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Transitions in Symptom Cluster Subgroups among Men Undergoing Prostate Cancer Radiation Therapy

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Abstract

Background—Prostate cancer is a common type of cancer worldwide and in the United States. However, little information has been reported on the symptoms of men overtime who receive radiation therapy.

Objective—Identify subgroups of men at pre-and post radiation therapy on general and treatment-related symptoms and to determine transitions in subgroup membership overtime.

Methods—Men (n=84) receiving completed questionnaires on fatigue, insomnia, pain, depression, anxiety, and sexual, urinary and bowel problems at pre-and posttreatment. Latent class analysis identified subgroups. One-way ANOVAs determined subgroups differed on symptoms, participant characteristics, and quality of life. Latent transition analysis examined subgroup transitions overtime.

Results—At pretreatment four subgroups identified: Resilient group with little to no symptom reporting, Adjusted group with moderately high treatment-related symptoms, low insomnia, depression, and anxiety, Distressed group consistently high on most symptoms, and Emerging group with moderately high fatigue, depression, and anxiety with few treatment-related symptoms. At posttreatment similar results to groups at pretreatment: Resilient, Adjusted and Distressed groups with an Impacted group having high pain, insomnia, depression, urinary, and bowel symptoms. Quality of life and participant characteristics further distinguished groups at pre-and posttreatment. Income level predicted a transition in group membership.

Conclusions—Men can be classified into distinctly different subgroups overtime.

Implications for Practice—Assessment and intervention with men in subgroups such as Distressed and Emerging before and during treatment may lessen potential for remaining distressed, or moving into Impacted group where symptom severity is high at posttreatment. Interventions to reduce multiple symptoms are vitally needed.

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Over one million men worldwide are diagnosed annually with prostate cancer.¹ Prostate cancer is the most common cancer among American men with an estimated 233,000 new cases in 2014.² Despite the growing number of patients with prostate cancer, the symptoms of these individuals who subsequently undergo treatment have not been extensively studied in comparison to other cancer types. Treatment options may include watchful waiting (active surveillance), surgery (radical prostatectomy), cryotherapy, radiation therapy (external beam and brachytherapy), hormone therapy, and/or chemotherapy. In the United States, about 40% of all men receive radiation therapy for prostate cancer.³

General symptoms frequently associated with cancer treatment are fatigue, pain, insomnia, depression, and anxiety. These symptoms have been described in a limited number of studies among men at pre-and post-radiation therapy (RT). In addition, to our knowledge there are no prostate cancer studies which have examined over time these general symptoms with the symptoms commonly reported with RT including sexual, urinary, and bowel problems. The presence of concurrent multiple symptoms may negatively impact quality of life (QOL) in persons undergoing cancer treatment.

Men undergoing RT for prostate cancer frequently report baseline fatigue (41%) with levels of fatigue further increasing (66%) for up to 5-years posttreatment.⁴ A recent systematic review which examined fatigue in prostate cancer patients revealed the common occurrence of fatigue across all treatment modalities.⁵ This review which included men undergoing RT concluded that fatigue severity differed across studies, with findings reporting decreased fatigue for many men from baseline to end of treatment, whereas other studies suggested fatigue more commonly increases from baseline to end of treatment. Insomnia has also been noted to occur during prostate cancer treatment with up to 39% of men indicating sleep difficulties before treatment begins.⁶ A majority of men receiving outpatient prostate cancer treatment indicated sleep difficulties with 36% reporting clinically significant levels of insomnia.⁷ Further analysis revealed half of these men also had significant depression.

Anxiety may be commonly experienced in patients undergoing RT. In a longitudinal study of patients receiving RT including men with prostate cancer, anxiety was measured over a 6-month period.⁸ Distinct trajectories of anxiety symptoms were noted in 3 patient subgroups during and following RT, including one group with clinically significant anxiety levels at baseline which lessened over time. It is interesting to note this group with greater anxiety scores also had the highest depressive symptoms, with researchers emphasizing the importance of examining clusters of symptoms overtime to gain insight into the interrelationships among single symptoms. Almost 18% of all patients with cancer including prostate cancer, who were scheduled to receive RT have reported clinically significant levels of depression and anxiety.⁹ Patients with these high levels of mood disturbance also had the lowest sleep quality. In a study tracking singular symptoms in patients with prostate cancer over the duration of RT, results indicated many men reported decreases in pain, difficulties sleeping, and a lack of energy over time.¹⁰ At RT baseline, researchers noted the somewhat unexpected finding of a moderately high prevalence (50%) of pain with etiology of the pain not known. Pretreatment pain was also found to be a significant predictor for a lack of energy.

