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The Association of Nocturia with Incident Falls in an Elderly Community-Dwelling Cohort

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The Association of Nocturia with Incident Falls in an Elderly Community-Dwelling Cohort

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An abstract of
A thesis submitted to the Faculty of the Graduate School of Emory University
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Abstract
The Association of Nocturia with Incident Falls in an Elderly Community-Dwelling Cohort
By Elizabeth Camille Pedigo Vaughan

Introduction: Nocturia, waking at night to void, increases in prevalence with increasing age. In a cross-sectional study of older, community-dwelling adults, nocturia was associated with a nearly two-fold increased risk of falling. No longitudinal, population-based studies examining the relationship of nocturia to falls have been reported. Methods: The University of Alabama at Birmingham Study of Aging is a prospective cohort study of 1000 community-dwelling older adults to examine risk factors for impaired mobility. Subjects were recruited from a stratified, random sample of Medicare beneficiaries to include equal numbers of black women, black men, white women and white men. Nocturia was assessed at baseline and falls were assessed at baseline and every 6 months. Data were obtained with the questions: 'How many times do you usually get up at night to urinate?' and 'In the past year/6 months have you fallen?' The analysis in this study was limited to those reporting no fall in the 12 months prior to baseline. Results: 692 individuals (mean age 74.5±6.2, 48% female, 52% black) did not fall in the 12 months prior to baseline. Of these, 214 reported at least one fall during 3 years of follow-up. Fallers and non-fallers did not differ in the diagnoses of hypertension, stroke, or orthostatic hypotension. Fallers were more likely diabetic, but diabetes was not a risk factor for falls in the final model. In unadjusted analysis, ≥ 3 nightly episodes of nocturia was associated with incident falls (RR=1.27, 95% CI (1.01-1.60)). After logistic regression controlling for age, gender, race, and gait speed, ≥ 3 episodes of nocturia was associated with an increased risk of falling (RR=1.26,(1.01-1.59)). Discussion: In a racially diverse, community-based sample of older adults who had not fallen in the past year, nocturia ≥ 3 times a night was associated in multivariable analysis with a 25% increased risk of an incident fall within 3 years. Controlling for gait speed-a marker of impaired mobility previously associated with accidental falls-had little impact on the effect size. While this study has several advantages over previous reports (longitudinal follow-up, performance-based measures of function, population-based sampling), causality cannot be ascertained.

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INTRODUCTION

Geriatric syndromes are conditions that are not attributable to a single disease process (1). Examples of these conditions that are highly prevalent in older populations include: accidental falls; urinary incontinence; delirium; syncope; and frailty. Geriatric syndromes have in common that there are multiple underlying risk factors (often shared risk factors) for these conditions and that multiple organ systems contribute to their pathogenesis. Geriatric syndromes reduce quality of life and result in disability. They often lead to changes in levels of assistance needed and can lead to institutionalization and even increased mortality.

Many clinical intervention studies target a single risk factor, often in the context of a randomized controlled trial. Clinical trials utilizing a single intervention may not result in a statistically significant reduction of an event resulting from multiple causes such as geriatric syndromes. From a research perspective, identifying highly prevalent risk factors for geriatric syndromes is the necessary first step in developing clinical interventions. Once risk factors have been identified, a multicomponent trial design that addresses the multifactorial nature of geriatric syndromes can be used to reduce the incidence of events. This approach has been successfully used with syndromes such as falls and delirium (2, 3). In order to select interventions that have a high likelihood of impacting the outcome in a multicomponent study, the investigator must have an understanding of the relationship between different risk factors and the clinical outcome, as well as the prevalence of those factors in the population, and how multiple factors may interact (1, 4). Population-based cohort studies with longitudinal follow-up provide volumes of data that can direct development of multicomponent intervention trials to improve the health of elderly persons.

