Review Article

Erectile dysfunction, masculinity, and psychosocial outcomes: a review of the experiences of men after prostate cancer treatment

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Abstract: Prostate cancer (PC) treatment side-effects such as erectile dysfunction (ED) can impact men's quality of life (QoL), psychosocial and psycho-sexual adjustment. Masculinity (i.e., men's identity or sense of themselves as being a man) may also be linked to how men respond to PC treatment and ED however the exact nature of this link is unclear. This review aims to provide a snapshot of the current state of evidence regarding ED, masculinity and psychosocial impacts after PC treatment. Three databases (Medline/PsycINFO, CINHAL, and EMBASE) were searched January 1st 1980 to January 31st 2016. Study inclusion criteria were: patients treated for PC; ED or sexual function measured; masculinity measured in quantitative studies or emerged as a theme in qualitative studies; included psychosocial or QoL outcome(s); published in English language, peer-reviewed journal articles. Fifty two articles (14 quantitative, 38 qualitative) met review criteria. Studies were predominantly cross-sectional, North American, samples of heterosexual men, with localised PC, and treated with radical prostatectomy. Results show that masculinity framed men's responses to, and was harmed by their experience with, ED after PC treatment. In qualitative studies, men with ED consistently reported lost (no longer a man) or diminished (less of a man) masculinity, and this was linked to depression, embarrassment, decreased self-worth, and fear of being stigmatised. The correlation between ED and masculinity was similarly supported in quantitative studies. In two studies, masculinity was also a moderator of poorer QoL and mental health outcomes for PC patients with ED. In qualitative studies, masculinity underpinned how men interpreted and adjusted to their experience. Men used traditional (hegemonic) coping responses including emotional restraint, stoicism, acceptance, optimism, and humour or rationalised their experience relative to their age (ED inevitable), prolonged life (ED small price to pay), definition of sex (more than erection and penetration), other evidence of virility (already had children) or sexual prowess (sown a lot of wild oats). Limitations of studies reviewed included: poorly developed theoretical and context-specific measurement approaches; few quantitative empirical or prospective studies; moderating or mediating factors rarely assessed; heterogeneity (demographics, sexual orientation, treatment type) rarely considered. Clinicians and health practitioners can help PC patients with ED to broaden their perceptions of sexual relationships and assist them to make meaning out of their experience in ways that decrease the threat to their masculinity. The challenge going forward is to better unpack the relationship between ED and masculinity for PC patients by addressing the methodological limitations outlined so that interventions for ED that incorporate masculinity in a holistic way can be developed.

Keywords: Erectile dysfunction (ED); masculinity; prostate cancer (PC); psychosocial; quality of life (QoL)

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Introduction

Globally, over one million new cases of prostate cancer (PC) were diagnosed in 2012 with incidence expected to increase to 1.7 million cases in 2030 (1,2). PC incidence is highest in western countries such as Australia/New Zealand, North America, and Europe (age standardised incidence rates per 100,000 range from 85.0 to 111.6) (1,2). Parallel to increasing incidence, survival has also increased in the UK, North America and Australia/New Zealand such that approximately 90% of men now survive their PC 5 or more years and over 80% survive at least 10 years (3-5). Although promising, extended survival means that many men live with high and enduring treatment side-effects that can persist for a decade or more (6,7). For instance, treatments such as surgery, radiation therapy, and androgen deprivation therapy (ADT) can have negative effects on urinary, bowel, hormonal, or sexual function (8,9). Regarding the latter, erectile dysfunction (ED) is the most common impact on sexual function and is often accompanied by a loss of sexual desire or difficulty reaching orgasm (10).

The exact incidence of ED following PC therapy is unknown with most epidemiological data derived from the post-radical prostatectomy (RP) cohort. While the exact recovery of erectile function is difficult to compare when reviewing clinical studies due to variables such as the definition of ED, the definition of return of erectile function, the use of erectogenic medication and the use of multimodal PC therapy, it is widely accepted that post-RP ED occurs for around 60–70% of men (11-15) despite advances in surgical techniques and technology. Factors such as the age of the patient, the level of pre-treatment erectile function, the extent of surgical neurovascular preservation, intraoperative changes on erectile haemodynamics, stage of disease and body mass index can contribute to the erectile outcome (13,15,16). In contrast to post-RP ED, radiation-induced ED usually develops later (usually 3-year post-radiation) with the actual rates of ED between RP and radiation groups similar (17). Several pathophysiological mechanisms for ED have been proposed that include cavernous nerve injury, vascular compromise (e.g., accessory pudendal artery ligation), damage to nearby structures, local inflammatory changes relating to surgical and radiation effects, cavernosal smooth muscle hypoxia with ensuing smooth muscle apoptosis and fibrosis, as well as corporal veno-occlusive dysfunction causing venous leakage (11-15).

In addition to physical treatment side-effects, for some men ED has quality of life (QoL) and psychosocial impacts including but not limited to depression, cancer-specific distress, self-esteem, relationship satisfaction, coping and adjustment (18-21). Masculinity (i.e., men's identity or sense of themselves as being a man) may also be linked to how men respond to PC diagnosis and treatment including their experience of psychological and psychosexual distress and adjustment (22-28). Low masculine self-esteem has been shown to contribute to increased anxiety, depression and cancer-specific distress in men with PC (29). Masculinity has also been implicated in men's reluctance to seek help for their emotional or sexual concerns after PC treatment (24,30,31). However, the exact nature of the impact of ED on psychosocial aspects of men's experience after PC treatment and how masculinity may feed into this is unclear (20,32).

Thus, the aim of this review is to provide a snapshot of the current state of the evidence regarding ED, masculinity and psychosocial impacts after PC treatment. Our review considers three questions:

(I) How is masculinity described in the literature in relation to ED after PC treatment?
(II) Does masculinity moderate the effects of ED on men's psychosocial or QoL outcomes after PC treatment?
(III) Is masculinity considered as a state of being that is affected by ED (i.e., masculinity is an outcome) after PC treatment?

Methods

Search strategy

The search strategy occurred in a two-step process. First, Medline and PsycINFO [via Ovid), CINAHL, and EMBASE databases were searched (January 1st, 1980 to January 31st, 2016] using the following keywords:

(I) ("prostat$ cancer" OR "prostat$ neoplasm$" OR "prostat$ carcinoma");
(II) (masculine OR masculinity OR masculinities OR manhood OR man-hood OR "sex role" OR "sex-role" OR "male identity" OR "male identities" OR "gender identity" OR "gender identities" OR "sexual identity" OR "sexual identities");
(III) 1 AND 2;
(IV) 3 limit to Human AND English.