Sexual, urinary, and bowel symptoms are often reported by men receiving prostate cancer treatment with sexual difficulties being the most frequently cited concern.¹¹ Prostatectomy, radiotherapy, and brachytherapy were found to worsen urinary and sexual bother and sexual functioning overtime when compared to pretreatment measures of these symptoms.¹² Radiotherapy in particular resulted in a worsening of bowel function and bother among men after treatment.

Three or more symptoms that commonly occur together can be referred to as a symptom cluster.¹³ Symptom cluster research has often focused on determining the existence of symptom clusters related to the multiple symptoms observed in patients during cancer treatment. Seminal findings in patients undergoing treatment with varying cancer diagnoses revealed the existence of 4 symptom subgroups based on a predefined symptom cluster of fatigue, pain, depression, and sleep disturbance.¹⁴ The 4 groups included: patients with highest severity in sleep disturbance and depression (all high), patients having lowest scores in fatigue and sleep disturbance (all low), and patients with high fatigue and low pain, or low fatigue and high pain. Group membership was not predicted by cancer type, stage, or treatment received. Further research has validated the subgrouping of patients into specific clusters based on similar symptom experiences, including patients with various types of cancer receiving biotherapy, chemotherapy, radiotherapy, and/or hormonal therapy.^{13,15,16}

In the limited number of studies on symptom clusters in prostate cancer patients during RT, one study revealed most men could be grouped into a cluster characterized by low levels of pain, fatigue, sleep disturbance, and depression.¹⁷ In a second study, five distinct symptom clusters were identified in men 6-to-8 months following prostate cancer treatment.¹⁸ These clusters were further distinguished by levels of pain, fatigue, emotional distress, and urinary, sexual, and bowel dysfunction. Four clusters had symptom scores in the moderate range indicating men continue to experience multiple symptoms for many months following treatment.

Symptom cluster subgroups in patients undergoing cancer treatment is an understudied area of inquiry. A recent systematic review found that many cancer patients have multiple symptoms which are associated with greater levels of distress.¹⁹ This review concluded that there is a need to more fully explore not only the occurrence of cancer-related multiple symptoms overtime, but their relationship to participant characteristics and QOL. It was also recommended that this research be conducted with participants having the same cancer diagnosis and treatment for effective interventions to be developed and implemented.

The Theory of Unpleasant Symptoms (TOUS) characterizes symptoms according to their severity (intensity), quality, distress, and duration.²⁰ Central to the TOUS is the premise that multiple disease-related symptoms often occur concurrently and have interactive and adverse synergy. In cancer patients, this premise is supported by findings indicating the worst fatigue and sleep quality were related to the most severe pain.²¹ Patient factors influencing the symptom experience include participant age, marital status, disease stage, and comorbidity. The outcome of the symptom experience is performance which is conceptualized as functional health status, cognitive functioning, and/or quality of life. In summary, the TOUS helps guide the current study by providing a framework that postulates

1) symptoms are multidimensional and interrelated, 2) patient factors influence the experience of symptoms and symptom clusters, and 3) quality of life is an outcome of the symptom experience.

A second theoretical perspective underpinning this study is transitions. Transitions are multidimensional, complex, and often unexpected individual experiences that result due to changes in life, health, relationships, and the environment.²² Men receiving treatment for prostate cancer who report changes in symptom prevalence and severity from pre-to posttreatment may be experiencing transitions in their health status and QOL.

Currently there are no published findings in men receiving prostate cancer RT related to symptom cluster subgroups at treatment baseline and how these identified subgroups may transition or change at posttreatment. Identifying and tracking subgroups overtime would result in a better understanding of treatment impact on the symptom experience, and ultimately assist patient care through the development of interventions that would target the management of multiple symptoms. The purpose of this study was to 1) identify and describe symptom cluster subgroups pre-and post-radiation therapy in men with prostate cancer, 2) to determine if the subgroups could be further distinguished by participant characteristics and QOL, and 3) to examine transitions in subgroup membership from pre-to posttreatment. Both general and treatment-related symptoms were chosen for examination in this study as they appear to occur commonly and concurrently and thus, these symptoms may be related to each other.

Methods

In a descriptive, longitudinal design participants were recruited from outpatient RT sites prior to beginning treatment. Men who were at least 21 years of age, able to read, speak, and understand English, diagnosed with stage I, II, or III prostate cancer, and receiving RT for the first time were eligible for participation. Radiation therapy included external beam radiation and brachytherapy. Men with stage IV disease were not included in the study because a cure is rarely possible and hormonal manipulation is often the main treatment given.

