

Most men treated with radiation therapy experienced short-term bowel dysfunction, which was mostly diarrhea, urgency, or abdominal or rectal pain. Several studies reported that bowel dysfunction resolved within one to four years following radiation treatment; long-term bowel dysfunction was also reported (Chapple & Ziebland, 2002; Resnick et al., 2013).

This review found that adjuvant androgen-deprivation therapy was associated with decreased energy levels, depressed mood, and weight gain. Fatigue was particularly severe when radiation therapy was combined with adjuvant androgen-deprivation therapy, and fatigue following radiation therapy could last many years. Treatment for localized prostate cancer not only affects physical aspects of QOL but also a man's perception of his masculinity, which may be threatened by physical outcomes of the treatment and heightened by use of adjuvant androgen-deprivation therapy (Chapple & Ziebland, 2002).

Few studies have reported data on psychosocial aspects of QOL. Three studies reported data on the impact of localized prostate cancer treatment on relationships (Chapple & Ziebland, 2002; Gotay et al., 2002; Weber et al., 2007), and Clark and Talcott (2001) noted an association between the severity of symptoms and distress. No studies reported the everyday experience of men treated for localized prostate cancer following a specific type of treatment, which limits understanding of post-treatment QOL outcomes in this patient population.

Optimally, cancer treatment should provide long-term survival and meet the physical and psychosocial needs of patients and their families. Consequently, careful consideration is needed regarding treatment to promote survival, well-being, and QOL. Patient

**TABLE 2. Findings About QOL Outcomes Among Men With Prostate Cancer**

Study	Treatment	Findings
Heath-cote et al., 1998	RRP	<ul style="list-style-type: none"> <li>• Impotence was reported to be the most common impairment on QOL.</li> <li>• 99 men had pre-RRP potency; 14 men had post-RRP potency.</li> <li>• 25 men had pre-RRP urinary symptoms. 22 men had urinary stress and urge incontinence post-RRP.</li> <li>• 93 men reported urinary dysfunction that did not affect their QOL activities, and 89 men were happy with their urinary function.</li> <li>• 104 men reported a higher QOL post-RRP, which may have been attributed to having received cancer treatment, but 13 expressed concerns about their cancer.</li> </ul>
Lilleby et al., 1999	RRP	<ul style="list-style-type: none"> <li>• 52 men had post-RRP intercourse-disabling sexual function; 64 reported psychological distress related to sexual function after RRP.</li> <li>• 30 men reported moderate to severe incontinence, and 2% required surgical intervention because of hematuria or bladder outflow dysfunction.</li> <li>• Six men reported moderate to severe impairment of QOL from fatigue, reduced social functioning, sleep disturbance, and reduced cognitive function.</li> </ul>
	EBRT	<ul style="list-style-type: none"> <li>• 58 men had flatulence, 39 had intestinal cramps, 20 had rectal bleeding, 19 had mucus discharge, 18 had rectal pain, and 5 had grade 3–4 delayed radiation proctitis, with 1 man requiring a colostomy.</li> <li>• 45 men had intercourse-disabling sexual function; 8 men reported psychological distress related to sexual function.</li> <li>• Nine men reported severe lower urinary tract symptoms; moderate lower urinary tract symptoms were also reported.</li> <li>• 14 men reported severe impairment of QOL for the same reasons as men who had received RRP.</li> </ul>
Clark & Talcott, 2001	RRP	<ul style="list-style-type: none"> <li>• Sexual dysfunction was experienced at 3–12 months post-RRP, causing mood disturbance, as well as anxiety about physical intimacy and relationships with partner.</li> <li>• Incontinence and urinary distress were worse at 3 months post-RRP and improved by 12 months post-treatment.</li> </ul>
	EBRT	<ul style="list-style-type: none"> <li>• Bowel dysfunction that lowered physical well-being and mood was reported at three months, but gradually improved by 12 months.</li> <li>• Similar problems with sexual dysfunction were noted with men who had been treated with RRP.</li> <li>• Irritative and obstructive urinary symptoms were reported 3 months post-treatment and continued to 12 months post-treatment.</li> </ul>
Frans-son et al., 2001	EBRT versus active surveillance (control group)	<ul style="list-style-type: none"> <li>• Men treated with EBRT passed mucus and passed stools more frequently than the control group, requiring medication to manage side effects.</li> <li>• Hematuria was reported in two men who had undergone EBRT.</li> <li>• Side effects from EBRT negatively affected social functioning.</li> </ul>
Fulmer et al., 2001	RRP	<ul style="list-style-type: none"> <li>• Men reported a high level of sexual dysfunction. Normal function returned over 18 months; men did not achieve baseline function.</li> <li>• Men receiving RRP had better baseline urinary function than men receiving radiation therapy. All men reported post-treatment voiding bother, with 42% resuming continence within 12 months and 69% returning to pretreatment incontinence pad use.</li> </ul>
	EBRT, brachytherapy boost, and adjuvant androgen-deprivation therapy	<ul style="list-style-type: none"> <li>• All men reported a high level of sexual dysfunction with no return to baseline function.</li> <li>• Higher baseline urinary dysfunction was reported than in other treatment groups.</li> <li>• Higher urinary dysfunction was reported than with RRP post-treatment, with all men reporting post-treatment voiding bother. However, 75% resumed baseline function, and 98% resumed pretreatment use of incontinence pads.</li> </ul>
	Brachytherapy and adjuvant androgen-deprivation therapy	<ul style="list-style-type: none"> <li>• Higher urinary dysfunction was reported than with RRP post-treatment, with all men reporting post-treatment voiding bother.</li> <li>• 80% reported no incontinence within 12 months, and 99% who had undergone brachytherapy resumed pretreatment pad use.</li> </ul>