A fall is defined by the World Health Organization as, "an event, which results in a person coming to rest inadvertently on the ground or other lower level (5)." Thus, a fall may result from a fall to the floor, but could also indicate a fall onto a bed or into a chair. Falls occur

in over one-third of persons 65 years of age or older each year (6). Approximately one in ten accidental falls result in an injury such as hip fracture, serious soft tissue injury, or subdural hematoma (7, 8). As a geriatric syndrome, multiple, modifiable risk factors for falls have been identified including gait abnormality, orthostatic hypotension, polypharmacy, impaired vision, cognitive decline, and impaired proprioception. In addition, urge urinary incontinence has been identified in some studies as a risk factor for falling (6, 9-13). In one recent study the authors postulated that nocturia (*waking from sleep at night to void* (14)) could be an important component of the association between urge urinary incontinence and incident falls (13). Nocturia has previously been associated with falls in a retrospective, cross-sectional study of older adults living in a retirement community in Florida (15). A second retrospective analysis assessed the association of frequent nocturia with hip fractures that occurred in the previous 5-year period (16). No prospective, population-based cohort studies of community-dwelling elderly have evaluated the association of nocturia with incident falls. This current study will examine the association between nocturia and subsequent accidental falls through a prospective, cohort study design.

BACKGROUND

The traditional model of disease involves a linear sequence of risk factor exposure which leads to early disease development and progresses to late disease. Intervention studies aim to prevent or modify the consequences of the single risk factor. As the understanding of complex disease pathogenesis has been gained, such as in oncologic research, this traditional model has not been sufficient to guide investigators considering effective therapies. A new model of disease progression, termed a concentric model, has been proposed in which multiple risk factors contribute through distinct pathways to impact disease progression (17). Building upon this concept of a concentric model, Inouye et al. suggest the *interactive concentric model* as a framework for conceptualizing the development of multicomponent intervention trials to address geriatric syndromes (1). An interactive concentric model defines a system in which multiple risk factors not only impact the development of a clinical phenotype through independent pathways, but some of those pathways interact leading to a synergistic or compound effect. Risk factor synergisms are targets which may lead to greater reductions in the burden of disease than targeting single risk factors or ignoring risk factors that are synergistic.

Previous studies have suggested that there are multiple factors that increase the risk of falling among elderly persons. Applying the interactive concentric model, risk factors such as age, gait abnormality, and poor vision could represent distinct risk pathways leading to falls. Risk factors such as orthostatic hypotension and polypharmacy could lead to pathways that coalesce. Both of these paths could be the result of conditions such as hypertension or diabetes that also increase the risk for the presence of nocturia. Thus, nocturia, while it could represent a distinct pathway of increased risk, might also represent a pathway of synergistic risk defined through an interactive concentric model.

Population-based cross-sectional studies suggest that the prevalence of nocturia at least two times per night increases with age. A study from Finland suggested that the increase in prevalence with age occurs more dramatically in men, while a study from the United States did

not show significant difference between genders in the increase of nocturia prevalence associated with age (18, 19). These studies suggest the population-based prevalence of nocturia at least twice a night is between 12-14%. Among individuals older than 60, the prevalence of at least two episodes of nocturia is between 25% and 45%. While nocturia is not generally considered a geriatric syndrome, nocturia is highly prevalent in the older population, has multiple underlying risk factors, (often shared risk factors) and multiple organ systems that contribute to their pathogenesis. Risk factors for nocturia include: benign prostatic hyperplasia in men, overactive bladder syndrome, nocturnal polyuria, obesity, diabetes mellitus, hypertension, vascular disease, chronic kidney disease, and sleep disorders (20-23). Individuals with nocturia may have one risk factor, but more commonly multiple risk factors for nocturia are present, particularly in persons over the age of 65.

The first study to examine the association between nocturia and falls, using accepted definitions for both, found that nocturia two to three times a night increased the odds of falling by 1.84 after adjustment for age and gender. Nocturia occurring three or more times a night more than doubled the odds of falling (15). As a cross-sectional study in a single retirement community, these results may not be generalizable to a more diverse population. In addition, the study was unable to control for measures of function and relied upon recalled falls in the year prior to the assessment, so it was possible for the outcome variable – *a fall* – to precede the predictor event – *nocturia*. Another retrospective study examined the association of nocturnal polyuria, nocturia, and hip fractures in an elderly, community-dwelling cohort in Finland and found increased odds of hip fracture with both increased nocturnal voided volumes and nocturia at least three times a night(16). This retrospective analysis queried baseline voiding patterns and reported falls from the previous five years; this long of a recall period could introduce significant imprecision. This statistical analysis also failed to control for age. A subsequent study published as an abstract, provided longitudinal follow-up in a Japanese cohort of community-dwelling elderly observed an association between nocturia and an increased risk of fall-related fractures

within 3 years (HR 2.63) associated with 2 or more episodes of nocturia (24). The analysis was adjusted for age, sex, body mass index, and a measure of physical activity. While this study did present longitudinal follow-up data, the number of events was relatively small (23 total events) as the investigators relied upon national health system data documenting fall-related fractures for outcome verification.

