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Compliance to exercise-oncology guidelines in prostate cancer survivors and associations with psychological distress, unmet supportive care needs, and quality of life

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Abstract

***Objective*: The purpose of this study was to determine prevalence of Australian prostate cancer survivors meeting contemporary exercise-oncology guidelines and identify associations with distress, unmet supportive care needs, and quality of life.**

***Methods*: A population-based cohort of 463 prostate cancer survivors who were on 10.8 months post-curative therapy was assessed for compliance with current exercise guidelines for cancer survivors, motivational readiness for physical activity, psychological distress, unmet supportive care needs, and quality of life.**

***Results*: Only 57 men (12.3%) reported sufficient exercise levels (150 min of moderate intensity or 75 min of strenuous exercise per week and twice weekly resistance exercise), 186 (40.2%) were insufficiently active, and 220 (47.5%) were inactive. Among inactive men, 99 (45.0%) were in the contemplation or preparation stage of motivation readiness. Inactive men had higher global distress ($p = 0.01$) and Brief Symptom Inventory-Anxiety ($p < 0.05$) than those who were insufficiently active. Total Supportive Care Needs and International Prostate Cancer Symptom scores were higher in inactive than insufficiently and sufficiently active men ($p < 0.05$). Lack of physical activity contributed to poorer quality of life.**

***Conclusions*: Only a small proportion of Australian prostate cancer survivors met contemporary exercise-oncology recommendations despite increasing recognition of exercise to improve patient outcomes. Strategies are urgently required to increase prostate cancer survivors' participation in aerobic and resistance exercise training.**

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Background

In the past decade, several exercise trials have been conducted with prostate cancer survivors mainly in the setting of localized disease during or following radiation and androgen deprivation therapy [1–8]. Overall, consistent positive outcomes have been reported across studies strongly indicating that both resistance and aerobic exercises is beneficial in reducing a number of treatment-related toxicities and improving symptoms. Furthermore, regular physical activity has been associated with lower incidence of prostate cancer death with those undertaking ≥3 h per week of vigorous activity having ~60% lower risk of prostate cancer death compared with men undertaking <1 h per week of vigorous activity [9]. This finding adds to the growing body of evidence suggesting that exercise may extend survival for cancer patients [10,11].

As a result of recent advancements in the field of exercise oncology, the American Cancer Society and American College of Sports Medicine [12,13] published exercise guidelines for cancer survivors including prostate cancer survivors. Survivors are advised to avoid inactivity regardless of cancer type or stage, even when undergoing difficult treatments; undertake 150 min per week of moderate or 75 min per week of vigorous aerobic exercise or an equivalent combination; and perform resistance exercise of moderate or high intensity on two or more days per week, the latter being particularly important for prostate cancer survivors who experience musculoskeletal toxicities. It is unclear how well promoted these guidelines are, and these may vary according to regions, hospitals, and treating oncologists/urologists.

It is unknown if prostate cancer survivors are meeting these recommendations and importantly undertaking the contemporary prescription of both aerobic and resistance exercise. The purpose of this study was to determine the prevalence of adherence to current exercise-oncology guidelines in Australian prostate cancer survivors and evaluate associations with psychological distress, unmet supportive care needs, and quality of life (QoL). We hypothesized that few Australian prostate cancer survivors are meeting current recommendations of exercise guidelines and that those meeting recommendations would have less distress and unmet supportive care needs and better QoL.

Methods

Participants

Eligible participants were men with localized prostate cancer in Queensland after 1 January 2011 recruited through the Queensland Cancer Registry [14]. Inclusion criteria were to have undergone/be undergoing prostate cancer treatment; able to read and speak English; no previous history of head injury, dementia, or current psychiatric illness; no concurrent cancer; and physician clearance. The study was approved by the Griffith University Human Research Ethics Committee as well as ethics committees of hospitals across Queensland, and all participants provided written informed consent. Participants were recruited as part of a randomized controlled trial that is ongoing [14], with cross-sectional baseline data reported in this paper.

Materials

Assessment was via computer-assisted telephone interview. Study variables were assessed using previously validated and reliable self-report measures [14].

Physical activity

Adherence to exercise was measured using the Godin Leisure-Time Exercise Questionnaire, which assesses the average frequency and duration of mild, moderate, strenuous, and resistance exercises during free time in a typical week in the past month [15]. Mild exercise was activity that required minimal effort with examples such as fishing, golf, and easy walking. Moderate exercise was activity that was not exhausting such as fast walking, tennis, easy cycling, and easy swimming. Strenuous exercise included activity in which the heart beats rapidly such as running, jogging, playing football, vigorous swimming, and vigorous cycling. Resistance exercise was added to this scale and included examples such as lifting weights, push-ups, sit-ups, and using resistance bands. Definition of sufficient activity was based on recommended physical activity guidelines for people with cancer according to the American College of Sports Medicine and American Cancer Society [13], which is to accumulate 150 min of moderate-intensity or 75 min of vigorous (or a combination of moderate and vigorous) aerobic exercise per week, in addition to resistance exercise sessions twice weekly.