All study participants were verified by their radiation oncologist as having nonmetastatic disease. Institutional review board approval was received prior to obtaining informed consent from each participant. Questionnaires were completed by participants within 2 weeks before the start of RT and again at 8 weeks (end of therapy). Men receiving brachytherapy were also measured at this second time point with the expectation they would be experiencing acute symptoms after 8 weeks of treatment.

Measures

Participants provided information on age, ethnicity, marital status, education, and income on a form developed by the investigator. Clinical information obtained from the medical record included cancer stage, time since diagnosis, Gleason score, PSA level, and prior prostatectomy. Participants indicated on a Co-Morbidity Index (CI) from an established

listing of 26 health problems if a health care provider had diagnosed them as having the condition (Yes or No).²³

Fatigue was measured by the 7-item Profile of Mood States Fatigue/Inertia Subscale (POMS F/I).²⁴ Responses are on a 5-point scale ranging from 0 (not at all) to 4 (extremely). Higher scores indicate increased fatigue. Test-retest reliability, internal consistency, concurrent, and construct validity have been demonstrated.²⁵ The POMS has been used in studies of men undergoing prostate cancer treatment.⁷ In this study, Cronbach's alpha was 0.95.

Insomnia was measured by the 7-item Insomnia Severity Index (ISI).²⁶ Responses range from 1(not at all) to 5 (very much) with a total cut-off score of 15 indicating clinically significant insomnia. The ISI has been used in prostate cancer studies with support for reliability and convergent and construct validity.²⁷ In this study, Cronbach's alpha was 0.90.

Pain was measured by the 2-item Pain Numeric Rating Scale (PNRS) which rates pain severity (0=no pain to 10=pain as intense as you can imagine), and impairment due to pain (0=does not interfere to 10=completely interferes). Responses to the two items were summed. A higher score indicates greater pain severity and impairment. Single-item pain intensity rating scales are a valid, reliable measure of cancer pain.²⁸

Depression was measured by the 20-item Center for Epidemiologic Studies-Depression Scale (CES-D) with responses ranging from 0 (rarely or none of the time) to 3 (most or all of the time).²⁹ A score of 16 indicates depression. The CES-D has evidence of reliability in clinical populations.³⁰ In this study, Cronbach's alpha was 0.84.

Anxiety was measured by 20-item State Anxiety Subscale (STAI-S) of the State-Trait Anxiety Inventory with scale responses ranging from 1 (rarely) to 4 (all the time).³¹ Higher scores indicate greater anxiety. The STAI-S demonstrates concurrent, convergent, divergent, and construct validity.³¹ In this study, Cronbach's alpha was 0.91.

Treatment-related symptoms were measured by the 26-item Expanded Prostate Cancer Index Composite (EPIC-26) which evaluates patient functioning and bother after prostate cancer treatment.³² The EPIC-26 contains domain scores for sexual, urinary irritative and obstructive, and bowel symptoms. A higher score suggests better health status for the symptom. The EPIC has shown construct validity.³² In this study, Cronbach's alphas for the subscales ranged from 0.57 (urinary irritative) to 0.92 (sexual).

Quality of life was measured by the 39-item Functional Assessment of Cancer Therapy-Prostate (FACT-P) which measures prostate cancer QOL.³³ Items are rated from 0 (not at all) to 4 (very much) with higher scores indicating better QOL. The FACT-P demonstrates internal consistency, concurrent validity, and sensitivity to change.³⁴ In this study, Cronbach's alpha was 0.86.

Statistical Analysis

Descriptive statistics were used to examine participant characteristics and scale scores. Changes in symptom scores for the sample were calculated as the posttreatment score minus the pretreatment score. Latent class analysis (LCA) was used to identify symptom cluster

subgroups based on reported symptoms. A sequence of LCA models, from 1 to 5 classes were run with fatigue, insomnia, pain, depression, anxiety, sexual, urinary irritative and obstructive, and bowel symptoms. The Akaike's Information Criterion (AIC) and Bayesian Information Criterion (BIC) were computed to compare the four models, and a model was selected based on minimizing either the AIC or BIC.³⁵ In addition, the quality of the resulting classification was evaluated in terms of the separation of the subgroups using the entropy index. Entropy denotes how possible it is to predict group membership given the observed indicators. Values range from 0 to 1 with high values (>0.90) indicating the groups are highly discriminative. All models were fit using Mplus software, version 5 (Muthen & Muthen, 2007).³⁶ After subgroups were created, one-way ANOVAs were examined to determine whether the groups differed on symptoms, participant characteristics, and QOL.