Data from a community-dwelling cohort of elderly with longitudinal follow-up would provide important data regarding the association of nocturia and falls as investigators continue to refine multicomponent interventions to address this troublesome geriatric syndrome. The University of Alabama at Birmingham (UAB) began enrolling elderly individuals into the Study of Aging in 1999 and researchers have continued to contact participants every 6 months for nearly ten years. This data set, which includes important data on lower urinary tract symptoms and variables related to function including accidental falls, allows for prospective follow-up to assess the association between nocturia and subsequent accidental falls.

METHODS

Data from the UAB Study of Aging, a longitudinal, prospective cohort study of community-dwelling elderly were used to investigate the following <u>null hypothesis</u>: *The risk of an incident fall associated with an increased frequency of nocturia (3 or more episodes nightly) will be the same as the risk of an incident fall associated with 2 or fewer episodes of nocturia in a racially diverse, community-based cohort of elderly persons with no history of a prior fall.*

Subjects

The subject population of the UAB Study of Aging includes 1000 individuals 65 years of age and older from five counties in west central Alabama, including three rural counties and two urban counties. The participants were randomly selected from Medicare beneficiary lists stratified by race and gender so that the cohort includes equal numbers of men and women, black and white, and urban or rural residence. Persons unable to understand the recruiter, those residing in nursing homes, or those who were unable to independently coordinate an appointment for the baseline, in-home interview were excluded. Written informed consent was obtained prior to beginning study procedures. All study procedures were approved by the Institutional Review Board at UAB.

The primary outcome of the UAB Study of Aging is to assess risk factors for impaired mobility in aging persons. The study enrolled subjects between 1999 and 2001 and is currently ongoing. A two-hour, in-home assessment was performed at baseline that included a medical history, cognitive screening test, screening for depression, assessment of activities of daily living, and questions regarding multiple facets of functional status, as well as a basic physical exam and three standardized measures of physical performance (gait speed, standing balance, and the ability to rise from a chair). Individuals were also asked to report if they had fallen in the year prior to the baseline assessment.

Measurements

Primary Outcome Variable - Falls

Incident falls were assessed at each 6-month follow-up telephone encounter through the question, "Have you fallen in the last six months?" Persons were also queried regarding injuries or medical care that resulted from a fall. If more than one fall occurred, participants were asked if the last fall occurred in the first or latter 3 months of the recall period. Once a fall was recorded, a person was identified as a 'faller' in the outcome analysis. Thus, the number of 'fallers' reflects the number of individuals who fell at least once during the 36 months of follow-up and not a cumulative number of falls that occurred.

Predictor Variables

The nocturia variable was assessed using the following question: "How many times do you usually get up at night to urinate?" The wording of the question shows strong agreement with International Continence Society definition of nocturia as *waking at night to void* (14). Persons were asked to record an integer value. Nocturia was assessed at the baseline assessment only.

Medical diagnoses of interest included hypertension, diabetes mellitus, a previous cerebrovascular accident (stroke), congestive heart failure, obesity, and orthostatic hypotension. Medical conditions included in the analysis were those that were verified in one of three ways: confirmation of a medication prescribed to treat the condition, a primary care provider note verifying the diagnosis, or hospital discharge records confirming the diagnosis. Height and weight measurements were used to determine the body mass index (BMI) for each participant. A BMI of greater than 30 was considered obese. Orthostatic blood pressure measurements were taken at the baseline assessment in a sitting position and after standing for three minutes. Subjects were deemed to have orthostatic hypotension if the systolic blood pressure decreased by at least 20 millimeters of mercury or the diastolic blood pressure dropped by at least 10 millimeters of mercury after changing position from sitting to standing. Medications included in

the analysis were benzodiazepines and diuretics. Diuretic medications included potassium-sparing, loop, and thiazide diuretics.

While several measurements of mobility were assessed, the measure utilized in this analysis was timed gait speed. Individuals were asked to walk at their normal pace for 2.7 meters or 9 feet. Subjects were timed during 2 walks, and the faster of the 2 walks was recorded for analysis. Times for the 2.7 meter walk were determined in a previous study (25) and a gait speed of 2.7 meters in 3.5 seconds or less was considered normal.