*(Continued on the next page)*

EBRT—external beam radiation therapy; QOL—quality of life; RRP—radical retropubic prostatectomy

**TABLE 2. Findings About QOL Outcomes Among Men With Prostate Cancer (Continued)**

Study	Treatment	Findings
Mada-linska et al., 2001	RRP	<ul style="list-style-type: none"><li>Sexual function was the same in both groups pretreatment.</li><li>12 months post-RRP, sexual function was dependent on age and was worse than post-EBRT. 91% of those aged younger than 65 years and 80% of those aged older than 65 years had sexual dysfunction.</li><li>No significant baseline urinary dysfunction was observed.</li><li>Post-RRP, 10% of men had incontinence that improved with time, with 33% resuming total urinary continence within 12 months.</li><li>Overall QOL was reported to be better post-RRP than EBRT.</li></ul>
	EBRT	<ul style="list-style-type: none"><li>No bowel dysfunction was reported pretreatment. Abdominal pain, loose stools, urgency, and rectal bleeding were reported by men six months post-EBRT.</li><li>At 12 months post-EBRT, sexual dysfunction was dependent on age, occurring in 48% of those aged younger than 65 years and in 51% of those aged older than 65 years.</li><li>No significant pretreatment urinary dysfunction was noted; 7% of men reported post-treatment incontinence, and 68% resumed total urinary continence within 12 months.</li></ul>
Chapple & Zie-bland, 2002	RRP, EBRT, radiation therapy with adjuvant androgen-deprivation therapy	<ul style="list-style-type: none"><li>Post-EBRT, some men reported diarrhea and anal bleeding that continued for many years.</li><li>11 men not treated with androgen-deprivation therapy reported having long-term sexual dysfunction, but they reported it did not affect their masculinity and was a small price to pay for their health. Most men tried various treatments for sexual dysfunction with varying degrees of success. Men treated with adjuvant androgen-deprivation therapy reported they had lost their libido and felt physically and psychologically changed.</li><li>Men reported post-treatment incontinence, urgency, and frequency. Men who had brachytherapy reported pain on passing urine and frequency of micturition.</li><li>Men reported loss of energy and masculinity, as well as fatigue. They noted a change in body shape, along with hot flushes, breast pain, and mood swings. Men's experiences and the effects of treatment on their masculinity negatively affected their QOL.</li></ul>
Gotay et al., 2002	RRP	<ul style="list-style-type: none"><li>73%–91% reported sexual dysfunction and 18%–50% had urinary dysfunction, both of which improved with time.</li><li>Most men whose symptoms decreased with time reported they would choose the same treatment again. Except for one man, men reported positive psychological outcomes related to personal growth, a greater appreciation of life, and the adoption of healthier lifestyles.</li></ul>
	EBRT	<ul style="list-style-type: none"><li>38%–88% reported sexual dysfunction, which improved with time.</li><li>5%–26% had urinary dysfunction, which improved with time.</li></ul>
Wei et al., 2002	RRP	<ul style="list-style-type: none"><li>Erectile dysfunction post-RRP was reported.</li><li>Urinary incontinence worse than with other treatments was reported.</li></ul>
	EBRT	<ul style="list-style-type: none"><li>Bowel and sexual function, as well as hormonal functioning, was worse than with RRP.</li></ul>
	Brachytherapy	<ul style="list-style-type: none"><li>Treatment was associated with worse bowel function than RRP and EBRT plus androgen-deprivation therapy.</li><li>Men who had undergone brachytherapy reported worse erectile function compared to other treatments.</li><li>Irritative urinary symptoms were reported.</li></ul>
Rondorf-Klym & Colling, 2003	RRP	<ul style="list-style-type: none"><li>Men reported sexual dysfunction and urinary dysfunction as having a negative effect on QOL.</li><li>Longevity of provision of information and support was helpful in optimizing QOL.</li></ul>