Second, targeted searches on Google Scholar were conducted with the terms "prostate cancer" AND (masculinity OR masculine OR hegemonic). Duplicates

were removed prior to examining article titles and abstracts. Cited reference searches of articles which met final inclusion criteria for review were conducted on Web of Science, Google Scholar, and via hand searches of article reference lists. For retrieval and eligibility of articles and data extraction, one author and a research assistant independently completed each stage and consulted with a third independent reviewer to resolve differences in decision-making.

Eligibility criteria

Potential articles were identified initially by examining the title and abstract and were then retrieved for more detailed evaluation against the apriori inclusion criteria. Peer-reviewed quantitative or qualitative journal articles containing primary data were included if they met the pre-determined eligibility criteria below:

(I) Participants were men (or a sub-group of men) who had been diagnosed with and received treatment for any stage of PC;
(II) Included a measure of ED or sexual function/dysfunction;
(III) Included a measure of masculinity in quantitative studies or masculinity emerged as a key theme in qualitative studies;
(IV) Included masculinity or psychosocial (e.g., distress, social support, adjustment) or QoL outcome(s);
(V) Published in English language;
(VI) Published after January 1st, 1980 and prior to January 31st, 2016.

Reviews, meta-analyses, editorials, commentaries, books or book chapters, guidelines, position statements, conference proceedings, abstracts and dissertations were excluded.

Data extraction

A data extraction form was created prior to the review to identify key characteristics of studies which met criteria for inclusion: source (author, year and country of publication); study design; participants (age, sexual orientation, disease stage, treatment type, time since treatment, ED score); masculinity measure; results corresponding to masculinity outcomes and masculinity as a contributor to (correlate) or moderator of psychosocial or QoL outcomes. Characteristics of included studies are summarised in *Tables S1*,*S2*.

Results

Search results

Systematic search

The systematic search identified 759 records for review after duplicates were removed. Of these, 242 underwent full-text review. One hundred and ninety articles were excluded because they focused on pre-treatment decision-making, had no outcomes of interest, or the relationship between masculinity and sexual function was not examined (*Figure 1*). The remaining 52 articles were reviewed and these included 14 quantitative and 38 qualitative studies. Quantitative research comprised 7 studies that were cross-sectional, 5 prospective, and 2 randomised controlled trials (RCT). Qualitative research included 35 cross-sectional and 3 prospective studies. Studies were published from 1995 to 2016 and most were conducted in the USA (39%), Australia (23%), Canada (14%), Europe (10%), or the UK (8%).

Sample characteristics

Sample sizes ranged from 3 to 1,070 (median =20); 68% of studies had less than 50 participants. Twenty-four studies provided a mean age for men and this ranged from 57.0 to 76.2 years. Most studies did not report the sexual orientation of the sample (65%) and where this did occur almost all sampled exclusively heterosexual men (33%); only one study focused on the experience of homosexual men (33). Of the 26 studies reporting disease stage, most men had localised PC (69%) and were treated with RP (45% of studies included mostly men receiving RP, 23% radiation therapy, and 23% hormonal ablation therapy; 9% of studies did not report treatment type). Less than half (45%) of studies reviewed reported time since treatment and this ranged from 0 to 60 months. Nine studies (17%) reported ED scores from validated measures and of these most used the sexual function subscale from the Expanded Prostate cancer Index Composite.

Masculinity measures

Measures most often used to assess masculinity in quantitative studies were the masculine self-esteem scale (33-36), Bem Sex-Role Inventory (37,38), or the single item EORTC-QLQ-PR25 measure ('Have you felt less masculine as a result of your illness or treatment?') (39,40). Other measures used in a single study were the Sexual Self-Schema scale for Men (41), the Conformity to Masculine Norms Inventory (22), Cancer-related Masculine Threat scale (23), and the Masculinity in Chronic Disease Inventory (32). Two studies

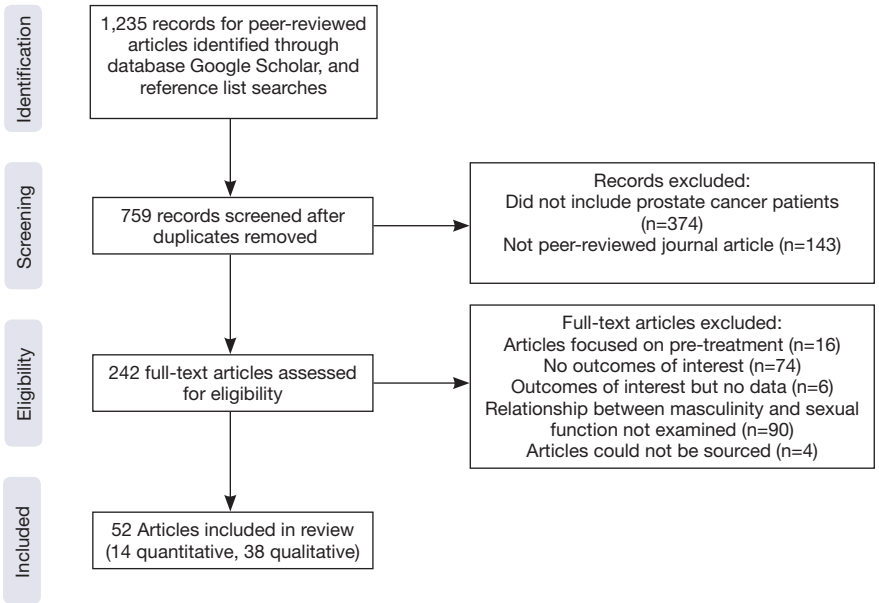

Figure 1 PRISMA flow diagram of systematic review inclusion and exclusion process

used un-validated measures (38,42).

Masculinity and sexual function after PC treatment

PC treatment and subsequent ED, loss of libido, and/or potency was consistently described in qualitative studies as having an impact on, or being a threat to, men's sense of masculinity (43-50). Some men chose to undergo radiation therapy instead of RP because the former offered a better chance of preserving sexual function which in their view was equivalent to masculinity (51,52). In almost every study, the belief that masculinity was lost ('no longer a man') or somehow diminished ('not a whole man') was described (26,43,44,48,52-71), and this was a source of anxiety, depression, or embarrassment for men; made them question their self-worth; and created feelings of disempowerment and a fear that they may be stigmatised (27,43-46,49,60,61,70,72-74).