Statistical Analysis

For this secondary data analysis, the investigator was given access to the first 36 months of data collected for each participant. Because a previous history of falling is known to be a very strong risk factor for a future fall (26) and many potential confounders could be present within individuals with a previous history of falling that might further impact the relationship of nocturia and falls, this analysis was limited to those individuals reporting <u>no falls</u> in the 12 months prior to the baseline assessment.

Initial descriptive analyses included examining the frequency of nocturia and age, as well as race and gender proportions within the cohort. The frequencies of selected predictor variables were also determined among both fallers and non-fallers. Because the absolute numbers of participants experiencing each consecutive frequency of nightly nocturia significantly subdivided the selected population and to correlate with clinically significant definitions of nocturia frequency, the nocturia variable was dichotomized. The univariate association of incident fall risk and nocturia was assessed comparing nocturia 2 or more times a night to less than 2 episodes a night. Univariate analysis was also performed comparing 3 or more episodes of nocturia to less than 3 episodes nightly. Following descriptive analyses assessing the frequency of variables of interest, chi square tests were utilized to evaluate significant differences in the proportion of fallers and non-fallers with each of the selected characteristics.

Logistic regression was utilized to assess the association of nocturia with the outcome of an incident fall during the 36 months of follow-up. Analyses were performed using SAS 9.1 (SAS Institute, Cary, NC). The first model assessing the association between nocturia 3 times nightly or more frequently and incident falls was adjusted for race, gender, and age. Subsequent modeling utilized backward and forward selection with a significance level of 0.05 to assess possible confounding variables including hypertension, diabetes, and diuretic use. Adjusting for an abnormally slow gait speed was the only additional variable in the final model.

Interaction was assessed initially in univariate analyses using the Breslow-Day Test for Heterogeneity to detect any possible interaction of variables with the risk factor of nocturia 3 or more times nightly. Interaction was further assessed in logistic regression modeling by including a product term for nocturia and either race, gender, or age. Likelihood estimates from the models with and without the interaction terms were compared using a likelihood ratio test with a chi-square distribution.

RESULTS

While 1000 individuals were recruited for the Study of Aging cohort, there were only 692 that reported no falls in the 12 months prior to the baseline assessment; these 692 respondents comprised the population for analysis. Of these individuals, 332 (48%) were female and 358 (52%) reported their race as black. Response to the nocturia question was missing for 12 individuals at baseline. Two hundred and fourteen (30.9%) individuals fell during the 36 months of follow-up and are referred to as 'fallers'. Missing data on falls was uncommon at the first 6-month follow-up assessment (5%) and highest at the 36-month follow-up assessment (18%).

Table 1 reveals the proportion of fallers and non-fallers with exposure to variables examined at baseline including: age, divided into 4 different age categories (65-74, 75-79, 80-84, and 85+), gender, race, comorbid medical conditions (hypertension, diabetes mellitus, congestive heart failure, history of cerebrovascular disease, orthostatic hypotension), use of benzodiazepines, diuretic use, obesity, and gait speed. Fallers were more likely than non-fallers to be 85 years or older, female, have a diagnosis of diabetes, use benzodiazepines or diuretics, and have an abnormally slow gait speed at the baseline assessment. Figure 1 reveals the frequency of nightly nocturia among the cohort. Fifty-six percent of the cohort experienced 2 or more episodes of nocturia nightly with nearly 30% of the cohort experiencing 3 or more episodes of nocturia each night. Table 2 indicates the relative risk of falling with increasing frequency of nocturia as a continuous variable. While the confidence intervals are not significant, the number of persons within each group is relatively small. The nocturia variable was further analyzed as a dichotomous variable by categorizing nocturia that occurred at least 2 times per night and nocturia that occurred at least 3 times per night. Fallers were more likely than non-fallers to have 3 or more episodes of nocturia nightly (33.8% vs. 26.4%, p-value 0.048).

Nocturia that was reported 3 or more times a night was associated with a 1.27, 95% CI (1.01 – 1.60) increase in the risk of an incident fall in univariate analysis (Table 3). After analysis using logistic regression modeling, with adjustment for age, gender, and race, the effect

of nocturia remained at 1.28, 95% CI (1.02 – 1.61) (Table 4). Further adjustment for an

abnormally slow gait speed revealed a relative risk of an incident fall associated with 3 or more

episodes of nocturia of 1.26, 95% CI (1.01 – 1.59) (Table 5).

