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ORIGINAL ARTICLE

Healthcare utilization in men with poorer sexual and urinary function recovery following robot-assisted radical prostatectomy

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Abstract

Purpose Robotic radical prostatectomy focuses on oncologic cure, urinary continence and sexual function recovery. However, little is known about the effect of declines in urinary continence and sexual function on healthcare utilization. We aim to identify these factors.

Materials and methods From March 2011 to September 2013, all men undergoing robotic prostatectomy within our healthcare system were enrolled. Men completed the expanded prostate cancer index composite-26 survey at the time of diagnosis and 90 days post-operatively. Patients were stratified according to change in scores in the sexual function and urinary incontinence domains. Patient, treatment and post-op utilization patterns were examined for association with the extent of decline in sexual function and urinary continence. Multivariate linear regression was used to identify factors independently associated with decline in continence and sexual function.

Results A total of 411 men who completed the baseline survey and at 90 days postoperatively were included. On multivariate linear regression, younger age ($p < 0.01$), higher preoperative sexual function (< 0.01), single marital status ($p = 0.04$) and more post-surgery email contacts ($p = 0.04$) were associated with higher declines in sexual function. For continence, no family history of prostate cancer ($p = 0.01$), higher baseline continence ($p < 0.01$) and more post-surgery physical therapy visits ($p < 0.01$) were associated with higher declines.

Conclusions Patients with the poorest quality of life outcomes at 90 days post-operatively were more likely to seek care via email and physical therapy encounters related to sexual function and urinary incontinence, respectively. This suggests that maximizing post-treatment quality of life can potentially reduce healthcare utilization.

Keywords Prostatectomy · Quality of life · Delivery of health care · Surgical procedures · Robotic

Abbreviations

US	United States
PCa	Prostate cancer
RALP	Robotic-assisted robotic prostatectomy
HRQOL	Healthcare-related quality of life
UI	Urinary incontinence
SF	Sexual function
KPSC	Kaiser Permanente Southern California
EPIC-26	Expanded Prostate Cancer Index composite 26
BMI	Body mass index
CCI	Charlson Comorbidity Index
PDE5i	Phosphodiesterase-5
EBL	Estimated blood loss

Introduction

Value-based care is rapidly being adopted in the United States (US) as the basis for healthcare delivery [1]. In this fashion, the goal for the healthcare system is to achieve

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optimal patient outcomes for the least amount of expenditure and utilization. For localized prostate cancer (PCa), the most common surgical treatment in the US is robotic-assisted radical prostatectomy (RALP) [2]. Optimal outcomes for RALP has been described as achieving the "trifecta": oncological cure, optimal urinary continence and sexual function recovery [3]. The comparative effectiveness of oncologic cure and its impact on healthcare utilization has been studied [4]. However, the remaining two domains of urinary continence and sexual function recovery in the trifecta have not been reported in terms of its impact on healthcare utilization.

In this study, we evaluate whether differences in healthcare-related quality of life (HRQOL), specifically urinary incontinence (UI) recovery and sexual function (SF) recovery following RALP is associated with variations in healthcare utilization. We hypothesize that patients with the lowest self-reported HRQOL following surgery in the SF and UI domains will have the highest healthcare utilization.

Materials and methods

This retrospective study based on a prospective cohort was approved by the Kaiser Permanente Southern California (KPSC) Institutional Review Board. KPSC is a fully integrated healthcare system insuring over 4 million members across 14 different medical centers in Southern California.

All men who underwent a RALP for PCa within KPSC from March 2011 to September 2013 were asked to participate in the study. Men completed the expanded Prostate Cancer Index composite (EPIC)-26, a validated HRQOL survey [5] at baseline (time of diagnosis) and 90 days following surgery, in English or Spanish. A certified medical Spanish translator was used to create the Spanish version. All men who completed the surveys were included in the cohort. The baseline surveys were administered in the office prior to the prostate biopsy; the 90-day postoperative survey was administered via mail or phone call by our research associates. 90 days was used as the end point as this is a commonly used surgical bundling period for reimbursement in both in our healthcare system and Medicare in the United States [6]. The operations were performed by a group of 20 experienced, fellowship-trained robotic surgeons operating at four different medical centers within KPSC. All surgeons had completed at least 70 RALPs prior to being included in the cohort.