Other qualitative studies described masculinity as framing men's experiences and adjustment after PC treatment (54). In this regard, due to their sexual dysfunction some men believed that they could no longer live a normal life (63) or respond appropriately in everyday interactions with women (72,73). Men also discussed the possibility that their wives would leave them because they could not satisfy them sexually or be an 'active partner' (66,70,75). Men limited social activities which had the potential for sex (e.g., parties) (61,67); adopted strategies that maintained the macho façade such as pseudo courtship or laughing at jokes about ED (66,67); or used traditional (hegemonic) masculine coping responses such as emotional restraint (60), stoicism (60,76), acceptance (66,76), optimism (27,67,69), and humour (47).

Many qualitative studies discussed that men rationalised their ED or sexual dysfunction through active attempts to cognitively reframe their experience which in turn allowed them to preserve their sexual identity or sense of masculinity. Men did this in four main ways: used age as a reference point to normalise or accept their experience (ED is an inevitable consequence of aging, ED is worse for younger men) (26,28,43-46,54,60,61,63,66,67,70); viewed ED or sexual dysfunction as a trade-off for prolonged life or health (health more important, small price to pay for being alive) (26,27,43,47,58,60,63,65-67,77); broadened their definition of sex as encompassing more than an erection and penetration (e.g., hugging, kissing, conversation and company) (27,44-46,60,61,63,66,67,75); and looked for other evidence of masculinity (e.g., already had children, sowed a lot of wild oats, being grateful for prior sexual experiences) (27,60,66).

In contrast to the majority of qualitative work, a small number of studies which sampled older men reported that changes in men's sexual function had minimal impact on masculinity (28,44-46,76). The potential impact of ED

on masculinity was also discussed in studies sampling men from a range of ages as something that happened to other men (43,63); ED was viewed as an ill-effect that men could live with (44-46); or ED had minimal impact because men or their partners had already experienced sexual dysfunction due to chronic or co-morbid disease (66,75).

Masculinity as a moderator

Two quantitative studies examined masculinity as a moderator of the relationship between sexual function and psychosocial or QoL outcomes. Together these studies showed that when men who had poor sexual functioning endorsed more traditional (hegemonic) masculine values they had worse social functioning, role functioning, and mental health outcomes (22), including depression (41).

Masculinity as an outcome or correlate

In the remaining 12 quantitative studies, masculinity was described as an outcome (32-36,38-40,42,78), or as a potential correlate or predictor of sexual function or bother (23,36,37,42). Collectively, these studies showed a consistent correlational relationship between poor sexual function and decreased masculinity (32,34-36,39,40,42,78), or increased masculinity and poorer sexual outcomes (23,36,42). However, this relationship did not hold in two studies when sexual function was included with other variables in a multivariate model as predictors of masculinity (33) or when the impact of masculinity on sexual symptoms at different points on the treatment trajectory were considered (37).

Of these quantitative studies, two also described the conditions under which the relationship between sexual function and masculinity may be strengthened (moderated) by interpersonal variables (36,38). Specifically, men who had sexual dysfunction or bother were more likely to interpret this as a threat to their masculinity if they had higher interpersonal sensitivity which can diminish social support and communication (38), or their spouse perceived low marital affection (36).

Discussion

Based on this review it is clear that for most men masculinity is crucial in their experience of PC treatment and ED in two ways: masculinity frames how men interpret what is happening to them; and men's sense of themselves and their masculinity suffers harm. While there is evidence that some men manage to cope with this impact and are able to cognitively reframe their experience relative to aging, prolonged life, the definition of sex, and other evidence of their virility or sexual prowess, this is a task that for many men will be challenging. Therefore, the role of clinicians and health practitioners in the field is to help men and their partners broaden their perceptions of sexual relationships and also to facilitate adjustment by assisting men to make meaning of, or seek alternative meaning for, their experience that presents less of a threat to their masculine identity.

While the proliferation of qualitative research in this context offers some key insights, this work has focused on understanding the masculinity phenomena. There are few quantitative studies and of these most confirm a correlational relationship between ED and masculinity and, with few exceptions, do not extend beyond this. Moving forward, three areas of focus for future research are apparent. First, we need empirical studies that establish the role of masculinity as a mediator or moderator of psychosocial and QoL outcomes for men experiencing sexual dysfunction. Two studies in this review (22,41) suggest a moderation effect for masculinity; men who had ED and more strongly endorsed traditional masculine values experienced poorer QoL and mental health outcomes. However, recent work on men's decisions to seek medical help for their sexual concerns after PC treatment suggests that aspects of masculinity such as emotional self-reliance and placing high value on the importance of sex may be a strength for men to draw upon in promoting help-seeking and ultimately better adjustment (30). The conditions under which masculinity may be a help or a hindrance to PC patient's adjustment require further exploration.

Second, for men experiencing ED after PC treatment, empirical studies are needed to identify factors that may interact with masculinity with regards to its influence on QoL or psychosocial outcomes, and determine their relative importance. Two studies in this review (36,38) reported that interpersonal factors such as marital affection may moderate the extent to which men interpret ED as a threat to their masculinity. However, there are a range of individual (e.g., age, sexual orientation), psychological (e.g., depression, anxiety, pre-treatment expectations), social (e.g., nature and quality of relationships, support) and medical (e.g., co-morbidities, medication use, pre-treatment erectile function, other treatment side-effects, treatment type)

factors that may also be important and these have yet to be explored fully.

Third, to facilitate knowledge advancement about the role and contribution of masculinity, established theory and consistent measurement approaches should be adopted. This review noted a trend toward use of masculinity measures that reflect traditional, hegemonic masculine values and ideals (e.g., Bem Sex Role Inventory, Conformity to Masculine Norms Inventory, Sexual Self-Schema scale for Men) that are not contextualised for men with cancer. Where context-specific scales have been applied, they are ambiguous, single-item measures (e.g., EORTC-QLQ-PR25 question) or capture only one aspect of masculinity (e.g., Masculine Self-Esteem scale). Recent development of two context-specific masculinity scales, the Cancer-related Masculine Threat scale (23) and the Masculinity in Chronic Disease Inventory (32) show promise, however more research is needed to establish the utility of these scales across the diversity of men who have ED after PC treatment, particularly accounting for sexual orientation, ethnic background, and treatment type.

Given the role of masculinity as an influencer of men's response to ED after PC treatment, our challenge going forward is to develop interventions that are responsive to masculinity, optimally working with masculinity as a potential strength. To do this we need to better unpack masculinity as it relates to ED and PC treatment through context-specific measurement of masculinity; quantitative empirical, prospective studies that consider the experience of men with differing sexual orientations, socio-demographic backgrounds, and PC treatments; assess moderating and mediating factors; and test interventions for ED that incorporate masculinity in a holistic way. In the interim, it is important for clinicians to invite a conversation with men and their partners about their expectations and goals with regards to sexual outcomes after a PC diagnosis and treatment and implement a care plan matched to these. In addition, given the links between a man's sexual QoL and his psychological outcomes, this care plan needs to also address psychosocial and subjective well-being based on current best practice approaches (79).