Latent transition analysis (LTA) was used to examine transitions in membership among the symptom cluster subgroups overtime. LTA estimates the probability of moving from one subgroup at pretreatment into another group at posttreatment. Logistic regression was used to determine if participant characteristics and QOL predicted who changed groups from pre-to posttreatment.

Results

One hundred and forty men were approached with 84 giving written informed consent. Most common reasons for refusal were too busy (n=14) and not interested (n=31). Most men were white, married, and had a mean age of 69 years (Table 1). Mean education level was 15 years with an annual household income of \$50,000 to 60,000. Mean number of comorbidities was 3.4 with a mean time since diagnosis of 20.6 months (1.7 years). Mean Gleason score was 7.2 (median=7.0) with a mean PSA level of 8.7 nanograms/milliliter.

Among the participants at pretreatment, QOL was reported as moderately high with a mean FACT-P score of 129.0 (SD=16.8, range =75-154). At posttreatment the mean QOL score was 120.4 (SD= 19.8, range= 73-153), indicating a slight decrease in QOL from pre-to posttreatment.

Symptom Cluster Subgroups

Sample means and standard deviations for the symptoms at pre-and posttreatment are presented in Table 2. Fatigue, pain, insomnia, and sexual, urinary (irritative and incontinence), and bowel symptoms significantly worsened for the participants from pre-to posttreatment. Anxiety and depression did not significantly change.

Based on the lowest Akaike (AIC) value of 5249.08, lowest BIC value of 5365.76 and entropy value of .92, 4 groups were identified at pretreatment with different symptom patterns. Table 3 presents symptom means and standard deviations for the 4 symptom cluster subgroups identified. At pretreatment, group 1 (n=39) who reported little to no symptoms were labeled as "Resilient". This group had less symptom reporting related to the other three subgroups except for urinary irritative symptoms. Group 2 (n=34) was characterized by moderately high sexual, urinary, and bowel symptoms with lower levels of insomnia, depression, and anxiety. This group was labeled "Adjusted" as they were further

distinguished by moderately high QOL scores. Group 3 (n=3) which was labeled “Distressed” was comprised of men who were consistently high on all symptoms except urinary incontinence. Depression and insomnia were above the scale cut-off levels for clinical significance. Group 4 (n=14) which was moderately high on anxiety, depression, and fatigue with few treatment-related symptoms was labeled “Emerging”. With a combination of high and low symptoms it was not apparent if Group 4 members at posttreatment would remain relatively constant with this profile or experience an overall worsening or improvement in symptoms.

Based on the F-statistic value the largest contributor to the identification of the subgroups at pretreatment was depression, with the Distressed group being the most depressed followed by the Emerging group. The second largest contributor to identifying subgroup membership was anxiety, with the Distressed and Emerging groups having the highest and second highest levels of anxiety. These subgroups were also highest and second highest on insomnia and fatigue. Pain and urinary incontinence did not contribute to overall identification of the symptom cluster subgroups at pretreatment

At posttreatment, based on the lowest Akaike (AIC) value of 5520.23, lowest BIC value of 5636.33, and entropy value of .91, 4 groups were identified with different symptom patterns. Table 4 presents symptom means and standard deviations for the 4 subgroups. All symptoms contributed to the identification of the subgroups. Similar to the groups found at pretreatment; the Resilient, Adjusted, and Distressed subgroups remained at posttreatment. Once again, the Resilient group reported the best symptom scores (less symptoms) compared to the other groups, the Adjusted group had the second best scores and continued to report moderately high QOL, whereas the Distressed group had the worst scores on fatigue, insomnia, depression, anxiety, and sexual. A newly identified fourth group at posttreatment had the worst scores on pain, urinary irritative and incontinence, and bowel, and the second worse scores on insomnia and depression in relation to the other three groups. This fourth group was labeled “Impacted” as it appeared these men may have experienced a stronger reaction to RT compared to the other three groups, as demonstrated by their higher levels of symptoms commonly associated with this treatment.

Differences in Sample Characteristics and QOL among Subgroups

At pretreatment, there were significant subgroup differences for participant age, with men in the Adjusted and Resilient groups being older than those in the Distressed group (Table 5). Gleason scores differed by group with the Resilient group having lower scores than the Adjusted and Distressed groups. PSA levels also differed by group, with the Distressed group having significantly higher levels than the other three groups. There were significant group differences in QOL. The Resilient group had higher QOL compared to the other three groups.