Tests of interaction were performed to determine any differential in the association

between nocturia and falls between strata for age, gender, and race. In univariate analysis the

Breslow-Day Test was statistically significant for one age group, aged 80-84, indicating effect

modification of nocturia at least 3 times nightly and fall risk within this age group compared to

the other age groups. Although not statistically significant, the odds ratio for falling among black

subjects with nocturia 3 or more times nightly in univariate analysis was 1.97 while it was 1.04

among whites (Table 6). In logistic regression analysis, after adjusting for age, race, gender,

nocturia, and gait sped, the likelihood ratio test was also statistically significant for a product term

included for nocturia and age 80-84 with a p-value of 0.008. A product term for the effect of

nocturia and race was not statistically significant with a p-value of 0.07 to assess for effect

modification by race after adjustment for other factors.

DISCUSSION

After selecting those without a fall in the year prior to the baseline assessment, the fallers and non-fallers were relatively similar in comorbid disease history, only differing slightly in the prevalence of diabetes mellitus which may indicate the importance of controlling for a prior history of falls to accurately assess other important risk factors. The prevalence of nocturia at least two times a night was higher than previous reports. This may reflect the advanced age of the cohort. While there was a trend toward an increased risk of falls with increasing frequency of nightly nocturia, the small number of participants in each group likely did not provide adequate sample size to fully assess a 'dose-response' effect. Nocturia at least three times a night was associated with an approximately 27% increased risk of falling. Even after adjusting for age, race, gender, and a marker of impaired mobility (abnormally slow gait speed), the effect size did not change significantly. Although statistically significant, the clinical significance of effect modification for nocturia in one age group, age 80-84 compared to the other age groups is questionable. This could indicate nocturia has a greater impact on the risk of falling in older, frailer individuals. While the test for interaction was not significant in the 85 and older age group, there were very few individuals in this group with both frequent nocturia and an incident fall which greatly limited the statistical power to detect interaction. While an assessment of difference in the effect of nocturia to increase the risk of falls between black and white participants was not statistically significant, there was a trend toward significance suggesting that frequent nocturia may have a greater impact on fall risk in black individuals compared to white individuals.

While some overlap in the geriatric syndromes of urinary incontinence and falls has been noted previously, teasing out this relationship can be challenging in studies. A previous study of urge urinary incontinence found a similar effect size of a 26% increased odds of falling among women with urge UI although the authors suspected nocturia could be a contributing factor (13).

The current analysis adds to the literature by further assessing the relationship of nocturia with falls in persons without a history of previous falls.

The current analysis has several advantages over previous studies. The UAB Study of Aging represents a racially diverse, community-based sample of elderly adults that have been followed longitudinally. Detection of a significant association between frequent nocturia and incident falls is further strengthened by the relatively conservative statistical analysis plan. By limiting the analysis to those individuals who did not report a fall in the 12 months prior to baseline, which is a major risk factor for falls, the error introduced by this significant confounding variable was greatly reduced. All subjects underwent performance-based measures of function at baseline allowing for control in the adjusted analysis of an assessment of mobility previously associated with increased fall risk. Comorbid medical diagnoses, which were considered as possible confounding variables, were verified through review of medical records or contact with the individual's primary care provider. Follow-up was fairly complete as evidenced by minimal missing data throughout the 36 months of reporting.

This study could be strengthened by including a reassessment of the nocturia variable at another time point as there may have been some variability in the occurrence of nocturia. Those with persistently frequent nocturia might have different risk than those with variable nocturia. While this analysis seeks to assess for the association of nocturia and incident falls, no causal relationship can be directly inferred. Information regarding the timing of falls (i.e. night vs. day) or events surrounding falls was not obtained.

Previous research studies of interventions to reduce the risk of falls in older individuals have highlighted the importance of a multicomponent approach to address multiple synergistic risk factors. Nocturia could represent a marker of increased frailty as it may be the consequence of other medical conditions such as chronic kidney disease, long-standing hypertension, diabetes, or polypharmacy. The act of repeatedly arising from bed to void may also present a risk factor for falling as an individual repeatedly ambulates to the bathroom in a dark or dimly lit room.