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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Supplementary

Table S1 Quantitative results summary (n=14)

Source & design	Participants	Masculinity measure	Masculinity as an outcome, mediator, moderator or correlate	Results
Allensworth-Davies [2016] (33), USA; CX	111 men recruited 2010–2011; Age: >50 years; SO: homosexual; Cancer stage: localised; Tx type: 60% RP, 27% RT (14% EBR, 13% Br), 9% WW; Time since Tx: ≥12 months prior to study; Sexual function (EPIC): mean ± SD, 36.6±20.6	Masculine self-esteem scale (Clark)	Outcome	• Better sexual function was significantly correlated with increased masculine self-esteem (Spearman's rho =0.22, P=0.02), however, when included in a multivariate model sexual function was not a significant predictor of masculine self-esteem, B=0.09; CI, 0.07–0.24; P=0.26
Burns [2008] (22), USA; CX	234 men; Age: mean ± SD, 62.4±8.7 years; SO: 90% heterosexual, 5% homosexual, 4% bisexual, 1% transgender; Cancer stage: 76% localised, 24% advanced; Tx type: 48% RT (26% EBR, 22% Br), 41% RP, 38% HA, 5% cryosurgery, 3% chemo; Time since tx: mean ± SD, 28.2±32.4 months; Sexual function (EPIC): mean ± SD, 39.9±33.0	Conformity to masculine norms inventory (Mahalik)	Moderator	• Men with poor sexual function had poorer social functioning, role functioning, and mental health, when they more strongly endorsed traditional masculine norms
Chambers [2015] (53), Australia; CX	403 men; Age: mean ± SD, 70.3±7.3 years; SO: NR; Cancer stage: NR; Tx type: 61% RP, 43% RT, 27% HA, 6% AS or WW; Time since tx: NR; Sexual function (IIED): mean ± SD, 7.2±9.2	Masculinity in chronic disease inventory (Chambers)	Outcome	• Men who had severe ED reported lower scores on the masculinity measure compared to men who had moderate to mild ED (mean, IIED =3.68 *vs*. 4.00), F(1,187) =9.85, P=0.002
Clark* [1997] (34), USA; CX	410 men; Age: range, 45–93 years; SO: NR; Cancer stage: advanced; Tx type: HA (chemical or orchiectomy); Time since tx: 44% ≤1 year, 38% 2–3 years, 18% 4–5 years; Sexual function: NR	Masculine image	Outcome	• Increased sexual problems were associated with a decreased masculine image (r=−0.41)
Clark, Inui [2003] (35), USA; CX	349 men; Age: >50 years; SO: NR; Cancer stage: localised; Tx type: 44% RT (39% EBR, 5% Br), 39% RP, 9% AS or WW, 8% HA; Time since tx: 12–48 months; Sexual function: NR	Masculine self-esteem scale (Clark)	Outcome	• Increased sexual dysfunction was significantly associated with decreased masculine self-esteem (β=−0.17, P=0.003)
Davison [2007] (39), Canada; PR	130 men; Age: mean ± SD, 62.1±6.0 years; SO: NR; Cancer stage: localised; Tx type: 100% RP, 30% HA; 94% had no additional tx after 1 year; Time since tx: 12 months; Sexual function (SHIM): 90% had mild-moderate, moderate, or severe ED 1 year post-RP	EORTC-PC module question (Have you felt less masculine as a result of your illness or treatment?)	Outcome	• Scores pre-post RP showed decreased sexual function after tx and significantly more men felt less masculine after tx (1.32±0.66 *vs*. 1.77±0.80, P<0.001)
Galbraith [2001] (37), USA; PR	185 men; Age: mean, 68.0 years; SO: NR; Cancer stage: localised; Tx type: 68% RT (25% mixed-beam RT, 14% conventional RT, 13% proton-beam RT), 32% RP, 16% WW; Time since tx: NR; Sexual function: NR	Bem sex-role inventory-short form (Bem)	Correlate	• Masculinity was not correlated with sexual symptoms at 6, 12, or 18 months post-tx
Hoyt [2013, 2015] (23,41), USA; PR	66 men; Age: mean ± SD, 65.8±9.0 years; SO: NR; Cancer stage: localised; Tx type: 71% RP, 32% RT, HA 9%; Time since tx: ≤24 months (mean ± SD, 18.0±10.0); Sexual function (EPIC-S): mean ± SD, 41.5±28.2;	Cancer-related masculine threat; sexual self-schema scale for men (Anderson)	Correlate, moderator	• Increased cancer-related masculine threat (men believed cancer was inconsistent with their masculinity) predicted declines (T1 to T3) in sexual function, β=−0.17, P<0.05; • For men with higher sexual self-schema (more traditional concepts of masculinity), poorer sexual functioning was associated with increased depression, β=−0.21, P<0.05
Lucas [1995] (78), South Africa; PR	15 men interviewed pre- and post-tx; Age: mean, 76.2 years; SO: NR; Cancer stage: advanced; Tx type: HA (orchiectomy); Time since tx: 3 months; Sexual function: all men reported loss of sexual function post-tx	Bem sex-role inventory (Bem)	Outcome	• 55% of men who were sexually active pre-tx found their loss of sexual function disturbing and this was more apparent for men who had higher scores on the masculinity scale (trend only, not analysed statistically)
Molton [2008] (38), USA; RCT	101 men (60 intervention, 41 control); Age: mean ± SD, intervention 60.6±4.8 years; control 59.9±5.6 years; SO: NR; Cancer stage: localised; Tx type: RP; Time since tx: mean ± SD, intervention 9.4±5.3 months; control 10.7±4.9 months; Sexual function (EPIC): mean ± SD, intervention 26.1±22.5; control 19.2±15.6	Concern about sexual functioning (e.g., it is important for me to fulfil my sexual role as a man)	Outcome	• Men who had higher interpersonal sensitivity (moderator) were more likely to interpret sexual dysfunction as a threat to their masculine identity, and these men benefited most from the cognitive-behavioural stress management intervention (larger pre-post change in sexual function compared to controls)
O'Shaughnessy* [2013] (42), Multi-country; CX	115 men; Age: 65% >60 years; SO: NR; Cancer stage: localised; Tx type: 55% RP, 32% RT, 13% WW, 13% HA; Time since tx: 75% >3 months; Sexual function: 65% self-reported ED	Feel less of a man? Cancer impacted masculinity?	Correlate, outcome	• 20% self-reported feeling less of a man post-tx; 42% felt that cancer impacted their sense of masculinity; • The belief that cancer impacted masculinity was a significant predictor of ED (B=1.47; CI, 1.14–1.89; P=0.001) and feeling less of a man (B=13.85; CI, 3.44–55.81; P=0.001)
Sharpley [2014] (40), Australia, New Zealand; RCT	1,070 men; Age: mean ± SD, 67.5±6.9 years; SO: NR; Cancer stage: locally advanced; Tx type: 100% HA (ADT), 100% RT; Time since tx: NR; Sexual function: NR	EORTC-QLQ-PR25 1-item (Have you felt less masculine as a result of your treatment?)	Outcome	• Increased sexual problems were correlated with loss of masculinity in the first 18 months after tx; increased sexual problems made the second largest contribution to loss of masculinity (after depression and anxiety), B=0.14, t=4.16, P<0.001; • In the first 18 months post tx, the combination of increased depression-anxiety and increased sexual problems were significant predictors of loss of masculinity P<0.001
Zaider [2012] (36), USA; CX	75 men; Age: mean ± SD, 60.6±8.2 years; SO: 97% heterosexual, 3% homosexual; Cancer stage: localised; Tx type: 57% RP, 32% RT; Time since tx: NR; Sexual function (IIED): mean ± SD, 14.4±11.08; 65% had poor erectile function	Masculine self-esteem scale (Clark)	Outcome	• Post-tx approximately 30% of men self-reported a loss of masculinity; • Sexual bother (r=−0.68, P<0.01) and erectile functioning (r=0.37, P<0.01) were significantly correlated with loss of masculine identity; • After controlling for sexual function, loss of masculinity was a significant predictor of sexual bother (β=−0.63, P<0.001); • Loss of masculine identity was more strongly related to sexual bother if a man's spouse perceived low marital affection