(Continued on the next page)

EBRT—external beam radiation therapy; QOL—quality of life; RRP—radical retropubic prostatectomy



TABLE 2. Findings About QOL Outcomes Among Men With Prostate Cancer (Continued)		
Study	Treatment	Findings
Miller et al., 2005	RRP deprivation	<ul style="list-style-type: none"> <li>Sexual dysfunction was reported in men treated with all modalities at 2.6 years but was worse in men who had undergone RRP.</li> <li>Sexual dysfunction was not as significant at 6.2 years.</li> <li>Urinary dysfunction was reported as being worse at 2.6 years, with incontinence being worse than after other treatments and no improvement at 6.2 years.</li> </ul>
	EBRT with or without adjuvant androgen-deprivation therapy	<ul style="list-style-type: none"> <li>Bowel dysfunction was reported at 2.6 years.</li> <li>Men developed urinary incontinence by 6.2 years.</li> </ul>
	Brachytherapy with or without adjuvant androgen-deprivation therapy	<ul style="list-style-type: none"> <li>Sexual dysfunction function was unchanged between 2.6 years and 6.2 years post-treatment.</li> <li>Urinary dysfunction was reported at 2.6 years, including irritative and obstructive symptoms and incontinence.</li> <li>At 2.6 years, men complained of incontinence.</li> </ul>
Soderdahl et al., 2005	RRP and laparoscopic radical prostatectomy	<ul style="list-style-type: none"> <li>No statistical difference was noted at 12 months in relation to bowel, sexual, and urinary function among RRP, nerve-sparing, or laparoscopic radical prostatectomy.</li> <li>At one month post-treatment, all groups had poor sexual function, which was worse following surgery than brachytherapy. All men reporting sexual dysfunction had improvement by 12 months.</li> <li>Worse urinary function scores were observed than with patients who had undergone brachytherapy.</li> </ul>
	Brachytherapy	<ul style="list-style-type: none"> <li>Initial bowel dysfunction, which returned to baseline at 12 months, was noted, as were irritative urinary symptoms.</li> </ul>
Willener & Hantikainen, 2005	RRP	<ul style="list-style-type: none"> <li>Three men reported erectile dysfunction, but rated their overall health as more important than sexual function.</li> <li>Three men were incontinent and wore pads.</li> <li>Health, family, and relationship with partner had the most impact on QOL.</li> <li>Information and support were reported to be helpful in optimizing QOL.</li> </ul>
Weber et al., 2007	RRP	<ul style="list-style-type: none"> <li>More highly educated men were able to better manage their sexual dysfunction, knowing where to seek advice, support, and treatment.</li> <li>Sexual function affected masculinity and men's role in society.</li> <li>Information and peer support was found to be helpful, as was additional support from the dyad.</li> <li>Younger men had a better outlook on life than older men.</li> </ul>
Fransson, 2008	EBRT	<ul style="list-style-type: none"> <li>Bowel dysfunction was reported.</li> <li>Urinary bother and pain on micturition was reported, with incontinence increasing during an 8- to 15-year period compared to the control group, which was not dependent on age.</li> </ul>
Sanda et al., 2008	RRP	<ul style="list-style-type: none"> <li>Men who had nerve-sparing surgery reported better sexual function. For all treatments, sexual function was dependent on age, size of prostate, and pretreatment prostate-specific antigen level, and partners reported distress about reduced sexual function.</li> <li>Urinary incontinence was worse two months post-RRP; urinary irritation and obstruction improved with surgery.</li> <li>Side effects were worse in men who were obese and had a large prostate size.</li> <li>Black men were overall less satisfied with their treatment than men of other ethnic origins.</li> </ul>
	EBRT with or without adjuvant androgen-deprivation therapy	<ul style="list-style-type: none"> <li>Bowel dysfunction reduced QOL as much as one year post-EBRT.</li> <li>Worse sexual function occurred in men receiving adjuvant androgen-deprivation therapy, which also exacerbated urinary irritation.</li> <li>Urinary symptoms improved by 12 months and returned to baseline at 24 months.</li> </ul>
	Brachytherapy with or without EBRT and/or adjuvant androgen-deprivation therapy	<ul style="list-style-type: none"> <li>Bowel dysfunction reduced QOL as much as one year post-brachytherapy.</li> <li>6% of men reported incontinence, as well as irritative and obstructive side effects, two years after treatment.</li> <li>Adjuvant androgen-deprivation therapy exacerbated urinary irritation.</li> </ul>
(Continued on the next page)		
EBRT—external beam radiation therapy; QOL—quality of life; RRP—radical retropubic prostatectomy		