At posttreatment, there were also significant differences among the groups in participant characteristics and QOL (Table 5). Differences in participant age persisted among the subgroups with the Adjusted group older in age than the Distressed group. Significant differences in income level that were not present at pretreatment were now found between the Adjusted and Distressed groups. Significant differences in Gleason scores revealed the

Distressed group had higher scores than the Resilient group. Significant differences in PSA level were also noted between the Distressed group who had higher scores when compared to the Resilient and Adjusted groups. Significant differences in QOL persisted with the Resilient group reporting greater QOL than the other three groups. There were no additional significant differences in participant or clinical characteristics at pre-or posttreatment related to the subgroups including months since diagnosed, prior prostatectomy, or comorbidities.

Transitions in Subgroup Membership

Due to the similar structure (i.e., four subgroups) observed for the symptoms at pre-and posttreatment we were able to estimate transition probabilities. The LTA model specifying a four-group solution had satisfactory fit to the data (AIC value of 10741.11, lowest BIC value of 10996.35, and entropy value of .93). Table 6 presents the transition probabilities of moving from one subgroup at pretreatment to another group at posttreatment. Membership in the Resilient, Adjusted, and Distressed groups remained relatively stable over time with 73%, 90%, and 100%, of the men respectively staying within their group. In contrast, all of the men in the Emerging group identified at pretreatment moved to another group; 66% moved to the Distressed group, 21% to the Adjusted group, and 13% to the Resilient group. Among all subgroups in which an individual moved to another group, there was a greater probability of transitioning from a pretreatment group of lower symptom reporting to a posttreatment group with higher level of symptom reporting. Logistic regression revealed the only significant predictor of a transition in group membership from pre-to posttreatment was income level (Table 7). Men with higher incomes were less likely to move to another group compared to men with lower incomes.

Discussion

Participants reported a significant increase at posttreatment in severity for many of the symptoms measured. Significantly higher levels of fatigue, pain, and insomnia following RT as found in this study have also been reported in patients undergoing RT for uterine and breast cancer.^{37,38} Consistent with earlier prostate cancer findings, results in the current study also indicated that men experienced a significant worsening in urinary, bowel, and sexual symptoms following RT.^{39,40}

Anxiety and depression did not significantly change for the sample from pre-to posttreatment. Anxiety was moderately high at pretreatment which supported statements expressed by many men that making a decision regarding treatment (prostatectomy vs. RT) was stressful, with the decision often reached close to the start of RT. Why anxiety remained moderately high at posttreatment is not known. Perhaps anxiety following treatment is now related to concerns of a different nature (e.g., treatment side-effects) than those experienced at pretreatment. Depression and anxiety were the largest contributors to the identification of pretreatment subgroups even though sample mean values for these symptoms did not significantly change overtime. This finding supports the importance of using symptom data to classify patients into subgroups to gain a more accurate representation of symptom patterns before radiation therapy begins. When reporting symptom results overtime only as sample means rather than stratifying patients into subgroups, valuable information may be

lost that would more clearly define the impact of prostate cancer on patient functioning and distress.⁴¹

Four subgroups were identified at pretreatment according to distinctly different symptom cluster patterns. The presence of a Distressed group who were high on most symptoms has been documented in several investigations of patients undergoing cancer treatment. Among patients receiving biotherapy; 7% of the sample clustered into a group characterized by significantly high levels of fatigue, pain, sleep disturbance, and depression.⁴² Breast cancer patients receiving chemotherapy and RT could also be characterized into all high subgroup with consistently elevated depression, fatigue, pain, and insomnia.⁴³ The current study demonstrates the value at pretreatment in measuring not only general symptoms but also those symptoms associated with RT (i.e., sexual, urinary, bowel problems) which help to further define the symptoms of the Distressed group as “all high”.

Men in the Distressed group were younger in age, with higher Gleason scores and PSA levels. It was not surprising younger men with professional and personal roles to meet who had greater disease severity and were starting RT that may affect sexual, urinary and bowel functioning would report higher symptom levels. QOL was also lower in the Distressed subgroup than the other three subgroups, indicating that as the number of symptoms rated as high increased, QOL was adversely affected.

Similar to prior investigations which revealed the existence of a group high on all symptoms, this study supported earlier findings which identified a second distinct subgroup at pretreatment that reported the lowest symptoms and the highest QOL.^{14,43} Specifically, the Resilient group had the lowest levels of fatigue, pain, insomnia, depression, anxiety, and sexual, urinary, and bowel problems. This subgroup which constituted almost half (46%) of the participants had the lowest Gleason scores which may relate to lower symptom reporting and higher QOL. Another explanation may involve resilience or the ability of an individual to quickly recover from stressful life circumstances. Individuals who are resilient have a greater capacity in challenging situations to rapidly regain a sense of self, physiologically and psychologically.⁴⁴ Future research into variables which may influence an individual's response to a cancer diagnosis and treatment such as coping styles and skills, social relationships, and learned resourcefulness is warranted to gain a better understanding into the defining characteristics of this subgroup.