*, quantitative and qualitative study. ADT, androgen deprivation therapy; AS, active surveillance; Br, brachytherapy; CT, clinical trial; CX, cross-sectional; EBR, external beam radiation therapy; ED, erectile dysfunction; EPIC, expanded prostate cancer index composite; EPIC-S, expanded prostate cancer index composite-sexual functioning; HA, hormonal ablation (including ADT, Orchiectomy); NR, not reported; IIED, international index of erectile dysfunction; PC, prostate cancer; PR, prospective; RCT, randomised controlled trial; RP, radical prostatectomy; RT, radiation therapy (including Br, EBR); SHIM, sexual health inventory for men; SO, sexual orientation; Tx, treatment; WW, watchful waiting.

Table S2 Qualitative results summary (n=38)

Source & design	Participants	Masculinity measure	Results
Appleton [2015] (43), UK; CX	27 men recruited pre- or post-tx; Age: range, 57–76 years; SO: NR; Cancer stage: NR; Tx type: RT (EBRT combined with HA or RP); Time since tx: 9 pre-tx, 8 6–8 months, post-tx, 10 12–18 months post-tx; Sexual function: NR	NR	• Physical outcomes of PC and tx impacted sense of masculinity ('lost a bit of your manhood', 'not feeling like a man anymore') but this impact was minimized with the view that health was more important, as an issue experienced by men other than the participant, as an inevitable consequence of aging, or as something that required acceptance because it was out of men's control
Arrington [2003, 2010, 2015] (44-46), USA; CX	16 men recruited from a Man-to-Man PC support group; Age: range, 66–81 years; SO: NR; Cancer stage: NR; Tx type: 69% RT, 19% RP and HA (orchiectomy), 13% WW; Time since tx: NR; Sexual function: NR	Do PC survivors' stories reveal changes in their sexual identity or practice?	• ED and loss of potency presented a threat to masculinity (e.g., less of a man) and this was a source of anxiety for the men who feared being stigmatised. Men responded to this threat by devaluing sex as less important (e.g., 'at this point in my life that wasn't terribly important'), ED as not having a big impact (e.g., 'an ill effect…and I can live with that'), or redefining sex as more than an erection (e.g., hugging, kissing, 'carrying on'); • Some men believed sex was not natural and inauthentic with sexual aids and rejected their use (e.g., not wanting to be an 'artificial man')
Arrington [2008] (51), USA; CX	Observed monthly meetings of a Man-to-Man PC support group from Jan 1997 to Feb 2001; Age: NR; SO: NR; Cancer stage: NR; Tx type: NR; Time since tx: NR; Sexual function: NR	NR	• PC deprived men of their sexual identity and some men tried a range of options to preserve their sexual function (e.g., vacuum device, injections, Viagra); • Men chose tx options that maintained their sexual ability and identity (e.g., RT in place of a RP to preserve sexual function as much as possible)
Berterö [2001] (54), Sweden; CX	10 men diagnosed with PC during 1990–1995 and interviewed Aug to Dec 1997; Age: mean, 67.6 years; SO: NR; Cancer stage: NR; Tx type: 70% RP, 40% HA, 40% RT and/or chemo, 10% WW; Time since tx: NR; Sexual function: NR	NR	• Men's view of their manliness (subtheme: image of manliness) impacted their sexual life and experiences after PC tx (main theme: altered sexual patterns); • Men also drew from experiences central to men's identities as benchmarks to help them adjust to an altered sex life [e.g., it would be worse if they were younger 'out hunting' for partners; or 'waiting for the starting signal' to start a family (procreation)]; • Tx did not only impact men physically (ED) but also their identity as if their 'manliness has disappeared' or was altered (e.g., 'castrated tomcat')
Bokhour [2001] (72); Clark, Bokhour [2003] (73), USA; CX	48 men recruited for interview beginning in September 1999; Age: range, 50–79 years; SO: heterosexual; Cancer stage: localised; Tx type: 98% RP or RT; 2% WW; Time since tx: range, 12–24 months; Sexual function: NR	NR	• Men felt that a central part of their lives as men was missing because they were no longer 'fazed' (aroused) by attractive women and felt that they would be 'unable to pull it off' (perform sexually) if they had the opportunity. For one man this impacted his sense of self-worth (being unwanted by women); • In response to ED, men described a diminished sense of masculine self-esteem ('losing the feeling that you're a whole man') and this was expressed as an absence of the 'sexual element' in daily interactions, fear about initiating intimacy with women, or discomfort having conversations about sex
Broom [2004] (52) Australia; CX	33 men; Age: range, 40–84 years; SO: NR; Cancer stage: NR; Tx type: 46% RP, 36% RT (30% EBR, 6% Br), 24% HA, 6% WW, 6% none, 3% cryosurgery; Time since tx: NR; Sexual function: NR	NR	• Loss of potency post-tx was linked to masculinity (e.g., 'so much part of the male psyche') and was a significant concern for most men in the study; • Removal of the prostate was also discussed as making a man 'no longer a complete man'; • Masculinity was a central aspect of decision making with some men focused on having the tx that allowed them to 'be a man' and retain sexual functioning rather than the most optimal life-preserving tx (e.g., choosing not to undergo RP)
Chambers [2015] (32), Australia; CX	15 men; Age: ≥41 years; SO: NR; Cancer stage: NR; Tx type: 80% RP, 13% RT (EBR), 13% AS, 7% HA, 7% WW; Time since tx: NR; Sexual function: NR	NR	• Men discussed the impact of prostate cancer on their sexuality and how much not being able to have sex (ED) impacted their masculinity ('being a man', 'what blokes do'), and was akin to 'chopping their legs off' or 'not being able to run' (something that occurs naturally and is enjoyable) and this impact made some men feel inadequate
Chapple [2002] (26), UK; CX	52 men interviewed during 2000–2001; Age: range, 50–85 years; SO: NR; Cancer stage: NR; Tx type: 67% HA, 49% RT (39% EBR, 10% Br), 14% RP, 8% WW, 6% cryosurgery, 4% vaccine trial/antigen therapy, 2% chemo; Time since tx: NR; Sexual function: NR	Once masculinity spontaneously emerged as a theme, men were asked to comment on whether or not their experience had affected their image of themselves as men	• Men who had tx without hormone therapy had ED but felt any impact on their masculinity was a 'small price to pay' for being alive or that their masculinity was a secondary concern to their health; • Some men who had hormone therapy rationalized any impact of tx on their sexual function as something that mattered less given their advancing age (but might matter more to a younger man). Another man described his sex life as disastrous and as having 'hermaphrodite status'