**TABLE 2. Findings About QOL Outcomes Among Men With Prostate Cancer (Continued)**

Study	Treatment	Findings
Gilberti et al., 2009	RRP	<ul style="list-style-type: none"><li>• 60% of men in both groups reported good pretreatment erectile function. At 6 months, both groups reported worse sexual function, which improved by 12 months. 65% resumed sexual function by five years.</li><li>• Incontinence was reported at six months; some men had either a suburethral sling or artificial urinary sphincter.</li></ul>
	Brachytherapy	<ul style="list-style-type: none"><li>• Proctitis was reported at six months and successfully treated with anti-inflammatory agents.</li><li>• 78% resumed sexual function by five years.</li><li>• Irritative side effects were reported at 6 months and 12 months, and they resolved by five years.</li></ul>
Smith et al., 2009	RRP	<ul style="list-style-type: none"><li>• Sexual dysfunction was reported in all treatment groups at three years, particularly in men receiving androgen-deprivation therapy.</li><li>• At three years post-treatment, men who had nerve-sparing radical prostatectomy had better sexual function than men who had non-nerve-sparing surgery (<math>p &lt; 0.001</math>).</li><li>• 33% of men at three years post-treatment used medication to achieve an erection.</li><li>• All treatments resulted in a degree of urinary dysfunction within the first year. Men who had RRP reported urinary function worse than that experienced by those who had undergone radiation or androgen-deprivation therapy at one year and three years post-treatment.</li></ul>
	EBRT with or without adjuvant androgen-deprivation therapy	<ul style="list-style-type: none"><li>• Men were most affected by bowel dysfunction one year post-treatment and reported high levels of erectile dysfunction at three years (82%).</li></ul>
	Low-dose brachytherapy	<ul style="list-style-type: none"><li>• Bowel and urinary function was better compared to high-dose brachytherapy.</li><li>• Sexual function was significantly higher, and sexual bother was lower, than other treatments at three years.</li></ul>
	High-dose brachytherapy	<ul style="list-style-type: none"><li>• All QOL outcomes measured at three years were significantly worse compared to low-dose brachytherapy.</li><li>• Bowel dysfunction (moderate and severe) was significantly worse compared to surgery or androgen-deprivation therapy (9%); 72% reported impotence at three years.</li></ul>
Toren et al., 2009	RRP	<ul style="list-style-type: none"><li>• Preoperative continence was significantly associated with postoperative continence. No significant difference was noted between urinary function in the nerve-sparing surgery and non-nerve-sparing surgery groups.</li></ul>
Pardo et al., 2010	RRP	<ul style="list-style-type: none"><li>• 50% of men receiving all treatments had severe, and 30% low to moderate, sexual dysfunction at baseline; post-treatment sexual dysfunction was reported to be worse in men with preexisting sexual dysfunction. 10% of men preserved sexual function post-RRP.</li><li>• Severe sexual dysfunction was reported in 64% of men who had nerve-sparing RRP and 83% of men who had non-nerve-sparing RRP, and sexual recovery was higher after nerve-sparing surgery than non-nerve-sparing surgery, which improved by three years.</li><li>• Decline in urinary incontinence was noted after treatment; it was worse in men who had undergone RRP than radiation. Improvement in continence was observed in 64% treated with nerve-sparing surgery.</li></ul>
	EBRT	<ul style="list-style-type: none"><li>• 60% of men preserved sexual function post-treatment.</li><li>• Men who had EBRT had a statistically significant worsening of bowel symptoms between pretreatment and three-year follow-up (moderate effect size of 0.6); of those, 34% had severe bowel symptoms, and 15% had moderate to small bowel symptoms.</li><li>• Worse irritative and obstructive urinary function was observed than with RRP.</li></ul>
	Brachytherapy	<ul style="list-style-type: none"><li>• Bowel dysfunction was worse after brachytherapy compared to RRP and EBRT (<math>p = 0.036</math>).</li><li>• 60% had sexual dysfunction that could continue beyond two or three years.</li><li>• Lower urinary tract and irritative urinary symptoms were worse than with RRP, but they improved with time.</li></ul>