Nocturia plausibly could result in daytime falls through the sleep deprivation that can occur from multiple awakenings at night. Further research is warranted to consider the possibility of addressing nocturia as part of a multicomponent approach to reduce fall risk.

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Table 1: Baseline characteristics of fallers and non-fallers

Variable	Fallers (N=214) Number Percent		Non-Fallers (N=478) Number Percent		X^2	p-value
Age 65-74	99	46.3	284	59.4	10.35	**0.001**
Age 75-79	57	26.6	106	22.1	1.63	0.20
Age 80-84	29	13.6	54	11.3	0.71	0.39
Age 85+	29	13.6	34	7.1	7.4	**0.007**
Race – Black White	103 111	48.1	255 223	53.3	1.61	0.2
Gender – Female Male	124 90	57.9	208 270	43.5	12.33	**<0.001**
HTN	157	73.3	327	68.4	1.73	0.19
DM	58	27.1	97	20.3	3.94	**0.047**
CHF	29	13.6	79	16.5	1.40	0.24
CVA	23	10.7	44	9.2	0.40	0.53
Orthostatic Hypotension	9	4.2	24	5.0	0.22	0.64
Benzodiazepine use	27	12.6	26	5.4	10.77	**0.001**
Obesity	73	34.1	136	28.5	2.25	0.13
Diuretic use	96	44.9	175	36.6	4.22	**0.04**
Gait Speed (abnormal)	188	87.9	367	76.8	11.4	**0.001**

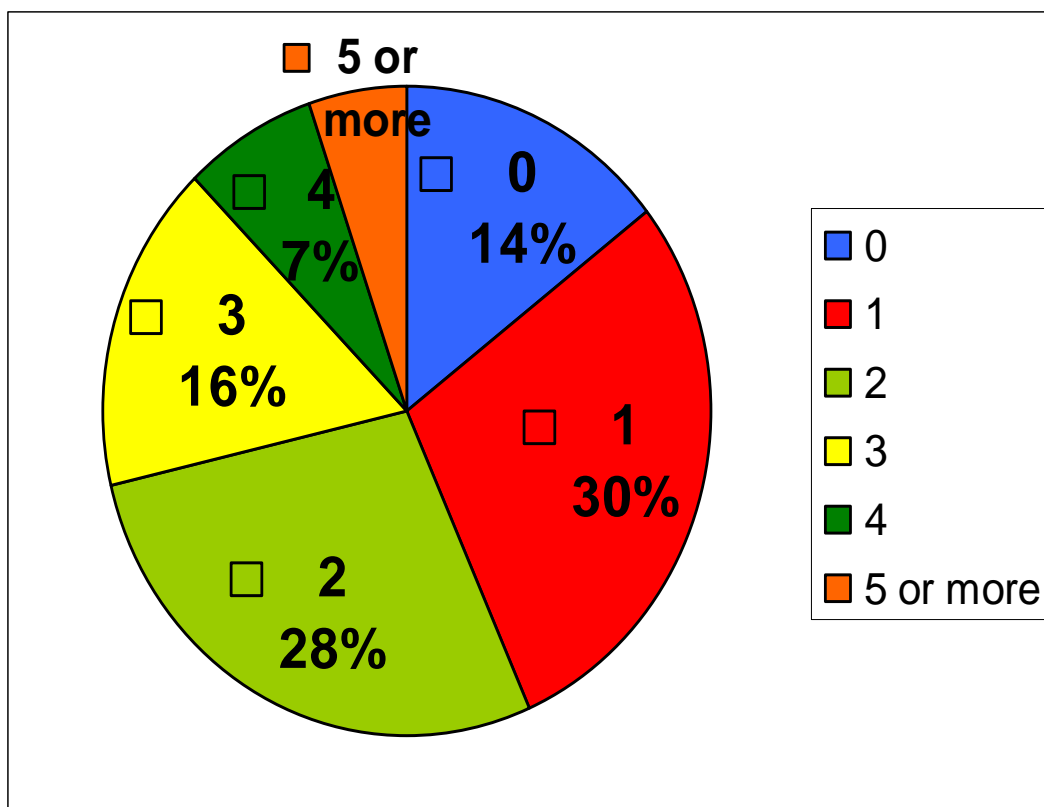Figure 1: Nocturia variable – Frequency (self-reported nightly episodes)