de Moraes Lopes [2012] (55), Brazil; CX	10 men; Age: range, 48–74 years; SO: NR; Cancer stage: NR; Tx type: RP; Time since tx: NR; Sexual function: NR	NR	• Men with UI and ED felt that this impacted their masculinity which contributed to feelings of losing self-respect and esteem
Dieperink [2013] (56), Denmark; CX	13 men; Age: mean, 71.0 years; SO: NR; Cancer stage: Localised or locally advanced; Tx type: RT with HA (ADT); Time since tx: NR; Sexual function: NR	NR	• Bodily changes and sexual dysfunction impacted masculinity ('don't feel like men anymore')
Ervik [2010] (57), Norway; CX	10 men; Age: range, 59–83 years; SO: NR; Cancer stage: Localised or locally advanced; Tx type: 70% HA; 30% AS; Time since tx: NR; Sexual function NR	NR	• Men described hormone therapy as having a negative impact on their masculinity ('manhood dried', not 'being a first lover')
Ervik [2012] (58), Norway; CX	10 men; Age: range, 56–83 years; SO: NR; Cancer stage: 30% localised, 70% locally advanced; Tx type: 100% HA, 20% RT; Time since tx: NR; Sexual function: NR	NR	• Men described ED, loss of libido and impotency as impacting on their sense of masculinity ('not a man anymore', 'manhood dried'); • Some men described ED as the 'price to pay' for prolonged life
Evans [2005] (59), Canada; CX	57 participants including 3 men with PC; Age: NR; SO: NR; Cancer stage: NR; Tx type: NR; Time since tx: NR; Sexual function: NR	NR	• Men with PC discussed ED as diminishing their sense of masculinity ('sense of loss due to impotence', 'don't feel whole', 'not the norm')
Fergus [2002] (60), Canada; PR	18 men; Age: mean, 65.0 years; SO: 78% heterosexual, 22% homosexual; Cancer stage: NR; Tx type: 61% RP, 33% RT, 22% HA, 5% WW. Time since tx: NR; Sexual function: 72% self-reported minimal to no erectile function following tx	NR	• Loss of sexual function posed a threat to men's masculine identities ('threaten a man's sex life, you threaten the man', not a 'whole man' anymore) and this was reflected in the main overarching theme: 'Preservation of Manhood'; • Men viewed tx as a tradeoff between sex and life and sexual dysfunction was the price to pay; • Men diminished their sense of lost masculinity due to sexual dysfunction by focusing on evidence of their virility such as having children (e.g., not feeling like less of a man because they 'biologically contributed' to creating children). Other men focused on the fact that they still had their libido without which they believed they 'wouldn't be a man'; • Some men with sexual dysfunction felt inferior (not 'measuring up') to other men, particularly gay men who compared themselves to their partners. For these men ED made them feel not only a 'lesser male' but a 'lesser gay' male; • Some men expressed their loss of sexual ability as losing their empowerment, their image of themselves, their bragging rights about sexual prowess, and in this sense they believed they were 'no longer a viable man' ('eunuch', 'gelding'); • Sexual dysfunction was viewed as an invisible stigma which diminished men's self-esteem and confidence and made them feel like a 'lesser person' even though they still 'looked like a man'; • Men rationalized their loss using coping approaches typically conceptualized in traditional hegemonic masculinity such as 'carrying on', 'not feeling sorry for themselves'; conceding that sexual dysfunction is part of aging and would be harder to deal with if they were younger men; reconceptualising their definition of sex to include other acts of intimacy; and shifting focus to prior sexual experiences for which they were grateful
Gannon [2010] (61), UK; CX	7 men; Age: range, 58–70 years; SO: heterosexual; Cancer stage: localised; Tx type: RP; Time since tx: 7–15 months; Sexual function: all men had self-reported none to minimal erectile function	NR	• Erectile function for penetrative sex was synonymous with masculinity and ED therefore deprived men of their sexual purpose as the 'active' partner (e.g., 'very important to me…as a man', 'being a man means that sexually you must be active'); • ED was seen by some men as embarrassing and made them feel inadequate and not the same man they used to be and this in turn limited social activities which included the potential for sex (e.g., parties); • Some men redefined masculinity to encompass the ability to give pleasure to a woman rather than just penetrative sex and this enabled them to retain their masculinity despite experiencing ED ('I don't feel any less of a man'); • Men also minimized the importance of sexual activity in the face of advancing age ('I'm not a teenage boy you know', erectile function 'tends to drop off anyway')
Gilbert [2013] (62) Australia; CX	44 cancer patients (26.5% PC); Age: NR; SO: NR; Cancer stage: NR; Tx type: NR; Time since tx: NR; Sexual function: NR	Interview topic: changes to sexuality and intimacy	• Loss of sexual performance impacted masculinity and was viewed as an 'assault on your masculinity', with men not able to return to their 'full self" after tx
Gray [2002] (75), Canada; CX	3 men; Age: ≥50 years; SO: Heterosexual; Cancer stage: NR; Tx type: 67% HA, 33% RP, 33% RT; Time since tx: NR; Sexual function: NR	NR	• One man believed that his inability to meet his wife's sexual needs impacted his sense of masculinity whereas the other two men conceptualized sexuality more broadly and denied that a loss of sexual function impacted their sense of masculinity (and this may also be influenced by one man's personal experience of caring for his wife with chronic illness)