(Continued on the next page)

EBRT—external beam radiation therapy; QOL—quality of life; RRP—radical retropubic prostatectomy

**TABLE 2. Findings About QOL Outcomes Among Men With Prostate Cancer (Continued)**

Study	Treatment	Findings
Alemo-zaffar et al., 2011	RRP	<ul style="list-style-type: none"> <li>Erectile dysfunction was dependent on presurgery potency, age, prostate-specific antigen level, adjuvant androgen-deprivation therapy, and volume of disease.</li> <li>Five men pre-RRP and nine men post-RRP had penile prosthesis.</li> <li>28% of all men reported sexual dysfunction pretreatment: 17% of the RRP group, 47% of the EBRT group, and 33% of the brachytherapy group.</li> <li>63% of all men reported sexual dysfunction post-treatment: 65% of the RRP group, 63% of the EBRT group, 57% of the brachytherapy group.</li> <li>35% of men who had RRP had functional erection at two years.</li> </ul>
	EBRT	<ul style="list-style-type: none"> <li>37% of men had functional erections at two years.</li> <li>One man had penile prosthesis post-EBRT.</li> </ul>
	Brachytherapy	<ul style="list-style-type: none"> <li>One man pre-brachytherapy and four men post-brachytherapy had penile prosthesis.</li> <li>Men had better pretreatment sexual function than other treatment groups, were younger, and had fewer comorbidities.</li> <li>43% had functional erections at two years.</li> </ul>
Crook et al., 2011	RRP	<ul style="list-style-type: none"> <li>48% were able to have functional erections.</li> <li>63% in both groups were using phosphodiesterase-5, with more men in the RRP group using penile injections.</li> <li>Worse urinary function was observed than with brachytherapy.</li> <li>Information and support was found to be helpful.</li> </ul>
	Brachytherapy	<ul style="list-style-type: none"> <li>Bowel dysfunction was reported.</li> <li>66% were able to have functional erections.</li> <li>Irritative urinary symptoms occurred from 2–6 months and improved by 12 months.</li> <li>Information and support was found to be helpful.</li> <li>At five years post-treatment, men who had undergone brachytherapy expressed more satisfaction with their choice than men who had undergone RRP.</li> </ul>
Resnick et al., 2013	RRP	<ul style="list-style-type: none"> <li>Some men reported not having functional erections at two years and at five years.</li> <li>All reported erectile dysfunction at 15 years; 44% were not bothered by this because they had a declining interest in sexual intercourse.</li> <li>Men reported wearing pads at 2 years and at 5 years but not at 15 years post-treatment.</li> <li>Lower urinary tract symptoms were reported.</li> </ul>
	EBRT with or without adjuvant androgen-deprivation therapy	<ul style="list-style-type: none"> <li>Men reported urgency in defecation at 2 years, 5 years, and 15 years.</li> <li>All reported erectile dysfunction at 15 years; 38% were not bothered by this because they had a declining interest in sexual intercourse.</li> <li>Lower urinary tract symptoms were reported.</li> </ul>
Nicolaisen et al., 2014	RRP	<ul style="list-style-type: none"> <li>Low QOL was related to sexual dysfunction postsurgery; this improved over time, depending on patient age and surgical technique used.</li> <li>Incontinence and urinary bother reduced QOL.</li> <li>Information, education, and healthcare professional support were found to be helpful.</li> </ul>
	EBRT	<ul style="list-style-type: none"> <li>Bowel dysfunction was initially reported, but it resolved three to four years post-treatment.</li> <li>Low QOL related to sexual dysfunction post-EBRT worsened over time.</li> <li>Urinary bother and irritative symptoms occurred post-EBRT.</li> </ul>

EBRT—external beam radiation therapy; QOL—quality of life; RRP—radical retropubic prostatectomy

choice is a central tenet of modern healthcare systems, particularly in cancer services where treatment options have equivocal overall survival outcomes. Men who are presented with different treatment options for localized prostate cancer also need to be provided with full information about the potential harms and benefits, which can be identified from patient-reported outcome measures. This review found that QOL was often measured using health-related QOL outcome surveys that focus on one or a few body functions; when used in isolation, these surveys probably do not fully capture or reflect men's QOL following treatment for localized prostate cancer.