Psychological distress and unmet supportive care needs

The Brief Symptom Inventory-18 provided a global measure of current psychological distress with subscales of anxiety, depression, and somatization [16]. The sum of each of the three subscales comprises the Global Severity Index with higher scores indicating greater distress. The Supportive Care Needs Survey Short Form-34 assessed help required across psychological, health system and information, patient care and support, physical and daily living, and sexuality needs. An eight-item prostate cancer-specific module previously developed by our group was added [17]. Items are rated from 'No need/not applicable' to 'High need' with higher scores indicating greater unmet need.

Quality of life

The Assessment of QoL-8D (AQoL-8D) assessed health-related QoL [18], and the International Prostate Symptom Score (IPSS) [19] and symptom subscales of the Expanded University of California, Los Angeles Prostate Index Composite (EPIC) [20,21] measured disease-specific QoL.

Motivational readiness for physical activity

Motivational readiness for physical activity assessed intention to become more physically active across precontemplation, contemplation, preparation, action, and maintenance [22]. Respondents were assigned to one of the five stages of motivational readiness based on their most highly rated item. If there were more than one item that met these criteria, the participant was assigned to the stage that was at the highest in the stage of change process.

Remoteness

Suburb and postcode of participants' residence at diagnosis were assigned a Statistical Area 2 region using a concordance provided by the Australian Bureau of Statistics. Based on 2011 and 2012 data, areas were matched to the appropriate remoteness category: 'major city', 'inner regional'; 'outer regional'; 'remote and very remote'.

Statistical methods

Age and education were adjusted in all analyses. Due to the lack of independence and relationship between physical activity levels and a person's comorbidities and

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waist circumference, these latter two variables were not included as covariates. Analyses of covariance were conducted to assess whether the three physical activity groups differed in their scores on QoL, psychological distress, and supportive care needs controlling for possible confounders. All post hoc comparisons used the Tukey honest significant difference test, or the Dunnett's in cases where Levene's test of homogeneity of variance was significant. Prior to analyses, examination of frequencies, normal probability plots, and scatterplots revealed the bowel symptoms and bother to be significantly negatively skewed. Square root transformations were undertaken for these variables but led to no meaningful differences in results and hence were applied.

Results

Participants

Between September 2011 and November 2012, 1899 patients were identified as potentially eligible; of these, 1770 doctors were contacted for permission to contact their patients of whom 1564 (88.4%) agreed; 1501 patients were sent letters inviting them to the study; of these, 679 (45.2%) agreed to participate, and after screening for eligibility and consent, 463 agreed to proceed and completed the baseline assessment. Participants were on average 10.8 months post-diagnosis (SD = 3.03, range 0.6–21.6 months), and the majority (95.5%) had already undergone or commenced treatment ($n = 442$; Table 1). Remoteness of residence was representative of the male population aged 43–89 years in Queensland during 2012 ($p = 0.62$), and of prostate cancer patients aged 43–89 years diagnosed in Queensland during 2011 ($p = 0.20$).

Compliance to exercise-oncology guidelines

Of 463 prostate cancer survivors, only 57 participants (12.3%) reported sufficient levels of exercise (≥150 min of moderate-intensity exercise or ≥75 min of vigorous exercise per week and two resistance sessions per week), 186 (40.2%) were insufficiently active (not meeting recommendations), and 220 (47.5%) were inactive (no moderate or vigorous activity). Among those who were insufficiently active, 95 (20.5% of the total sample) met the aerobic but not resistance exercise guidelines.

Among those who were inactive, the mean weekly level of mild exercise reported was 157.9 min (*SD* = 252.3), with no moderate and strenuous exercise, and a mean of 0.4 sessions (SD = 1.4) per week of resistance exercise. The insufficiently active group had a mean mild exercise level of 151.05 min (SD = 259.9), moderate exercise of 123.7 min (SD = 127.7), strenuous exercise of 46.3 min (SD = 99.2), and resistance exercise of 0.4 sessions (SD = 1.2) per week. The sufficiently active group had a mean mild exercise level of 195.7 min (SD = 340.0), moderate exercise of 248.4 min (SD = 214.7), strenuous exercise of 133.9 min (SD = 158.8), and resistance exercise of 4.3 sessions (*SD* = 2.2) per week.