We identified 411 men who underwent RALP and had completed both the preoperative and 90 days post-operative EPIC-26 surveys. All patients were included in the analysis for decline in SF and UI. The EPIC-26 functional domain scores are expressed as 1–100, with 100 being the highest function [5]. Four patients did not provide sufficient responses to the UI questions to calculate their domain scores, leaving 407 men for this analysis. Decline less than 40 points in either domain was stratified as good, decline of 40–60 points was intermediate and decline of > 60 points was defined as poor.

Preoperative variables examined include patient age, body mass index (BMI), marital status, family history of prostate cancer, Charlson Comorbidity Index (CCI), preoperative pathology, and preoperative history of phosphodiesterase-5 (PDE5i) use. Operative outcomes include tumor pathology, margin status, estimate blood loss (EBL), and nerve-sparing status. Post-operative outcomes include new PDE5i prescriptions, physician phone encounters, email encounters, clinic visits, and physical therapy visits. These peri-operative variables were examined for association with the extent of decline in SF and UI from diagnosis to 90 days post-operatively. Spearman's correlation was used to test for association of continuous factors with the extent of decline. Multivariate linear regression was used to identify factors that were independently associated with decline in SF and UI. All analyses were performed using SAS Enterprise Guide 5.1 (Cary, NC).

Results

No patients underwent adjuvant radiation and/or androgen deprivation therapy within the study period. With regards to SF, 173, 90 and 148 patients fell into the good, intermediate and poor categories, respectively. Patient characteristics, operative, tumor pathology, and post-operative outcomes categorized by decline in SF are summarized in Table 1. Older age ($p = 0.01$), being married ($p = 0.01$), having lower baseline SF ($p < 0.01$), and using PDE5's prior to surgery ($p < 0.01$) were associated with smaller declines in SF at 90 days postoperatively. After surgery, those with larger declines in SF were more likely to initiate new PDE5 therapy ($p < 0.01$) and have more email contacts with their urologists ($p = 0.04$). No other variables were statistically significant.

For UI, there were 142, 109 and 156 patients in the good, intermediate and poor categories, respectively. Patient characteristics, operative, tumor pathology, and post-operative outcomes categorized by decline in UI are summarized in Table 2. Having a family history of PCa ($p = 0.04$), lower baseline continence ($p < 0.01$) and negative lymph nodes ($p = 0.04$) were associated with smaller declines in continence at 3 months. Post-operatively, patients with larger declines in UI were more likely to see a physical therapist ($p = 0.01$). No other variables were statistically significant.

On multivariate linear regression, younger age ($p < 0.01$), higher baseline SF ($p < 0.01$), single marital status ($p = 0.04$) and more post-surgery email contacts ($p = 0.04$)

Table 1 Patient demographics, operative and post-operative outcomes categorized by decline in sexual function at 90 days

