The Effects of BMI on the Development of Radiation Cystitis Onset: A Pilot Study

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Introduction

Radiation (RC) is a debilitating adverse side effect of pelvic radiation therapy and survivors of numerous cancers are at risk, such as prostate, cervical, gynecological, or colorectal cancer. Despite advancements within the field of radiation oncology, the location of the bladder makes it difficult to avoid during radiation and approx. 5-10% of cancer survivors with a history of pelvic radiation are at risk [1].
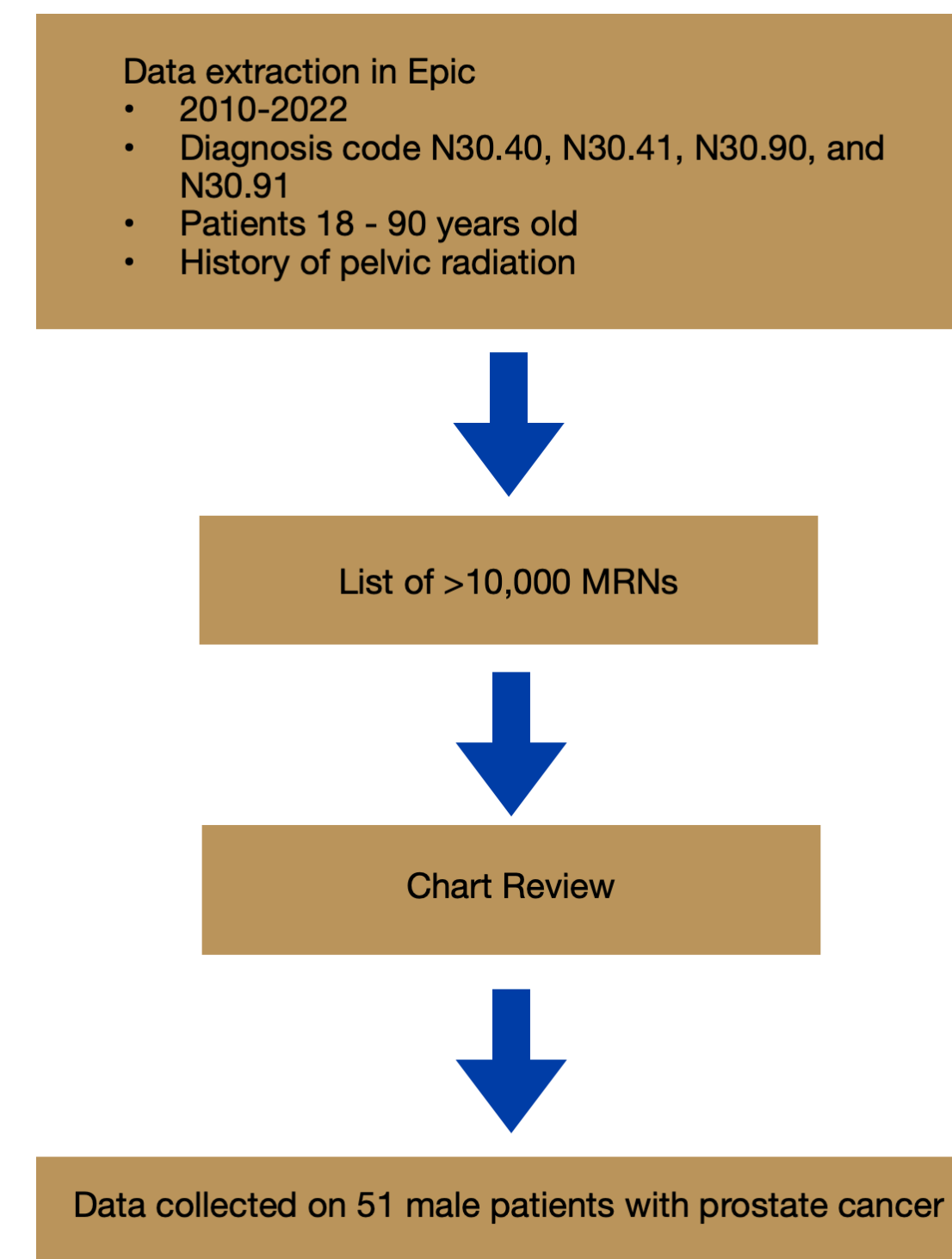
Prostate cancers survivors currently represent approx. 1/5th of all cancer survivors in the US and approx. half prostate cancer survivors that are treated with radiation therapy or surgery suffer from urinary or bowel dysfunction and development of RC increased over time [1, 2, 3]. While RC is not common, the long-term effects can be crippling. Symptoms of RC include urinary frequency, urgency, nocturia, dysuria, pelvic pain, and hematuria which can range from microscopic to gross hematuria with the passage of blood clots [4, 5]. We hope to provide more information on the risk factors of RC to help survivors and inform clinicians.