In the total sample, the majority of participants, 54.6% ($n = 253$), indicated that they were in the maintenance stage of motivational readiness for physical activity, 10.4% ($n = 48$) in the action stage, 19.2% ($n = 89$) in preparation stage, 9.8% ($n = 45$) in contemplation stage, and 3.9% ($n = 18$) in the pre-contemplation stage. When comparing among the three physical activity groups, 45.0% ($n = 99$) of inactive men were in contemplation or preparation stage, compared with 18.3% of the insufficiently active men, and 0.02% of the active men. See Table 1 for further details. Using a division of lower (pre-contemplation, contemplation, and preparation) and higher motivational stages (action and maintenance), active men (insufficient/sufficient) more frequently reported a higher stage of motivational readiness, compared with inactive men ($p < 0.001$).

Sociodemographic and clinical variables

The age of participants differed in relation to compliance to exercise-oncology guidelines ($p < 0.001$). Inactive men were older than those insufficiently ($p < 0.01$) and sufficiently active ($p = 0.001$). Inactive men had greater mean waist circumference compared with insufficiently ($p < 0.001$) and sufficiently active men ($p = 0.001$). As well, inactive men had higher rates of arthritis ($p < 0.05$) and diabetes ($p < 0.05$) than active men (sufficient/insufficiently active). Furthermore, groups differed when comparing those with a tertiary or trade education with those with a lower educational level ($p < 0.001$). There were no differences for BMI ($p = 0.09$), time since diagnosis ($p = 0.96$), or time since treatment ($p = 0.08$).

Psychological distress and unmet supportive care needs

Inactive men had higher global distress and anxiety than those insufficiently active ($p = 0.01$ and $p < 0.05$, respectively) (Table 2). There were no differences for depression ($p = 0.09$) or somatization ($p = 0.06$). Inactive men had higher supportive care needs for physical and daily living compared with those sufficiently and insufficiently active ($p < 0.05$) and higher need for care and support when compared with those insufficiently active ($p < 0.05$). Inactive men also had higher need for sexuality and information needs than sufficiently active men ($p < 0.05$). Total supportive care need score was higher in inactive men than those insufficiently and sufficiently active men ($p < 0.05$).

Disease-specific and health-related quality of life

Prostate cancer-specific QoL is shown in Table 3. Inactive men had a higher IPSS score than insufficient ($p < 0.01$) and sufficiently active men ($p < 0.05$). Differences were

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Table 1. Sociodemographic and clinical variables in inactive, insufficiently active, and sufficiently active men

	Inactive [a] (n = 220)	Insufficient [b] (n = 186)	Sufficient [c] (n = 57)	Total (n = 463)
	Mean (SD)			
Age	66.0 (7.1)	63.4 (8.3)	62.0 (6.6)	64.4 (7.7)
Range	45–89	43–85	46–77	43–89
Months since diagnosis	10.8 (3.2)	10.9 (2.9)	10.8 (3.0)	10.8 (3.0)
Range	0.6–21.6	2.8–20.1	5.6–19.1	0.6–21.6
Months since treatment	7.19 (3.1)	7.26 (2.8)	8.21 (3.2)	7.34 (3.0)
Range	0.1–18.5	0.7–14.7	0.4–17.4	0.1–18.5
Waist circumference (cm)	104.8 (10.5)	100.5 (9.6)	99.0 (9.0)	102.4 (10.3)
Range	81–143	81–131	82–125	81–143
BMI	28.4 (4.6)	27.6 (4.7)	27.1 (3.2)	27.9 (4.5)
Range	18–45	19–57	20–36	18–57
Education (%)				
University or college degree	15.0	36.0	22.8	24.4
Trade/technical certificate/diploma	37.3	33.9	50.9	37.6
Senior high school	10.0	10.2	12.3	10.4
Junior high school	25.0	16.1	12.3	19.9
Primary school	12.3	3.8	1.8	7.6
Did not complete primary school	0.5	0.0	0.0	0.2
Gross household income (%)				
<$20,000	16.8	8.1	5.3	11.9
$20,000 to $39,999	30.5	15.1	15.8	22.5
$40,000 to $59,999	12.7	15.6	19.3	14.7
$60,000 to $79,999	11.8	11.3	17.5	12.3
$80,000+	26.4	46.2	40.4	36.1
Unwilling to answer	0.5	1.1	1.8	0.9
Do not know	1.4	2.7	0.0	1.7
Current smoking (%)				
Every day	7.3	3.2	0.0	4.8
Some days	2.7	3.2	0.0	2.6
Not at all	90.0	93.6	100.0	92.6
Other physical health conditions (%)				
High blood pressure	45.9	45.2	35.1	44.3
Hypercholesterolemia/hyperlipidemia	37.3	33.3	33.3	35.2
Arthritis	38.2	28.0	36.8	33.9
Heart disease	17.7	10.2	17.5	14.7
Lung disease	14.6	10.8	10.5	12.5
Previous cancer (other than BCCs/SCCs)[d]	10.9	9.1	7.0	9.7
Diabetes	11.8	6.5	1.8	8.4
Stroke	5.0	2.7	5.3	4.1
Osteoporosis	3.6	2.7	8.8	3.9
Treatment received (%)				
Radical prostatectomy	64.1	73.1	86.0	70.4
EBRT with ADT	17.7	8.6	5.3	12.5
EBRT without ADT	4.1	3.8	0.0	3.5
Brachytherapy with ADT	1.4	2.7	0.0	1.7
Brachytherapy without ADT	3.6	5.4	7.0	4.8
EBRT and brachytherapy with ADT	1.8	2.1	1.8	1.9
ADT only	3.6	1.6	0.0	2.4
Others	3.6	2.7	0.0	2.8
BMI (%)				
Underweight	1.4	0.0	0.0	0.7
Normal	22.7	27.4	24.6	24.8
Overweight	45.5	50.0	57.9	48.8
Obese	29.1	20.4	17.5	24.2
Morbidly obese	1.4	2.2	0.0	1.5
Waist circumference (%)[e]				
Normal/not at risk (<94 cm)	13.6	25.3	36.5	21.0
Increased risk (94–102 cm)	25.7	31.3	28.9	28.4
Greatly increased risk (>102 cm)	60.8	43.4	34.6	50.7