Variable	Decline < 40 points ($n = 173$)	Decline 40–59 points ($n = 90$)	Decline > 60 points ($n = 148$)	Total ($n = 411$)	p value
Age, mean (SD)	62.2 (7.1)	60.4 (7.3)	60.5 (6.3)	61.2 (6.9)	0.01
BMI, median	28	27.7	28.2	28	0.93
PSA, median	5.9	5.6	5.8	5.7	0.75
Bx Gleason score (6–10)	–	–	–	–	0.24
Married	148 (88.1%)	69 (78.4%)	117 (79.1%)	335 (82.7%)	0.01
FHx of PCa, (yes)	15 (8.7%)	10 (11.1%)	21 (14.2%)	46 (11.2%)	0.24
Baseline continence domain, mean (SD)	89.6 (17.9)	94.3 (12.2)	94.9 (11.5)	92.5 (14.8)	< 0.01
Baseline sexual domain, mean (SD)	44.0 (30.2)	70.9 (18.7)	86.8 (11.2)	65.3 (29.5)	< 0.01
Tumor path (T2a–T3b)	–	–	–	–	0.78
Nodal Path (N0, N1, Nx)	–	–	–	–	0.04
Path Gleason, mean (SD)	6.7 (0.6)	6.8 (0.7)	6.8 (0.6)	6.7 (0.6)	0.91
Positive margin	31 (20.1%)	20 (27.8%)	25 (19.7%)	76 (21.5%)	0.89
Blood loss, mean (SD)	131 (166)	141 (115)	117 (74)	129 (129)	0.14
PLND (yes)	33 (24.4%)	17 (24.3%)	27 (25.2%)	77 (24.7%)	0.91
Nerve sparing (any: unilat and bilateral)	120 (89.9%)	66 (94.3%)	101 (94.4%)	287 (92.3%)	0.49
New PDE5i use post-op	38 (22%)	20 (22.2%)	51 (34.5%)	109 (26.5%)	< 0.01
Pre-Op PDE5i use	84 (48.6%)	34 (37.8%)	40 (27%)	158 (38.4%)	< 0.01
Phone Enc. 90 days post-op, mean (SD)	6.1 (7.8)	5.0 (5.4)	7.0 (8.5)	6.2 (7.7)	0.35
Email Enc. 90 days post-op, mean (SD)	4.1 (8.2)	5.5 (9.3)	5.3 (9.3)	4.9 (8.9)	0.04
Clinic visits 90 days post-op, mean (SD)	8.3 (4.1)	7.9 (4.3)	8.1 (4.3)	8.1 (4.2)	0.65
Any physical therapy visits 90 days post-op	16 (9.2%)	10 (11.1%)	12 (8.1%)	38 (9.2%)	0.84

Table 2 Patient demographics, operative and post-operative outcomes categorized by decline in urinary continence at 90 days

Variable	Decline < 40 points ($n = 142$)	Decline 3–59 points ($n = 109$)	Decline > 60 points ($n = 156$)	Total ($n = 407$)	p-Value
Age, mean (SD)	60.6 (7.7)	61.4 (6.8)	61.9 (6.3)	61.3 (6.9)	0.42
BMI, median	28.1	28.1	27.8	28.0	0.94
PSA, median	5.4	5.9	5.9	5.8	0.10
Bx Gleason score (6–10)	–	–	–	–	0.29
Married	113 (81.9%)	90 (83.3%)	127 (82.5%)	330 (82.5%)	0.41
FHx of PCa (yes)	20 (14.1%)	13 (11.9%)	12 (7.7%)	45 (11.0%)	0.04
Baseline continence domain, mean (SD)	87.3 (18.9)	93.9 (11.81)	97.1 (7.49)	92.8 (14.16)	< 0.01
Baseline sexual domain, mean (SD)	65.6 (32.4)	66.3 (28.9)	66.8 (27.2)	66.2 (29.6)	0.34
Tumor path (T2a–T3b)	–	–	–	–	0.76
Nodal path (N0, N1, Nx)	–	–	–	–	0.04
Path Gleason, mean (SD)	6.7 (0.7)	6.7 (0.7)	6.8 (0.6)	6.7 (0.7)	0.28
Positive margin (yes)	22 (18.8%)	21 (23.1%)	36 (25%)	79 (22.4%)	0.13
Blood loss, mean (SD)	141 (183)	114 (80)	126 (97)	127 (128)	0.82
PLND (yes)	19 (19.4%)	25 (30.1%)	38 (29.9%)	80 (26%)	0.15
Nerve sparing (any: unilat and bilat)	86 (87.8%)	80 (96.3)	113 (89%)	279 (90.6%)	0.08
New PDE5i use post-op	42 (29.6%)	26 (23.9%)	41 (26.3%)	109 (26.8%)	0.30
Pre-op PDE5i use	55 (38.7%)	43 (39.4%)	54 (34.6%)	152 (37.3%)	0.67
Phone encounters 90 days post-op, mean (SD)	5.9 (7.8)	6.3 (7.3)	6.9 (8.2)	6.4 (7.8)	0.12
Email encounters 90 days post-op, mean (SD)	4.8 (7.9)	6.0 (11.6)	5.0 (8.4)	5.2 (9.2)	0.79
Urology clinic visits 90 days post-op, mean (SD)	7.9 (4.2)	7.7 (3.9)	8.9 (4.5)	8.2 (4.3)	0.06
Any physical therapy visits 90 days post-op	8 (5.6%)	9 (8.3%)	20 (12.8%)	37 (9.1%)	0.01