Aims and Objectives

In order to further investigate the risk factors of RC, there is a need identify common factors that may increase an individual's risk for developing RC (e.g. BMI, gender, age at radiation treatment, age at RC diagnosis, type of cancer, other cancer treatments, Diabetes status, total radiation dose, type of radiation (e.g. external beam radiation, brachytherapy, proton therapy), radiation regimen, and history of bladder disease.
- The primary goal of this pilot study is to determine if increased Body Mass Index (BMI) prior to the onset of radiation therapy effects the development of RC onset
- A secondary goal is to begin to characterize patients diagnosed with RC.

Methods

Data extraction in Epic
- 2010-2022
- Diagnosis code N30.40, N30.41, N30.90, and N30.91
- Patients 18 - 90 years old
- History of pelvic radiation

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List of >10,000 MRNs

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Chart Review

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Data collected on 51 male patients with prostate cancer

A list of patients diagnosed with RC between 2010-2022 using the diagnosis codes: N30.40 and N30.41: radiation cystitis with and without hematuria, and N30.90 and N30.91: cystitis, undefined with and without hematuria, was extracted from EPIC. From this list of over 10,000 patient medical record numbers (MRNs), 132 male patients between the ages of 18 and 90, with a diagnosis of prostate cancer and history of pelvic radiation, were investigated through retrospective chart review. BMI and RC onset was available and collected for 51 patients. Patients were divided into two groups based on when they developed RC, within 5 years of the start of radiation therapy or after 5 years from the start of radiation therapy and their initial BMIs were evaluated. BMI at the start of radiation therapy was classified using the CDC BMI groups: 18.5-24.9 is considered healthy weight, 25.0-29.9 is overweight, and ≥30.0 is obese.

Observed Frequencies			
RC Onset	BMI at the Start of Radiation		
	Healthy	Overweight	Obese
< 5 years	6	12	10
> 5 years	4	7	12