(Continues)

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Table 1. (Continued)

	Inactive [a] (n = 220)	Insufficient [b] (n = 186)	Sufficient [c] (n = 57)	Total (n = 463)
	Mean (SD)			
Motivational stage (%)				
Pre-contemplation	6.8	1.6	0.0	3.9
Contemplation	17.3	3.8	0.0	9.7
Preparation	27.7	14.5	1.8	19.2
Action	9.6	10.2	14.0	10.4
Maintenance	35.9	68.3	82.5	54.6
Unable to be assigned	2.7	1.6	1.8	2.2

EBRT, external beam radiation; ADT, androgen deprivation therapy.
[a]Inactive, no moderate or strenuous exercise;
[b]Insufficient, insufficiently active;
[c]Sufficient, sufficiently active;
[d]Basal Cell Carcinomas/Squamous Cell Carcinoma;
[e]$n = 45$.

Table 2. Psychological distress and supportive care needs in inactive, insufficiently active, and sufficiently active men

	Inactive [a]	Insufficient [b]	Sufficient [c]	Total
	Mean (SD)			
BSI-18[d]				
Somatization	1.55 (2.32)	1.06 (1.67)	1.19 (1.77)	1.31 (2.02)
Depression	1.55 (3.06)	1.08 (1.82)	1.28 (1.93)	1.33 (2.51)
Anxiety	1.57 (2.56)	1.14* (1.83)	1.37 (1.79)	1.37 (2.21)
Global distress	4.67 (6.91)	3.28* (4.14)	3.84 (4.47)	4.01 (5.69)
SCNS-SF34[d,e]				
Physical	12.36 (5.13)	11.14* (3.84)	10.65* (3.00)	11.66 (4.47)
Psychological	15.21 (7.41)	14.64 (6.58)	14.89 (6.84)	14.94 (7.01)
Health system/information	19.66 (7.55)	18.12 (6.28)	16.84* (5.03)	18.69 (6.84)
Patient care	7.95 (3.31)	7.12* (2.24)	7.05 (2.40)	7.51 (2.84)
Sexuality	10.42 (4.68)	10.08 (4.24)	9.29* (3.90)	10.15 (4.42)
Total	65.62 (21.30)	61.15* (17.59)	58.73* (16.12)	62.97 (19.43)

BSI-18, Brief Symptom Inventory-18; SCNS-SF34, Supportive Care Needs Survey Short Form-34.
[a]Inactive, no moderate or strenuous exercise;
[b]Insufficient, insufficiently active;
[c]Sufficient, sufficiently active;
[d]Higher scores indicate higher distress or higher supportive care needs;
[e]SCNS-SF34 scored by summing items in each domain: physical (8 items; range 8–34); psychological (10 items; range 10–49); health system/information (11 items; range 11–50); patient care (5 items; range 5–24); sexuality (5 items; range 5–25); total (39 items; range 39–154).
*$p < 0.05$ compared with inactive;
**$p < 0.01$ compared with inactive.