Hagen [2007] (47), Canada; CX	15 men; Age: mean, 63.7 years; SO: heterosexual; Cancer stage: NR; Tx type: 67% surgery (including RP), 27% RT, 13% HA; Time since tx: NR; Sexual function: NR	Participants encouraged to expand on ways they felt PC had changed how they viewed themselves as men and life in general	• 'Threats to masculinity' was a main theme as part of men's adjustment to day to day living with PC and sexual dysfunction as a tx side-effect; • Men's strategies to adjust to the impact of sexual dysfunction on their masculine identity included humour (e.g., 'mourning a dead rooster') or a pragmatic approach in which life with ED was preferable to no life
Hamilton [2015] (63), Australia; CX	18 men; Age: mean ± SD, 63.1±3.8 years; SO: 94% Heterosexual; Cancer stage: NR; Tx type: 100% HA (ADT), 83% RT, 11% RP; Time since tx: NR; Sexual function: NR	NR	• Tx side-effects including ED impacted masculinity and this in turn led to feelings of worthlessness for some men (e.g., without an erection 'can't have a normal life', is life 'really worth living?'); • Men minimized the impact of ED by rationalizing that it 'goes with the territory' of aging and refocused their desire on 'conversation and company' rather than having sex with women (e.g., 'not so much trying to be Tom Cruise'); adopting a pragmatic view that life was more important than being able to have sex and dying prematurely; or distanced themselves as apart from traditional masculine notions of men who would be impacted by ED (e.g., 'Tarzan brow beating sort of guy')
Harden [2002] (64) USA; CX	22 men; Age: mean, 63.7 years; SO: NR; Cancer stage: 59% advanced; Tx type: 46% RP, 46% HA, 41% RT; Time since tx: 82% receiving tx at time of focus group; Sexual function: 59% self-reported sexual problems	NR	• Many men discussed the impact of tx on their erectile function and their feeling of being 'incomplete' or 'harmless'
Klaeson [2012] (65) Sweden; CX	10 men interviewed between Apr and Aug 2008; Age: NR; SO: NR; Cancer stage: NR; Tx type: NR; Time since tx: NR; Sexual function: NR	Asked to talk about being a man with PC and how this affected their sexuality	• Men were prepared to sacrifice their sexual function for the chance to stay alive however they missed their sexuality as part of their normal life; • Men described being only half the man they were before tx
Lavery [1999] (48) Australia; CX	12 men; Age: mean, 62.4 years; SO: Heterosexual; Cancer stage: 17% advanced; Tx type: 75% surgery, 42% RT, 42% HA; Time since tx: NR; Sexual function: NR	NR	• Impotence impacted men's feelings of masculinity, particularly younger men; • Sexual function was viewed as central to the 'male psyche' and its absence was difficult for some men. Men discussed having to just 'accept it' but in doing so they felt bitter and as if they were 'only half a man'
Letts [2010] (76), Canada; CX	19 men; Age: mean, 65.0 years; SO: Heterosexual; Cancer stage: NR; Tx type: 53% RT (EBR), 47% RP; Time since tx: 12–60 months (mean, 30.0); Sexual function: All men self-reported negative changes in their erections, orgasms, and sexual satisfaction post-tx	NR	• Men reported that sexual changes had no impact on their masculinity; • One man felt that sexual function did impact his masculinity (not 'a complete person') but other aspects of life were more important; • Men experienced difficulty talking about their ED and this was attributed to masculine ideals such as emotional restraint (e.g., 'men don't like to talk about their feelings') and stoicism (e.g. 'their problem', 'suffer by themselves…in silence'); • Men discussed having little control over sexual changes ('can't help it', 'nothing you can do') and having to accept ('something have to live with') that their 'sex lives are over'
Maliski [2008] (66), USA; CX	95 men (60 Latino, 35 African American); Age: ≥50 years; SO: NR; Cancer stage: NR; Tx type: Latino men 67% surgery, 18% RT, 15% HA; Black men 46% surgery, 34% RT, 17% HA; Time since tx: range, 0–24 months (approx.); Sexual function: NR	Asked to talk about impact of PC tx-related symptoms on sense of masculinity	• PC tx and subsequent ED impacted men's masculinity as an inability to please or take care of their partner, and feeling like a lesser man ('less of a man', 'incomplete'); • Some men discussed that when they were with their 'buddies' they maintained a façade that they were sexually active because that is what men do; • Men minimized the threat of ED to their sense of masculinity by normalizing ED as part of the ageing process (already had 'plenty of sex', 'much worse for younger men'); as their erectile function already having served its purpose ('already had children'); or as a choice they needed to make between life and sex; • Acceptance ('if it's god's will') balanced with waiting and hoping ('I'm only a year or so after my operation', 'giving it a little more time') that their sexual function would return some time in the future was a strategy that some men used to enable them to live with ED; • Some men renegotiated what it meant to be a man ('but I'm different' to other men) by focusing more on relational aspects (e.g., talking with their partner) rather than physical aspects (e.g., 'being a man is more than having sex'); • Men who had comorbid conditions that impacted their erectile function prior to tx saw ED post-tx as something that was already a part of their lives and had less impact (e.g., 'already a member of the dead bird club'). Men who had partners with conditions that inhibited their sexual relationship similarly discussed ED as something that did not greatly impact their life
Martin [2015] (74), Australia; CX	11 men; Age: NR; SO: NR; Cancer stage: 82% localised, 18% locally advanced; Tx type: 91% RP, 36% RT, 18% HA (ADT); Time since tx: NR; Sexual function: NR	NR	• ED impacted men's notion of manliness such that it was a 'social stigma' when sexual function was impaired and this had psychological effects