Table 3 Multivariate linear regression identifying factors independently associated with decline in sexual function

Variable	Parameter estimate (95% CI)	*p*-Value
Age	0.6 (0.28 to 0.97)	< 0.01
Gleason score	0.04 (− 3.65 to 3.72)	0.98
Any nerve sparing	0.97 (− 4.44 to 6.37)	0.73
Positive nodes	9.37 (− 4.72 to 23.45)	0.19
Baseline sexual function	0.80 (0.71 to 0.89)	< 0.01
Married	− 6.50 (− 12.6 to 0.35)	0.04
Charlson score	0.49 (− 1.59 to 2.57)	0.64
New PDE5i use post-op	− 0.24 (− 6.25 to 5.77)	0.94
Pre-op PDE5i use	− 3.38 (− 8.95 to 2.19)	0.24
Email encounters	− 0.27 (− 0.53 to 0.02)	0.04

Table 4 Multivariate linear regression identifying factors independently associated with decline in urinary continence

Variable	Parameter estimate (95% CI)	*p*-Value
Age	0.22 (− 0.26 to 0.69)	0.37
Family history of PCa	− 14.8 (− 26.3 to 3.29)	0.01
Gleason score	− 1.32 (− 6.60 to 3.97)	0.63
Any nerve sparing	3.21 (− 4.33 to 10.74)	0.41
Positive nodes	20.52 (1.93 to 39.12)	0.03
Baseline continence	0.65 (0.44 to 0.86)	< 0.01
Married	0.70 (− 7.63 to 9.02)	0.87
Charlson score	0.56 (− 2.13 to 3.25)	0.68
New PDE5i use post-Op	− 5.33 (− 13.6 to 2.89)	0.20
Pre-op PDE5i use	− 3.25 (− 10.7 to 4.22)	0.39
Physical therapy visits	17.43 (7.50 to 27.35)	< 0.01

were independently associated with higher decline in SF. These findings are summarized in Table 3.

On multivariate linear regression, no family history of PCa ($p = 0.01$), higher baseline continence ($p < 0.01$) and more post-surgery physical therapy visits ($p < 0.01$) were independently associated with higher decline in UI. These findings are summarized in Table 4.

Discussion

The current healthcare climate has mandated better assessment and measurement of healthcare expenditure in relation to outcomes. In the US in 2010, the total cost of treatment for PCa was $11.8 billion, and that figure is projected to rise to over $18.5 billion by 2020 [7]. The escalating cost of PCa care has prompted implementation of comprehensive system-wide and national registries to better assess treatment outcomes and identify modifiable factors [8,9,10]. With the high success rate for oncologic control and long life expectancy following treatment for PCa, increasingly patients and clinicians are focusing on HRQOL, or achieving the “trifecta” of outcomes.

Other studies have analyzed declines in HRQOL and its association with healthcare utilization in similar fields. Mols et al. analyzed HRQOL among Dutch cancer survivors, finding that although HRQOL was comparable between older and younger cancer patients, cancer survivors visited medical specialists more often compared to age-matched controls [11]. For men with castrate-resistant prostate cancer, McKay et al. reported that men with symptomatic skeletal events (pathologic fractures, bone radiation, operations) had significantly worse HRQOL and higher healthcare utilization costs, highlighting the need for better supportive care and disease-modifying treatments [12]. In our study, we found that young, unmarried men with the greatest declines in SF were more likely to email their physicians. We also found that men with the greatest losses of continence were significantly more likely to visit physical therapists. To our knowledge, our study is the first to report that when HRQOL goals are not met, patients are more likely to utilize healthcare resources.