also detected among various EPIC dimensions and subscales. For example, inactive men had lower urinary bother scores compared with insufficiently and sufficiently active men ($p < 0.05$). Urinary dimension and urinary function scores were lower in inactive compared with those in insufficiently active men ($p < 0.01$). Sexual dimension and sexual function scores were lower in the inactive compared with those of insufficiently active ($p < 0.001$) and sufficiently active ($p = 0.01$) men, and sexual bother scores lower compared with those of the insufficiently active men ($p < 0.01$). There were no differences for any of the remaining EPIC domains or subscales. Health-related QoL outcomes are shown in Table 4. Inactive men had lower AQoL-8D utility scores than the insufficiently active men ($p < 0.01$), lower independent living scores than insufficiently active ($p = 0.01$) and the sufficiently active men ($p < 0.05$), lower coping scores than insufficiently active ($p < 0.01$) and sufficiently active men ($p < 0.01$), and lower senses ($p < 0.01$) and physical superdimension scores ($p < 0.05$) than insufficiently active men.

Discussion

The present study reports four important findings: (1) only 12% of this population-based sample of Australian men with prostate cancer reported meeting current exercise-oncology guidelines with the large majority (~48%) inactive (not undertaking any moderate or vigorous exercise); (2) ~30% of men were at least in the contemplation and preparation stages of changes suggesting presence of a teachable

Table 3. Disease-specific QoL in inactive, insufficiently active, and sufficiently active men

	Inactive[a]	Insufficient[b]	Sufficient[c]	Total
	Mean (SD)			
IPSS[d]	8.45 (6.79)	6.19** (5.86)	5.74* (5.01)	7.21 (6.33)
EPIC[e]				
Urinary	83.75 (16.43)	88.37** (13.65)	88.92 (13.25)	86.26 (15.14)
Function	84.04 (17.55)	89.14** (15.02)	88.15 (15.55)	86.60 (16.48)
Bother	83.51 (17.93)	87.83* (14.77)	89.47* (13.03)	85.98 (16.31)
Bowel	92.67 (11.17)	94.27 (9.72)	95.02 (6.30)	93.60 (10.13)
Function	92.01 (10.33)	93.78 (8.97)	94.36 (6.71)	93.01 (9.44)
Bother	93.21 (13.80)	94.76 (11.66)	95.68 (7.95)	94.14 (12.38)
Sexual	30.91 (21.16)	42.30*** (23.17)	44.26** (25.42)	37.14 (23.26)
Function	20.71 (22.88)	32.97*** (26.88)	36.10** (27.32)	27.55 (25.91)
Bother	54.06 (36.65)	63.27** (30.47)	62.61 (33.58)	58.81 (34.14)
Hormonal ($n = 82$)	82.08 (15.15)	80.16 (9.74)	76.71 (11.04)	81.21 (13.42)
Function	76.64 (17.65)	71.73 (12.96)	70.00 (10.80)	74.76 (16.08)
Bother	86.87 (14.70)	87.18 (10.86)	82.29 (11.47)	86.75 (13.37)

IPSS, International Prostate Symptom Score; EPIC, Expanded Prostate Index Composite.
[a]Inactive, no moderate or strenuous exercise;
[b]Insufficient, insufficiently active;
[c]Sufficient, sufficiently active; [d]Higher scores indicate greater symptom severity;
[e]Higher scores indicate better QoL.
*$p < 0.05$ compared with inactive;
**$p < 0.01$ compared with inactive;
***$p < 0.001$ compared with inactive.

Table 4. Health-related QoL in inactive, insufficiently active, and sufficiently active men and Australian population norms [31]

	Inactive [a]	Insufficient [b]	Sufficient [c]	Total	Australian norms – male
	Mean (SD)				Mean (SE)
AQoL[d]					
Utility Score	0.82 (0.18)	0.88** (0.12)	0.88 (0.13)	0.85 (0.16)	0.87 (0.005)
Independent Living	0.88 (0.14)	0.92* (0.11)	0.94* (0.10)	0.90 (0.13)	0.95 (0.003)
Happiness	0.82 (0.12)	0.84 (0.10)	0.85 (0.10)	0.83 (0.11)	0.82 (0.004)
Mental Health	0.70 (0.15)	0.73 (0.13)	0.73 (0.15)	0.72 (0.14)	0.71 (0.005)
Coping	0.82 (0.13)	0.86** (0.10)	0.88** (0.11)	0.85 (0.12)	0.84 (0.004)
Relationships	0.82 (0.15)	0.84 (0.12)	0.84 (0.13)	0.83 (0.14)	0.78 (0.005)
Self-worth	0.88 (0.14)	0.90 (0.10)	0.90 (0.11)	0.89 (0.12)	0.89 (0.004)
Pain	0.82 (0.21)	0.86 (0.20)	0.86 (0.18)	0.84 (0.20)	0.91 (0.004)
Senses	0.83 (0.12)	0.87** (0.10)	0.87 (0.10)	0.85 (0.11)	0.90 (0.004)
Mental	0.52 (0.21)	0.56 (0.18)	0.57 (0.20)	0.54 (0.20)	0.51 (0.007)
Physical	0.72 (0.19)	0.79* (0.18)	0.79 (0.17)	0.76 (0.19)	0.85 (0.005)