The treatment decision is often influenced by numerous factors, including the provision of information, as well as peer and family support (Rondorf-Klym & Colling, 2003; Weber et al., 2007). Nicolaisen et al. (2014) suggested that men who received information pre- and post-treatment adjusted to their side effects better than those who did not. Health professionals must be fully knowledgeable about the effects of treatment on QOL, so they can appropriately inform and support men facing decisions about treatment options. In addition, health professionals need to have the skills and opportunity to build therapeutic relationships with such men to enable identification of their care priorities and provide appropriate information and support.

## Limitations

This literature review is restricted to data collected from men who were treated for localized prostate cancer, not locally spread or metastatic disease. Data reviewed were also restricted to articles published in English. The findings of the review should be considered in this context.

In some studies, men were treated for localized prostate cancer more than 20 years ago, which may affect the generalizability of these findings. This review considered the surgical techniques used and radiation doses administered to ensure that those treatments and doses are still used. It also considered that because of the longevity of side effects and the relatively high survival rate from treatment for localized prostate cancer, a significant population of men who are living with outcomes from those treatments would exist. The use of robotic laparoscopic surgery has been introduced to improve outcomes in men with localized prostate cancer. Evidence indicates better outcomes in terms of perioperative morbidity and risk of positive surgical margins, but no data exists to infer any difference in urinary continence or sexual function compared to other surgical techniques (Ramsay et al., 2012). This review also focused on treatment for localized prostate cancer, which

meant that some published evidence was excluded if the current authors had doubt about treatment intent.

Data were mostly collected using validated health-related QOL questionnaires that generate data about impaired function, loss of function, and resumed function of body systems. Two studies adapted validated questionnaires, and one study used a newly developed questionnaire that was not fully validated. Many studies collected data about either urinary function or sexual function, and they did not capture data related to other aspects of QOL, such as social functioning or emotional well-being. Given that QOL outcomes are subjective and specific to individuals, QOL research designs should encompass the whole experience of these men. Where data were collected via interview, whether the man's partner was present during the interview, and if this had any influence on responses, was not always apparent.

Some of the side effects reported by the men could be attributed to or exacerbated by comorbidities associated with aging. A few studies reported baseline data, but the majority of studies did not, so the extent of loss of function because of the treatment could not always be determined. Some studies did not publish details of participants' age, and only a few studies used age-matched controls. Some studies had age-eligibility criteria, such as excluding men above a certain age, which may have reduced the representativeness of the sample. Because of variation in the participant age range and the time of data collection following treatment across the studies, conducting a meta-analysis was not possible.

Potential for bias existed in some studies because of sample selection; some samples were self-selected, and some were purposefully selected. Significant variation also occurred across the studies in regard to the time points at which data was collected (1 month to 15 years post-treatment). Some studies were prospective and reported longitudinal data, so drawing conclusions about changes in function over time was possible. To interpret data in instances with nonresponders, proportional data was evaluated. An additional limitation to interpreting the data was lack of specificity in how QOL outcomes were defined, assessed, and measured by authors. For example, to evaluate urinary incontinence, most studies measured the number of pads used per day, which may not be a consistent measure or necessarily correlate with the severity of this side effect.

Given that the majority of the data reported functional impairment, developing a coding structure and an a priori analytical framework and conducting a content analysis would have been possible (Dixon-Woods et al., 2005). However, in an effort to conduct a comprehensive review, all types of data were included. In addition,

adopting a more integrative analytical approach enabled the authors to address the purpose of the review.

## Implications for Practice

The role of the nurse in supporting people with cancer, independent of the care setting, is to ensure an optimal outcome. For men treated for localized prostate cancer, this means providing information and support immediately post-treatment, for several months post-treatment, and, for some men, for three to five years. In the United Kingdom, no formal long-term assessment of men treated for prostate cancer exists; however, the National Cancer Survivorship Initiative ([NCSI], 2013) has proposed personalized care planning based on the needs of individuals. Recognition of short- and long-term effects of localized prostate cancer treatment on men's QOL has implications across care settings, and provision of care should be planned accordingly.