Within our healthcare system, a standard, initial pelvic floor physical therapy visit costs the system $274, with subsequent visits costing the system $186 based on current CPT codes [13]. Comparing good to poor UI groups, there is a difference of 12 physical therapy visits, which approximates $2,232 difference. This is the minimum cost, prior to any additional testing, labs or equipment that are required during the visit. Quantifying the cost of email encounters is more difficult, as patients are not billed for these encounters within our system, and there is currently no billing code for an email encounter as designated by the American Medical Association [14]. Fortunately, physician emails have been shown to reduce office visits [15, 16]. However, increased electronic medical record documentation, which encompasses e-mail encounters, has been attributed to physician fatigue, burnout, and possible eventual attrition [17, 18]. Furthermore, There is mounting evidence that EMR workload is quickly taking up the majority of a physician’s workday and this is likely only to get worse in the future [19]. Our finding of patients with decreased SF generating increased e-mail encounters may contribute to physician workload and/or office encounters in practices that do not have physician e-mail access, both resulting in increased healthcare utilization.

In our study, we also found that young, unmarried patients with higher baseline SF were significantly more likely to have the highest declines in SF. This “most to lose” phenomenon has been described previously by Hampson et al., who showed that while young men may retain higher absolute sexual function than older men following RARP, they also experience a greater overall decline in function making them more prone to sexual bother [20]. Similarly, in our study patients with negative family history of prostate cancer are associated with a higher decline in UI. We hypothesize this could be due to these patients having the highest hopes and expectations of positive SF recovery, but yet lacking social and family support to cope with SF and UI loss following surgery. Multiple studies have reported that patients are often more dissatisfied following RARP versus radical retropubic prostatectomy due to higher expectations for functional recovery after RARP [21, 22]. Finally, we found higher UI decline in patients with positive lymph nodes on pathology, we hypothesize that this is associated with higher grade cancer and likely a wider surgical resection focusing on oncologic control rather than preserving pelvic musculature and urinary sphincter length.

Improved preoperative counseling in this higher risk group and providing them with realistic goals of recovery for both UI and SF may lead to less perceived loss of function and an overall more satisfied patient population, utilizing less healthcare resources post-operatively. Generating less patient emails would reduce physician workload and indirectly reduce costs. In the continence domain, with better counseling, we hypothesize patients would expect to have some degree of urinary leakage, at least initially, reducing physical therapy visits and directly reducing costs and is an area in need of future research.

Our study has limitations. It is a short-term, retrospective study, analyzing UI and SF 90 days post-surgery but studies have shown that these parameters should continue to improve after the first 90 days postoperatively, up to 2 years, then plateau [9, 10]. We aimed to capture the most acute postoperative period of healthcare utilization. Surprisingly, nerve-sparing status was not significantly correlated with declines in either domain. We suspect this is due to the short timeframe of our study and differences in nerve sparing status would be more apparent in the future. Another limitation belies in the heterogeneity of the surgeons and the various experiences and techniques they have, as well as the different clinical workflow and possible variables that may not be captured in describing healthcare utilization. We acknowledge there may be parameters within the patients' general health which could affect their SF and UI, thus we have used CCI as a proxy. Finally, we used an English version of the EPIC-26 survey and translated this to Spanish using certified medical Spanish interpreters. We did not use a validated Spanish version of the EPIC-26 as currently only a Spanish EPIC-50 is validated and this is another limitation of our study.

Despite these limitations, our study highlights the population of men with the greatest declines in UI and SF following RALP are likely to have increased healthcare utilization. This study elucidates the need for future research on ways to mitigate these burdens to both patients and clinicians.

Conclusions

Even after adjusting for patient and tumor characteristics, patients with the poorest HRQOL at 90 days following RALP were more likely to seek care via email and physical therapy encounters related to SF and UI, respectively. This suggests that achieving better post-treatment HRQOL outcomes can improve patient satisfaction in addition to potentially reducing clinician workload and healthcare utilization costs.

Authors' contribution PA Elliott: Data collection, manuscript writing/editing. GA Abdelsayed: Data collection, manuscript writing/editing. PS Kilday: Data collection, manuscript writing/editing. BJ Kim: Data collection and management. JN Slezak: Data analysis. GW Chien: Research question, design, data analysis, interpretation, manuscript writing/editing.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Human and animal participation This article does not contain any studies with animals performed by any of the authors.

Informed consent Informed consent was obtained from all individual participants included in the study.

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