[a]Inactive, no moderate or strenuous exercise;
[b]Insufficient, insufficiently active;
[c]Sufficient, sufficiently active;
[d]Higher scores indicate better QoL.
*$p < 0.05$ compared with inactive;
**$p < 0.01$ compared with inactive.

moment; (3) psychological distress differed in relation to activity levels with inactive prostate cancer survivors reporting higher global distress and anxiety; and (4) unmet supportive care needs were higher and several aspects of health-related and disease-specific QoL lower in inactive men including domains of urinary and sexual function.

To our knowledge, this is the first population-based study to examine adherence to contemporary exercise-oncology recommendations including aerobic and resistance modes in men with prostate cancer who have received or were receiving curative therapy. We found that very few prostate cancer survivors (~12%) met exercise recommendations with ~40% insufficiently active and a large proportion inactive (~48%). Previous reports from North America on aerobic exercise recommendations in cancer survivors at least one year post-diagnosis suggested higher prevalence of participation at ~43% of prostate cancer survivors [23] and more recently ~47% in middle-aged cancer survivors (including a variety of cancers) from the Behavior Risk Factor Surveillance System [24]. These reports were either initiated or published prior to the more recent recommendations from the American Cancer Society [12] and American College of Sports Medicine [13] that include integration of resistance exercise. Compliance to aerobic-only exercise guidelines from our total cohort using the same self-reported instrument to assess physical activity was ~33%, which is lower than those previously reported in North America (~43%) [23].

Extensive evidence has accumulated in recent years on the benefits of aerobic and resistance trainings in men with prostate cancer during active therapy or in those who have completed therapy including radiation/androgen deprivation [1,2,4,6–8]. Vigorous exercise has been also associated with reduction in prostate cancer-specific death by ~60% in a cohort of 2705 men with prostate cancer from the Health Professionals Follow-up Study [9]. Recent expert reviews in urology/oncology have further incorporated aerobic and resistance exercise interventions as evidence-based strategies to mitigate toxicities from androgen deprivation including components of metabolic syndrome, sexual dysfunction, and fatigue [25]. With 88% of our Australian cohort of men not adhering to contemporary exercise-oncology recommendations, strategies are urgently required to increase prostate cancer survivors' participation in aerobic and resistance exercise programs. For example, we recently reported a year-long exercise trial in prostate cancer survivors with both supervised and home-based components that may facilitate translation into practice and improve participation [6].

Our early study in supportive care needs for men with prostate cancer indicated that one-third of men reported a moderate to high need for help in the sexuality, psychological, and health system and information domains [17], a finding confirmed elsewhere [26]. Crucially, in this study, inactive men had higher supportive care needs compared with men who were insufficiently and sufficiently active. In addition, although the prevalence of distress in this population was low [27], men who were inactive had higher anxiety and global distress compared with those who were insufficiently active. The link between inactivity and psychological distress suggests that exercise interventions have potential to provide health benefits beyond physical functioning.

Enhanced continence post-surgery has been reported in prostate cancer survivors who have normal weight and are physically active compared with survivors who are obese and sedentary. Further, 58 weeks post-surgery, the incidence of incontinence appears to be the same for overweight but physically active men compared with normal weight but sedentary men [28]. Our cohort of inactive men had a higher IPSS score based on urinary symptoms than those insufficiently and sufficiently active men. Notably, the majority of our cohort ~70% underwent radical prostatectomy hence supporting that meeting specific exercise levels may lead to better continence. We also noted that our cohort of inactive men had greater mean waist circumference (i.e., ~105 cm) compared with insufficiently (i.e., 101 cm) and sufficiently (i.e., 98 cm) active men. Importantly, waist circumference ≥102 cm is a key criterion for metabolic syndrome diagnosis [29]. Further, abdominal obesity, such as waist circumference, correlates with fat mass changes by dual-energy X-ray absorptiometry and has been extensively reported in large epidemiological studies on cardiovascular and metabolic diseases [30]. Increasing physical activity is a key strategy for reducing fat mass and is more effective when combined with caloric restriction, but such an energy imbalance also results in loss of muscle and bone mass unless accompanied by resistance training. This further emphasizes the importance of cancer survivors meeting both the aerobic and resistance training components of the guidelines.