Nurses require knowledge and skills (developed from practice education and experience working in teams with shared philosophies of care) to build care relationships with men diagnosed with localized prostate cancer to enable self-efficacy. The aim of patient-centered care is to assist shared decision-making about treatment options, support self-management (where appropriate), and provide emotional support (Ahmad, Ellins, Krelle, & Lawrie, 2014). This requires nurses to facilitate collaboration with men treated for localized prostate cancer who wish to manage their care; learn about their disease, treatment, side effects, and side effect management; and plan and coordinate holistic care.

Localized prostate cancer treatments, particularly radical prostatectomy, are associated with immediate and long-term sexual dysfunction and urinary dysfunction. Men who experience post-treatment sexual dysfunction may need review by a nurse specialist or a doctor working in the field of genitourinary oncology or andrology who use tools such as the Sexual Health Inventory for Men (SHIM) (Rosen, Cappelleri, Smith, Lipsky, & Peña, 1999) to conduct more in-depth assessment. For example, a man who has a very low SHIM score may need referral to specialist professionals, such as a sex therapist, relationship counselor, or clinical psychologist. Men may also require a mental health assessment. A number of strategies exist for assessing urinary incontinence, including history taking and the use of validated scales (e.g., IPSS), patient diaries, and clinical investigations. Some health organizations also employ continence specialist nurses. Urinary incontinence may require medication (e.g., solifenacin succinate [VESIcare®]), the use of incontinence pads or urinary sheaths, or surgical intervention (e.g., insertion of a bladder sling).

Radiation therapy treatments primarily cause diarrhea, urgency, and pain. Nurses can educate men to use

## Knowledge Translation

- Nurses need to be knowledgeable about quality-of-life outcomes after treatment for localized prostate cancer so they may work collaboratively with men to conduct holistic assessments and plan appropriate supportive care.
- Following treatment for localized prostate cancer, men may experience bowel, sexual, urinary, and endocrine dysfunction, as well as fatigue.
- Holistic outcomes measures and insight into the experiences of men treated for localized prostate cancer will increase understanding of the needs of this patient group.

bowel diaries, guide them about obtaining continence pads, and advise about alert cards (Bladder and Bowel Foundation, 2014). In addition, nurses can advise men who experience frequent episodes of diarrhea about having a low-fiber diet, staying well-hydrated, and using anti-diarrhea agents (e.g., loperamide [Immodium®]). Codeine phosphate may also be prescribed for moderate rectal or anal pain. Men may also need referral to a gastroenterologist or, in severe cases, a colorectal surgeon.

Fatigue may be a long-term side effect of radiation therapy. In the United Kingdom, the NCSI (2013) has established Health and Wellbeing Clinics to optimize QOL outcomes related to lifestyle for people treated for cancer. Together with Macmillan Cancer Support (2012), the NCSI developed a holistic needs assessment, which is recommended for use prior to the completion of cancer treatment. The use of such assessment tools and initiatives should enable nurses to support men managing treatment-related fatigue.

A key implication of the findings of this review is that men need to have accurate information about the QOL outcomes following treatment for localized prostate cancer before treatment, so they can share in decision making, and after treatment, so they can self-manage symptoms and side effects with support from healthcare professionals and more ably adjust to the changes in their body functions. A range of studies (e.g., specialist health professionals, cancer charities, information websites for patients with cancer, peer support or patient support groups) are available to provide information to men with localized prostate cancer.

## Conclusion

Research that evaluates the effect of treatments on QOL should use age-matched controls; record baseline data; ideally be prospective, longitudinal studies; and incorporate holistic, validated data collection tools. In addition, definitions and methods to measure



side effects (e.g., urinary and fecal incontinence) should be defined and reported.

Few qualitative studies provide in-depth insight into the experience of men treated for localized prostate cancer. Future research that captures the everyday experience of men who have had a specific type of treatment for localized prostate cancer will aid the development of assessment tools and care interventions that focus on improving QOL outcomes. Additional research is also required to evaluate QOL outcomes following newer treatments, such as robotic laparoscopic surgery, to determine if such techniques improve outcomes related to QOL.

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