Table 1: Observed Frequencies of Demographic Data

Results
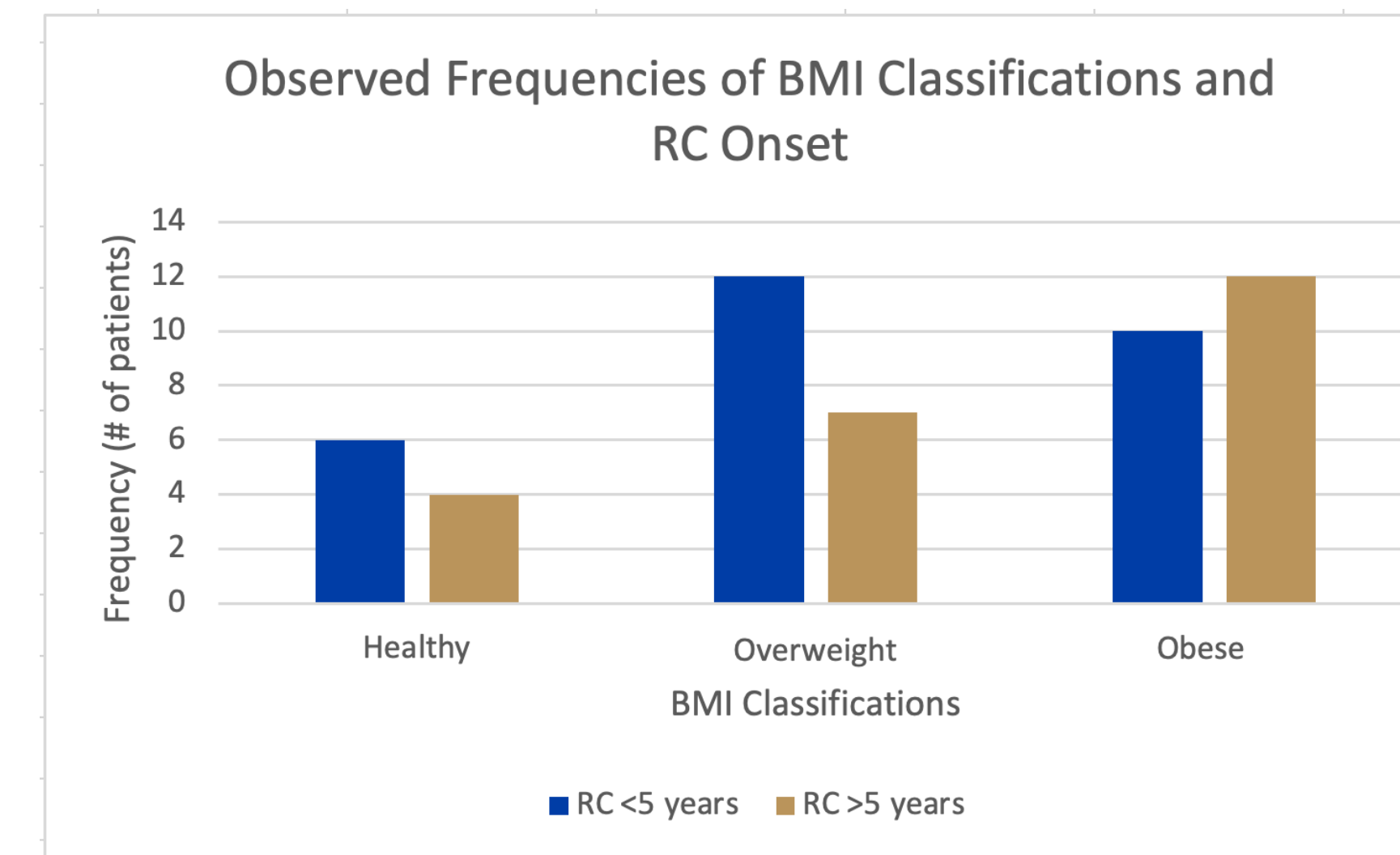

Observed Frequencies of BMI Classifications and RC Onset

Fig 1: No significant difference was found between RC onset and BMI at time of radiation, p = 0.38.

ANOVA Comparing Intial BMI Classifications to RC Onset					
SUMMARY					
Groups	Count	Sum	Average	Variance	
Healthy	10	42.5805556	4.25805556	7.6910673	
Overweight	19	98.6555556	5.19239766	10.8324201	
Obese	22	134.872222	6.13055556	17.3375426	
ANOVA					
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	25.5910603	2	12.7955301	0.97754845	0.38359625	3.19072734
Within Groups	628.291563	48	13.0894076			
Total	653.882623	50				