We further identified levels of activity in relation to disease-specific and health-related QoL. Sexual dimension and sexual function scores were lower in the inactive compared with insufficiently active and sufficiently active men, and sexual bother scores lower compared with the insufficiently active men. There was a significant and clinically meaningful advantage for the insufficiently active men over the inactive men for several dimensions of QoL. However, the sufficiently active men exhibited equal or only marginally better scores compared with those insufficiently active. It appears that being inactive has considerable negative consequences for QoL, and even a modest amount of moderate/vigorous activity is associated with benefit across a wide range of QoL dimensions. If the men were not inactive, then their scores were actually equal to or higher than the Australian norms [31] for all of the QoL dimensions except pain, senses, and physical superdimension.

Our study has several features that are worthy of comment. First, we used a large population-based cohort of metropolitan and rural Australian prostate cancer survivors, and this is the first report on adherence to contemporary exercise-oncology recommendations including aerobic and resistance exercise modes. Second, we targeted a well-defined population of men with prostate cancer who received or were undergoing active therapy. Third, we employed a range of well-established instruments of distress, unmet supportive care needs, and disease-specific and health-related QoL in relation to adherence to current exercise-oncology guidelines. Limitations included the following: the cross-sectional nature of the study that does not permit us to infer causality; the leisure-time assessment does not include occupational or domestic work and is self-assessed, which is normally inferior to objective measures (e.g., accelerometer). However, it was not feasible to implement objective measures of physical activity given the large number of participants involved in the study.

In summary, approximately 88% of prostate cancer survivors in Australia do not meet physical activity guidelines for people with cancer, and almost half is totally inactive. Lack of physical activity appears to contribute to higher

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psychological distress, greater reported unmet supportive care needs, and poorer QoL. However, most men were at least contemplating behavioral change, and of those who were inactive, almost a third were preparing for change suggesting an opportunity for intervention capitalizing on a teachable moment. Further research addressing effective and translatable lifestyle interventions for this patient group are needed.