Identification of an Adjusted subgroup consisting of older men (mean age 71 years) with moderately high sexual, urinary, and bowel symptoms and QOL was not unexpected. While reasons for an elevation in physiological symptoms are not known, it appears accommodation to these symptoms may have occurred as evidenced by low mood scores and high QOL. Accommodation may relate to findings which report that some men experience age-associated declines in erectile, urinary, and bowel functioning.⁴⁵⁻⁴⁷ In addition, research has found older men undergoing prostate cancer treatment have better mental well-being than younger men despite indicating poorer sexual and urinary functioning.⁴⁸

An Emerging subgroup with a significantly different symptom pattern has been verified elsewhere with cancer patients including Kim et al.⁴³ who identified subgroups of patients with high pain and low fatigue, and high fatigue and low pain. Groups with somewhat counterintuitive symptom levels were also revealed by Dodd et al.⁴² who reported one subgroup with mild pain and sleep disturbance, moderate fatigue, and depression, and a second subgroup characterized by mild pain and fatigue, sleep disturbance and no depression. Once again as with other identified subgroups in this study, participant characteristics, traits, or other attributes that would further define the Emerging group are lacking. Continued research into underlying physiological makers (i.e. neuroendocrine, genetic) looks promising as one explanation for level of symptom distress. In a subsample of participants from this study, our prior reported findings suggested the lack of a strong association at both pre-and posttreatment between cytokine levels and symptoms.⁴⁹

The 3 subgroups identified at posttreatment labeled as Resilient, Adjusted and Distressed were similar in symptom profile and participant characteristics to those found at pretreatment. A majority of men in the Emerging group with its pretreatment profile of low sexual, urinary and bowel symptoms had moved to an Impacted group with scores indicating a worsening in pain, urinary, and bowel symptoms. In addition, the already moderately high mood and fatigue levels reported at pretreatment for the Emerging group did not lessen from these levels for those moving into the Impacted group. Identification of a Distressed group at pretreatment (n=3) and posttreatment (n=10) suggests high levels on most symptoms may not dissipate overtime. Furthermore, some men who were not all high before the start of treatment now reported being high on most symptoms. When taken together, the symptoms of the Impacted and Distressed groups contained the worst scores on all symptoms. Similarities in the symptom profiles of these two groups suggest they may be related. Future research is needed to identify which men prior to RT may be at increased risk for these high symptom levels at posttreatment, which comprised 16% of the sample. As evident in this study, a more in-depth description of the subgroups was limited by the number of participant characteristics examined.

Income level at posttreatment significantly differentiated the subgroups between the lowest (Distressed) and highest (Adapted) income levels. Lower income levels have been linked to higher depression and somatic symptoms across different cancer types and treatments.⁵⁰ Lower income levels at posttreatment were also related to increased symptoms in women with breast cancer, with income proposed as a major factor in whether posttreatment care was accessed.⁵¹

The large number of men (83%) in the Resilience and Adapted subgroups indicates many men had high QOL and were experiencing few to no symptoms following RT. Whether this profile is found many months following prostate cancer treatment was addressed by Maliski et al.¹⁸ who reported that at eight months posttreatment, the largest number of men (48%) clustered into a group characterized by minimally low symptom scores. These men were further described as “doing well”. One reason for why symptom reporting may be lower than expected at posttreatment may be found in research which indicates men with prostate cancer who were aware of their diagnosis and treatment plan, experienced less distress than persons with other cancer types (e.g., breast, digestive, lung, gynecologic, head/neck).⁵² It

was surmised that prostate cancer treatment (surgery or RT) may have been perceived by men as a less intense type of treatment with fewer residual effects compared to other cancer diagnoses and treatments.