Table 2: Nocturia variable – Relative risk for falling associated with increasing frequency of nocturia

Increasing Frequency of Nightly Nocturia (N= participants with this level of frequency)	Relative Risk **(compared to no nocturia)**	95% Confidence Interval
One episode (N=197)	0.77	(0.58 – 1.00)
Two episodes (N=190)	0.89	(0.69 – 1.16)
Three episodes (N=111)	1.14	(0.85 – 1.53)
Four episodes (N=49)	1.28	(0.88 – 1.86)
Five or more episodes (N=35)	1.21	(0.77 – 1.90)

Table 3: Univariate association of significant variables (RR) with falls during 36 months of follow-up
(Total N=692) Falls: 214, No Falls: 478

Variable	Relative Risk	95% Confidence Interval
Nocturia 3 or more times (N=680)	**1.27**	**(1.01 – 1.60)**
Compared to age 65-74 Age – 75-79	1.18	(0.92 – 1.51)
Age – 80-84	1.15	(0.84 – 1.58)
Age – 85+	**1.57**	**(1.17 – 2.1)**
Gender- Female vs. Male	**1.49**	**(1.19 – 1.87)**
Race – Black vs. White	0.87	(0.69 – 1.08)
Diabetes	**1.29**	**(1.01 – 1.64)**
Gait speed (slow vs. normal)	**1.78**	**(1.24 – 2.57)**

Table 4: Results of logistic regression – Risk of falling within 36 months of follow-up based on exposure variables

Variable	Beta	Standard Error	Relative Risk	95% Confidence Interval
Nocturia 3 or more times (N=680)	0.2504	0.1167	**1.28**	**(1.02 – 1.61)**
Compared to age 65-74 Age – 75-79	0.2669	0.1364	1.31	(0.99 – 1.71)
Age – 80-84	0.3318	0.1713	1.39	(0.99 – 1.95)
Age – 85+	0.5424	0.1603	1.72	(1.26 – 2.36)
Gender – Female Male	0.3986	0.1154	1.49	(1.19 – 1.87)
Race – Black White	-0.1899	0.1121	0.83	(0.66 – 1.03)

Table 5: Results of logistic regression – Risk of falling within 36 months of follow-up based on exposure variables after analysis of factors by backward/forward elimination

Variable	Beta	Standard Error	Relative Risk	95% Confidence Interval
Nocturia 3 or more times (N=680)	0.2347	0.1154	**1.26**	**(1.01 – 1.59)**
Compared to age 65-74 Age – 75-79	0.2339	0.1354	1.26	(0.97 – 1.65)
Age – 80-84	0.2918	0.1707	1.34	(0.96 – 1.87)
Age – 85+	0.4791	0.1599	1.61	(1.18 – 2.21)
Gender - female vs. male	0.3666	0.1153	1.44	(1.15 – 1.81)
Race – Black vs. White	-0.2378	0.1123	0.79	(0.63 – 0.98)
Gait speed – slow vs. normal	0.4677	0.1875	1.60	(1.11 – 2.31)

Table 6: Assessment of variables interacting with the association of nocturia more than 3 times a night and odds of falls

Variable	Stratum 1 Odds Ratio (Variable =0)	Stratum 2 Odds Ratio (Variable =1)	ORmh*	95%C.I.	p-value**
Age 65 -74	1.35	1.44	1.39	(0.98 – 1.99)	0.85
Age 75-79	1.65	0.91	1.41	(0.99 – 2.01)	0.15
Age 80-84	**1.21**	**4.10**			**0.02**
Age 85+	1.49	0.86	1.40	(0.99 – 2.00)	0.34
Race – Black (Variable = 1) vs. White	**1.04**	**1.97**	**1.50**	**(1.05 – 2.15)**	**0.09**
Gender- Female vs. Male	1.41	1.56	1.48	(1.04 – 2.12)	0.78
HTN	1.04	1.50	1.39	(0.97 – 1.99)	0.42
DM	1.53	1.06	1.39	(0.97 – 1.97)	0.37
Abnormal gait (slow vs. normal)	0.66	1.49	1.37	(0.95 – 1.95)	0.19
Diuretic	1.37	1.39	1.38	(0.97 – 1.97)	0.96

ORmh – Mantel-Haenszel OR; p-value for Breslow-Day test