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References

1. Segal RJ, Reid RD, Courneya KS, *et al*. Resistance exercise in men receiving androgen deprivation therapy for prostate cancer. *J Clin Oncol* 2003;**21**:1653–1659.
2. Segal RJ, Reid RD, Courneya KS, *et al*. Randomized controlled trial of resistance or aerobic exercise in men receiving radiation therapy for prostate cancer. *J Clin Oncol* 2009;**27**:344–351.
3. Galvao DA, Nosaka K, Taaffe DR, *et al*. Resistance training and reduction of treatment side effects in prostate cancer patients. *Med Sci Sports Exerc* 2006;**38**:2045–2052.
4. Galvao DA, Taaffe DR, Spry N, Joseph D, Newton RU. Combined resistance and aerobic exercise program reverses muscle loss in men undergoing androgen suppression therapy for prostate cancer without bone metastases: a randomized controlled trial. *J Clin Oncol* 2010;**28**:340–347.
5. Beydoun N, Bucci JA, Chin YS, Spry N, Newton R, Galvao DA. Prospective study of exercise intervention in prostate cancer patients on androgen deprivation therapy. *J Med Imaging Radiat Oncol* 2014;**58**:369–376.
6. Galvao DA, Spry N, Denham J, *et al*. A multicentre year-long randomised controlled trial of exercise training targeting physical functioning in men with prostate cancer previously treated with androgen suppression and radiation from TROG 03.04 RADAR. *Eur Urol* 2014;**65**:856–864.
7. Bourke L, Gilbert S, Hooper R, *et al*. Lifestyle changes for improving disease-specific quality of life in sedentary men on long-term androgen-deprivation therapy for advanced prostate cancer: a randomised controlled trial. *Eur Urol* 2014;**65**:865–872.
8. Cormie P, Galvao DA, Spry N, *et al*. Can supervised exercise prevent treatment toxicity in prostate cancer patients initiating androgen deprivation therapy: a randomised controlled trial. *BJU Int* 2014; Advance online publication; doi: 10.1111/bju.12646.
9. Kenfield SA, Stampfer MJ, Giovannucci E, Chan JM. Physical activity and survival after prostate cancer diagnosis in the health professionals follow-up study. *J Clin Oncol* 2011; **29**:726–732.
10. Holmes MD, Chen WY, Feskanich D, Kroenke CH, Colditz GA. Physical activity and survival after breast cancer diagnosis. *JAMA* 2005;**293**:2479–2486.
11. Meyerhardt JA, Giovannucci EL, Holmes MD, *et al*. Physical activity and survival after colorectal cancer diagnosis. *J Clin Oncol* 2006;**24**:3527–3534.
12. Rock CL, Doyle C, Demark-Wahnefried W, *et al*. Nutrition and physical activity guidelines for cancer survivors. *CA Cancer J Clin* 2012;**62**:243–274.
13. Schmitz KH, Courneya KS, Matthews C, *et al*. American College of Sports Medicine roundtable on exercise guidelines for cancer survivors. *Med Sci Sports Exerc* 2010;**42**: 1409–1426.
14. Chambers SK, Newton RU, Girgis A, *et al*. Living with prostate cancer: randomised controlled trial of a multimodal supportive care intervention for men with prostate cancer. *BMC Cancer* 2011;**11**:317.
15. Godin G, Shephard RJ. A simple method to assess exercise behavior in the community. *Can J Appl Sport Sci* 1985;**10**:141–146.
16. Derogatis LR, Lopez MC. *Brief Symptom Inventory 18: Administration, Scoring and Procedures Manual*, National Computer Systems, Inc.: Minneapolis, 2000.
17. Steginga SK, Occhipinti S, Dunn J, Gardiner RA, Heathcote P, Yaxley J. The supportive care needs of men with prostate cancer (2000). *Psycho-Oncology* 2001;**10**:66–75.
18. Richardson J, Khan M, Iezzi A, *et al*. *The AQoL-8D (PsyQoL) MAU Instrument: Overview (Research Paper 39)*, Centre for Health Economics, Monash University: Melbourne, 2009.
19. Barry MJ, Fowler FJ Jr, O'Leary MP, *et al*. The American Urological Association Symptom Index for benign prostatic hyperplasia. The Measurement Committee of the American Urological Association. *J Urol* 1992;**148**:1549–1557.
20. Litwin MS, Hays RD, Fink A, Ganz PA, Leake B, Brook RH. The UCLA Prostate Cancer Index: development, reliability, and validity of a health-related quality of life measure. *Med Care* 1998;**36**:1002–1012.
21. Wei JT, Dunn RL, Litwin MS, Sandler HM, Sanda MG. Development and validation of the Expanded Prostate Cancer Index Composite (EPIC) for comprehensive assessment of health-related quality of life in men with prostate cancer. *Urology* 2000;**56**:899–905.
22. Clark MM, Novotny PJ, Patten CA, *et al*. Motivational readiness for physical activity and quality of life in long-term lung cancer survivors. *Lung Cancer* 2008;**61**(1):117–122.
23. Blanchard CM, Courneya KS, Stein K. Cancer survivors' adherence to lifestyle behavior recommendations and associations with health-related quality of life: results from the American Cancer Society's SCS-II. *J Clin Oncol* 2008;**26**(13):2198–2204.
24. Nayak P, Holmes HM, Nguyen HT, Elting LS. Self-reported physical activity among middle-aged cancer survivors in the United States: behavioral risk factor surveillance system survey, 2009. *Prev Chronic Dis* 2014;**11**: E156.
25. Nguyen PL, Alibhai SM, Basaria S, *et al*. Adverse effects of androgen deprivation therapy and strategies to mitigate them. *Eur Urol* 2014; Advance online publication; doi: 10.1016/j.eururo.2014.07.010.
26. Smith DP, Supramaniam R, King MT, Ward J, Berry M, Armstrong BK. Age, health, and education determine supportive care needs of men younger than 70 years with prostate cancer. *J Clin Oncol* 2007;**25**: 2560–2566.
27. Chambers SK, Zajdlewicz L, Youlden DR, Holland JC, Dunn J. The validity of the distress thermometer in prostate cancer populations. *Psycho-Oncology* 2014;**23**(2): 195–203.
28. Wolin KY, Luly J, Sutcliffe S, Andriole GL, Kibel AS. Risk of urinary incontinence

following prostatectomy: the role of physical activity and obesity. *J Urol* 2010;**183**: 629–633.

29. Executive Summary of the Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). *JAMA* 2001;**285**:2486–2497.
30. See R, Abdullah SM, McGuire DK, *et al*. The association of differing measures of overweight and obesity with prevalent atherosclerosis: the Dallas Heart Study. *J Am Coll Cardiol* 2007;**50**:752–759.
31. Richardson J, Khan MA, Chen G, Iezzi A, Maxwell A. Population norms and Australian profile using the assessment of quality of life (AQoL) 8D utility instrument (research paper 72). Melbourne, Centre for Health Economics, Monash University, 2012

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