Research is needed to determine the relationships among income level, symptom reporting and transitions in subgroup membership. Having financial resources may assist individuals in pursuing options to mitigate distressful symptoms. For example, findings revealed Hispanic women with higher income levels receiving breast cancer treatment had greater use of complementary and alternative medicine, with results suggesting a significant relationship between depression and prayer.⁵³ Income may also be an important factor in decreasing patient symptoms at the end of life with greater symptom burden strongly linked to lower levels of wealth.⁵⁴

Study limitations include that the participants who were mostly white, married, well educated with high income levels, which restricts generalizability of the findings to men with a similar demographic profile. The small sample size and low number of men in some of the subgroups warrants the replication of these results in larger studies of men undergoing RT. Evaluating prevalence and severity of multiple symptoms in a more ethnically and economically diverse sample is recommended because symptom experiences may be significantly different. An examination of symptoms, symptom patterns, and transitions in subgroup membership for more than the two time points of pre-and posttreatment, may result in a more accurate depiction of how symptoms change during and after RT. Study strengths include the use of multi-item validated measures to assess each symptom which may have contributed to a better understanding of the components that determine a symptom's prevalence and severity. Study findings provided new insight into an understudied population who may be experiencing symptoms at baseline that are not apparent until their severity reaches recognizable levels at posttreatment. Future study to examine which subgroups respond to an intervention that targets multiple symptoms would be of value.

Men diagnosed with prostate cancer report concurrent multiple symptoms which may worsen with treatment. Our preliminary findings suggest it may be important to intervene early at baseline when patients with a cluster of moderate-to-high symptoms have been identified and in doing so, proactively lessen symptom burden before its severity can increase with RT. By assessing and intervening with men in subgroups such as Distressed and Emerging before and during treatment, the potential for remaining distressed or moving into the Impacted group may lessen. Our current ability to address multiple symptoms has been restricted by a dearth of evidenced based practice interventions that effectively target more than one symptom. Lessening the impact of concurrent symptoms before and after treatment through a greater focus on the development and testing of interventions is imperative if we are to make the cancer experience more manageable and improve QOL.

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Table 1
Demographic and Clinical Characteristics

Characteristic	Mean	SD	Range
Age (years)	69.0	8.3	50-88
Education (HS=12 years)	14.8	2.7	8-22
Comorbidities	3.4	2.2	0-11
Gleason score	7.2	1.0	5-10
PSA level (ng/ml)	8.7	7.4	.6-51
Months since diagnosed	20.6	52.8	0-276
Characteristic	n	%	
Marital Status			
Single	6	7.1	
Married	63	75.0	
Widowed	1	1.2	
Divorced	12	14.3	
Other significant relationship	2	2.4	
Ethnicity			
Native American	1	1.2	
Black, not Hispanic	2	2.4	
White	70	83.3	
Hispanic	5	6.0	
Not provided	6	7.1	
Prior prostatectomy			
Yes	24	28.6	
No	60	71.4	
Stage at diagnosis			
I	18	21.4	
II	35	41.7	
III	14	16.7	
Unknown	17	20.2	

Abbreviations: HS, high school; PSA, prostate specific antigen

Table 2
Symptom Scores at Pre -and Posttreatment (n=84)

Symptom	Pretreatment		Posttreatment	
	Mean	SD	Mean	SD
Fatigue	6.85	5.80	8.84 ^b	7.33
Pain	1.92	3.17	3.46 ^b	4.35
Insomnia	5.50	5.28	6.52 ^a	5.89
Depression	9.11	7.46	9.35	9.20
Anxiety	34.17	9.50	33.42	9.26
Sexual	41.92	31.47	28.77 ^c	27.77
Urinary irritative	86.30	14.06	68.75 ^c	22.52
Urinary incontinence	84.87	18.89	79.36 ^b	22.03
Bowel	94.84	7.91	82.93 ^c	18.19

Changes in symptom scores for the sample were calculated as the posttreatment score minus the pretreatment score.

^a $P < .05$

^b $P < .01$

^c $P < .001$

Table 3

Pretreatment Symptom Scores by Group

Symptom	Resilient (n=39)		Adjusted (n=34)		Distressed (n=3)		Emerging (n=8)		F	P
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
Fatigue	3.74	4.14	7.50	4.62	19.33	1.53	14.50	3.82	24.18	.00
Pain	1.77	3.04	1.79	3.19	5.00	5.57	2.00	2.88	.99	.40
Insomnia	2.44	2.51	6.47	4.24	19.00	5.29	11.25	5.55	29.17	.00
Depression	3.97	3.24	10.47	3.93	30.33	4.73	20.38	5.40	79.63	.00
Anxiety	28.92	5.11	34.50	7.08	57.33	5.51	49.63	5.21	42.34	.00
Sexual	58.09	28.26	25.79	25.74	25.89	31.77	32.43	32.61	8.63	.00
Urinary irritative	91.35	9.79	79.92	15.13	75.00	25.00	92.19	11.93	5.97	.00
Urinary incontinence	90.46	15.36	80.45	21.08	84.08	14.13	75.59	21.42	2.50	.07
Bowel	97.22	4.62	94.12	6.89	68.06	8.67	96.35	6.07	23.07	.00