Navon [2003] (67), Israel; CX	15 men; Age: mean, 70.0 years; SO: heterosexual; Cancer stage: advanced; Tx type: 100% HA, 40% RP, 33% RT; Time since tx: ≥6 months prior to study; Sexual function: NR	NR	• When informed by their doctor that PC tx would result in sexual dysfunction, men minimized this by focusing on the risk to their life; hoping sexual dysfunction was temporary; and redefining sex as being more than an erection and penetration. However, as tx proceeded men believed that tx 'robbed them of what they loved best in life—sex' and 'the sparkle of things vanished'. Some men discussed that they no longer felt like men (e.g., 'a man without urge and capacity for sex isn't a man'); • In order to 'pass as ordinary men', some men engaged in 'pseudo courtship' (pretending to be interested in women and responding to women who showed sexual interest in them) and continued to talk and joke about sex with other men. Some men found this 'sham' to be upsetting but felt they had no choice but to conceal their sexual dysfunction and/or withdraw from social situations so others would not ask questions; • A common strategy adopted by men to cope with impotence was to attribute it to part of the normal aging process (e.g., 'drop in sexual capacity') and something experienced by many older men. Despite this strategy, men discussed struggling to put their memories of sexual pleasure out of their minds or get rid of them because they caused them grief
Ng [2006] (77), Australia; CX	20 men; Age: range, 50–70 years; SO: NR; Cancer stage: NR; Tx type: HA with RT or RP; Time since tx: NR; Sexual function: NR	NR	• One man discussed that he no longer felt like a man because he had ED and found this difficult to understand and accept but minimized the impact of ED by 'feeling relieved' that he still had his life (e.g., 'sex is not everything')
O'Brien [2007] (68), Scotland; CX	59 men (including subgroup of PC patients) interviewed Jun 1999 to Feb 2001; Age: NR; SO: NR; Cancer stage: NR; Tx type: NR; Time since tx: NR; Sexual function: NR	Presented statements about masculinity (e.g., 'masculinity is dangerous to men's health')	• Men experienced sexual dysfunction after tx and this made them feel less like a man (e.g., 'it lowers your machoness without a doubt'); • Although men noted that as they age they may experience a loss of their sex drive, some men discussed feeling 'robbed' of aspects of masculinity (ability to have an erection) before their time and found this to be devastating (e.g., 'having it physically taken away early…that's the hard bit')
Oliffe [2005] (27), Australia; CX	15 men; Age: mean, 57.0 years; SO: heterosexual; Cancer stage: localised; Tx type: RP; Time since tx: mean, 21 months; Sexual function: NR	NR	• Men noted feeling a 'loss of potency' which reflected not only their ability to have an erection but also their 'sense of being a man'. One man discussed having 'very black experiences', 'feeling old', 'worthless', and trying to keep himself 'invisible'; • Men reconsidered their sexual relationships as having a relationship beyond penetrative sex (e.g., touch) and some held hope that impotence would 'settle down' in the future; • Men acknowledged that forgoing sexual potency was the trade-off for living longer, others minimized the impact of impotence by stating that they had already 'had their fun' (e.g., 'I've shown a lot of wild oats'), and one man used medication (e.g., Viagra) to help him 'perform like the old days' and 'feel like a man'
Oliffe [2006] (28), Australia; CX	16 men interviewed during 2001; Age: mean ± SD, 67.3±9.4 years; SO: heterosexual; Cancer stage: advanced; Tx type: 69% HA (ADT) + RT, 25% HA only (ADT), 6% HA (ADT) + RP; Time since tx: NR; Sexual function: NR	NR	• Men minimized the impact of impotence on their masculinity with the view that sex was 'not the most important thing in our lives'; • Other men discussed that without libido they were not thinking about or desiring sex so impotence was not difficult to accept and had little impact on their masculinity
Phillips [2000] (69), Canada; PR	34 men; Age: mean, 60.6 years; SO: Heterosexual; Cancer stage: NR; Tx type: RP; Time since tx: 2–2.5 months; Sexual function: all men self-reported ED	NR	• Men described taking an optimistic approach to ED after surgery (e.g., too early to worry about sexual function and focus on getting well; • Secondary issue to incontinence; hopeful ED will get better with time); despite an optimistic approach some men reported that ED impacted their identity and self-worth as they questioned their masculinity and worth, and not feeling like a man (e.g., 'you're an 'it' instead of a man')
Powel* [2005] (70), USA; CX	71 men (of which 48 provided responses to an open-ended question); Age: mean, 57.0 years; SO: NR; Cancer stage: NR; Tx type: RP; Time since tx: mean, 16 months; Sexual function: NR	NR	• Some men discussed that their lack of sexual function caused them to feel less like a man (e.g., 'feel like I've lost my manhood') and this was linked to depression and a fear that their wife would leave them; • Men minimized the impact of ED by rationalizing that it was a part of aging and would be more significant if they were younger
Rivers [2011] (49), USA; CX	12 African-American men; Age: mean, 59.8 years; SO: heterosexual; Cancer stage: NR; Tx type: 42% RT, 33% surgery, 25% surgery + RT; Time since tx: <60 months; Sexual function: 92% self-reported ED	NR	• Some men discussed that loss of libido or ED impacted their sense of masculinity which decreased their self-confidence and esteem
Seidler, [2015] (71) Australia; CX	17 men (7 men with PC); Age: range, 57–77 years; SO: NR; Cancer stage: NR; Tx type: 86% surgery, 29% RT, 14% HA; Time since tx: NR; Sexual function: NR	Open-ended question about cancer's impact on identity and masculinity	• Men linked their sexual functioning to their masculinity and self-esteem (masculinity has 'taken a hit')
Wittman* [2015] (50), USA; PR	20 men interviewed Jan 2010 to Jun 2012; Age: mean, 60.2 years; SO: 95% heterosexual, 5% homosexual; Cancer stage: 80% localised, 20% locally advanced; Tx type: 100% RP, 10% RT; Time since tx: pre-tx and 3 months post-tx; Sexual function (EPIC-S): mean ± SD, 46.5±25.1; 30% had ED	NR	• Pre-tx, men expected that ED would not impact their sense of masculinity; • Post-tx, 75% of men felt that ED had impacted their masculinity

*, quantitative and qualitative study. ADT, androgen deprivation therapy; AS, active surveillance; Br, brachytherapy; CX, cross-sectional; EBR; external beam radiation therapy; ED, erectile dysfunction; EPIC-S, expanded prostate cancer index composite-sexual functioning; HA, hormonal ablation (including ADT, orchiectomy); NR, not reported; PC, prostate cancer; PR, prospective; RP, radical prostatectomy; RT, radiation therapy (including Br, EBR); SO, sexual orientation; Tx, treatment; WW, watchful waiting.