Table 2: ANOVA Analysis

A chi-squared test of independence showed no significant association between initial BMI and onset of RC, $X^2(2, N= 51) = 1.42$, $p= 0.49$. Among patients with an initial BMI classified as healthy ($M= 4.26$, $SD= 2.77$), overweight ($M= 5.19$, $SD= 3.29$), and obese ($M= 6.13$, $SD= 4.16$) there was no significant difference in onset of RC ($F(2, 28) = [0.978]$, $p = 0.38$).
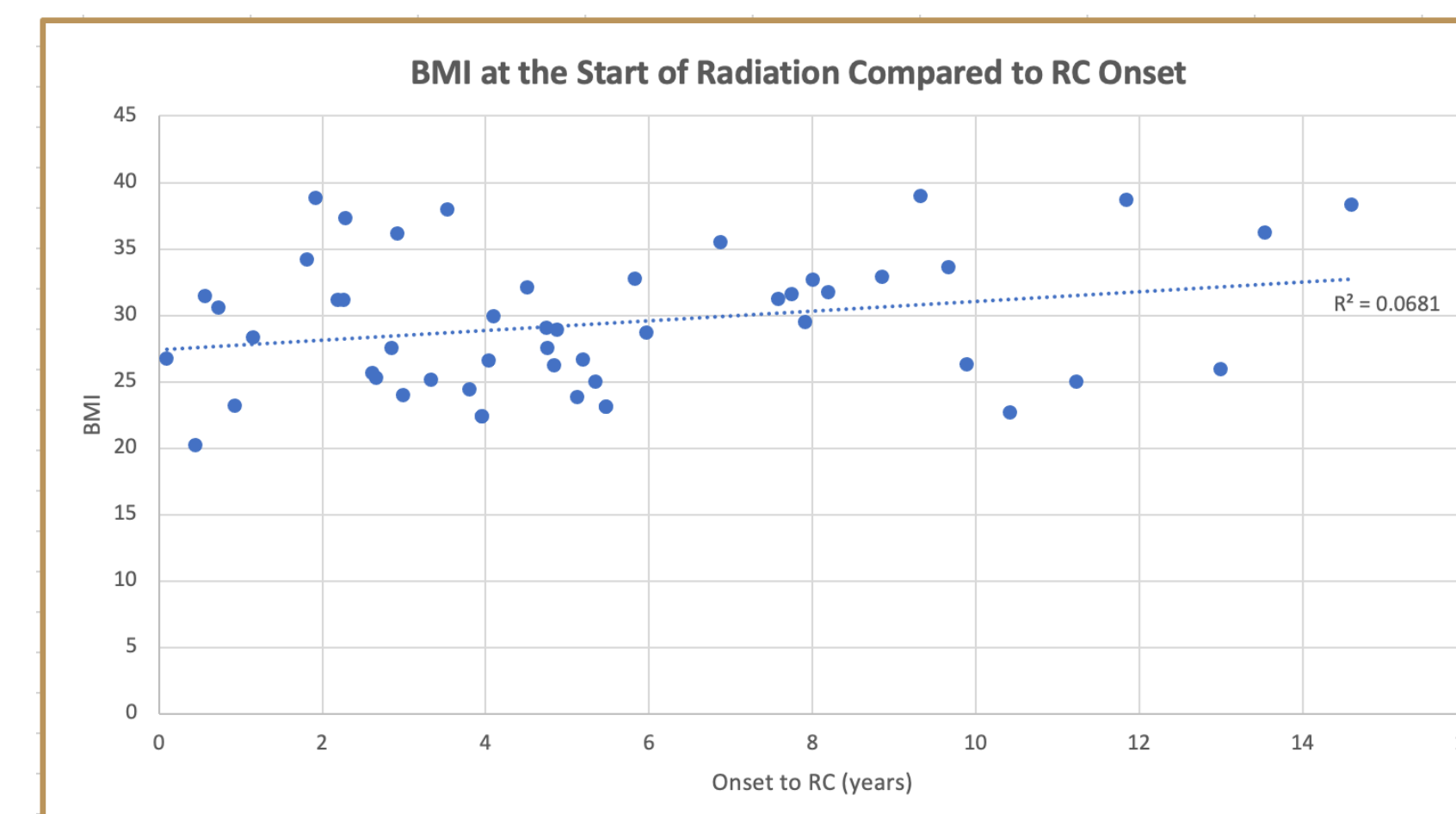

BMI at the Start of Radiation Compared to RC Onset

Fig 2: No association was found between BMI at time of radiation and duration of RC onset. Correlation coefficient = 0.0681; p = 0.49.

Conclusions

The results do not support the hypothesis that increased BMI prior to the onset of radiation therapy, increases the risk of earlier RC development. Of note, these results are limited due to data constraints and a limited sample size of 51 patients. Chart review and data collection ended up providing increased challenges and information on the details of radiation, and even BMI, were often not available because radiation was performed prior to electronic chart establishment or patient's radiation treatments were performed outside the Beaumont Health system. There also exists potential confounding variables among this that, including: diabetes status, other comorbidities, and the type and dosage of radiation regimen. Given the limited capacity of this study, but the need for more research in this pressing area of medicine, further investigation is encouraged.

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Acknowledgements

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