Table 4

Posttreatment Symptom Scores by Group

Symptom	Resilient (n=32)		Adjusted (n=38)		Distressed (n=10)		Impacted (n=4)		F	P
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
Fatigue	3.53	3.83	10.83	6.70	17.40	7.28	12.00	3.37	18.62	.00
Pain	1.52	2.91	3.43	3.44	5.70	5.19	13.25	4.50	14.56	.00
Insomnia	2.69	2.73	7.35	4.98	13.20	7.61	12.75	5.91	16.51	.00
Depression	2.84	3.14	8.92	3.96	29.50	6.79	15.00	5.83	105.32	.00
Anxiety	26.44	3.74	34.76	6.16	50.60	7.24	34.00	7.87	49.04	.00
Sexual	48.65	29.42	16.00	15.49	12.08	21.31	25.00	22.57	13.06	.00
Urinary irritative	80.08	17.06	62.50	21.35	69.38	20.08	22.92	9.55	10.55	.00
Urinary incontinence	86.56	16.86	76.46	21.36	77.36	21.50	53.13	43.21	3.58	.02
Bowel	91.80	10.82	83.00	15.26	70.83	20.79	41.67	12.27	17.38	.00

Table 5
Selected Participant Characteristics and QOL: Pre-and Posttreatment Subgroups

	Resilient		Adjusted		Distressed		Emerging		F	P
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
Pretreatment										
Age	68.69	7.40	71.44	8.74	60.67	2.52	63.75	8.55	3.304	.024
Education	14.86	2.95	14.71	2.60	12.67	1.15	15.88	2.42	1.038	.381
Income ^a	6.69	2.71	7.00	3.05	5.00	1.73	6.14	3.76	.538	.658
Gleason score	6.77	.93	7.47	1.05	8.33	.58	7.38	.92	4.782	.004
PSA level	7.35	5.60	7.95	4.80	31.53	17.81	9.08	5.17	15.757	.000
FACT-P	135.58	10.69	122.45	12.63	87.50	8.50	107.73	19.10	24.11	.000
	Resilient		Adjusted		Distressed		Impacted			
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	F	P
Posttreatment										
Age	68.69	7.40	71.44	8.74	60.67	2.52	63.75	8.55	3.02	.034
Education	14.86	2.95	14.71	2.60	12.67	1.15	15.88	2.42	.25	.859
Income ^a	6.69	2.71	7.00	3.05	5.00	1.73	6.14	3.76	2.83	.044
Gleason score	6.77	.93	7.47	1.05	8.33	.58	7.38	.92	4.36	.007
PSA level	7.35	5.60	7.95	4.80	31.53	17.81	9.08	5.17	4.18	.009
FACT-P	136.42	12.27	118.13	10.75	86.87	11.92	98.25	11.53	54.15	.000

Abbreviations: Education, high school=12 years; FACT-P, Functional Assessment of Cancer Therapy-Prostate, measures QOL; PSA, prostate specific antigen.

^aIncome (annual) : 1= < \$10,000, 2= \$10,000 - 19,999, 3=\$20,000 - 29,999, 4=\$30,000 - 39,999, 5=\$40,000 - 49,999, 6=\$50,000 - 59,999, 7 = \$60,000 - 69,999, 8=\$70,000 - 79,999, 9=\$80,000 - 89,999, 10=\$90,000 - 99,999, 11=\$100,000 +.

Table 6
Transition Probabilities: Pre- and Posttreatment for All Subgroups

Pretreatment Subgroups	Posttreatment Subgroups			
	Resilient	Adjusted	Distressed	Impacted
Resilient	0.729	0.203	0.025	0.043
Adjusted	0	0.899	0.03	0.072
Distressed	0.000	0.000	1.000	0.000
Emerging	0.129	0.213	0.658	0.000

Table 7
Logistic Regression Distinguishing Subgroups with Selected Participant Characteristics and Quality of Life

Variable	β	SE	Odds Ratio
Age	-.041	.039	.960
Education	.103	.120	1.108
Income	-.245	.114 ^a	.783
Gleason score	.297	.309	1.346
PSA level	.000	.040	1.000
FACT-P	-.018	.018	.982

^a $P < .05$

Abbreviations: Education, high school=12 years; FACT-P, Functional Assessment of Cancer Therapy-Prostate, measures QOL; PSA, prostate specific antigen.