The Prognostic Implications of Night Sweats in Two Cohorts of Older Patients

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Background: **When asked, a significant number of patients report having experienced night sweats. Those who do are more likely to report decreased physical health, mental health, and quality of life. In most cases the cause of night sweats is unknown. We therefore do not know how much to worry about patients with this symptom. The present study examined associations between night sweats and mortality.**

Methods: **We used logistic regression and proportional hazards analyses to investigate potential predictors of mortality, including night sweats reported at baseline, among 2 different cohorts of people older than 65 years of age (n = 682 and n = 852) who were followed for an average of 7.3 and 7.5 years, respectively.**

Results: **Patients who reported night sweats were not more likely to die or to die sooner than those who did not report night sweats after controlling for age, sex, body mass index, education, and income. This held true as well for patients who reported more severe night sweats among the cohort in which the severity of night sweats was quantified.**

Conclusions: **Patients who report night sweats on a primary care health history questionnaire do not seem, on average, to be at increased risk for mortality. (J Am Board Fam Med 2010;23:97–103.)**

Several published studies have examined the epidemiology of night sweats ("sweating during the night even when it isn't excessively hot in your bedroom") among primary care patients, demonstrating that it is both common and underreported. Approximately 40% of consecutive adult patients visiting a primary care clinician[1] and 10 to 20% of older adults registered with a primary care practice reported having experienced night sweats during the past month.[2] Women are only slightly more likely to be affected than men. Only 12% of all patients with night sweats, and only 47% of patients with severe (soaking) night sweats, have ever reported the symptom to their primary care clinicians. Prevalence rates of 41%, 41%, and 16% have been reported in gastroenterology clinic patients; patients admitted to a university hospital (medicine, surgery, obstetrics, and gynecology units); and hospice patients, respectively.[3–5]

On average, patients with night sweats report lower general health and health-related quality of life (per the self-administered version of the Quality of Well Being Scale), mental health, and physical and social functioning (per the Medical Outcomes Study Short-Form 36) than do those without night sweats, after controlling for age, sex, education, income, and race.[2] The night sweats are bothersome to a bed partner in at least 10% of cases.[1]

Night sweats are associated with many other symptoms, including but not limited to symptoms of anxiety (eg, feeling nervous or fretful, being a nervous person, having nervous spells) and depression (eg, feeling down in the dumps); symptoms of sensory impairment (eg, impaired hearing, impaired vision, numbness of extremities); pain (eg, muscle cramps); and subjective sleep disturbances (eg, daytime tiredness, waking up with a bitter taste in mouth, legs jerk during sleep, and awakening with pain during the night).[2,6,7] Adults with night sweats also seem to be more likely to use selective serotonin reuptake inhibitors, tricyclic antidepressants, other antidepressants, antihistamines, or alcohol.[1] Night sweats are clearly associated with acute febrile illnesses and chronic in-

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fections.[1,2] However, in a cohort of older patients, we could find no associations between reported night sweats and actual sensory deficits or self-reported diabetes, thyroid disease, depression, gastroesophageal reflux disease, hypertension, osteoarthritis, osteoporosis, or autoimmune diseases.[2] In patients undergoing sleep studies, those reporting night sweats were not more likely to have sleep apnea.[7]

In one study, when asked, neither primary care clinicians nor their patients knew what caused the patients' night sweats in a majority of cases.[1] In fact, less than 20% of physicians and affected patients, when asked, were able to even venture a guess as to the cause. The most frequent guesses were menopause, stress, medications, and diabetes. To our knowledge, no information has been published regarding the prognosis of patients with this symptom.

In the present study, we analyzed data from 2 very different cohorts of older patients to determine whether individuals with subjective night sweats die more often or sooner than those without night sweats, after controlling for other known predictors of mortality. In one of the cohorts we were also able to examine persistence of the symptom over time and 1-year incidence.

Methods

Geriatric Continuity Clinic Database

The Geriatric Continuity Clinic (GCC) was a primary care continuity clinic serving patients older than 65, operated by 2 family physicians with certificates of added qualifications in geriatrics at the University of Oklahoma Health Sciences Center between 1989 and 2001. All patients seen in the GCC were required to complete a 34-page health history questionnaire and undergo a complete history and physical examination as a requirement for enrollment in the practice. The waiting list for an initial appointment was generally 6 to 12 weeks. As a result, patients were not usually acutely ill when first seen.

In 1999, the data from the initial evaluation of all patients enrolled during the prior 10 years (n = 740) were transferred to a research database. Deaths have subsequently been tracked clinically using the University's billing system and the Social Security Death Index. Permission was granted by the University of Oklahoma Health Sciences Center's Institutional Review Board to conduct the following analyses. This dataset has not been used in previous studies of night sweats.

Included in the initial questionnaire was a comprehensive review of systems consisting of 87 items of the form: "In the past 12 months have you noticed…." One of the items in the review of systems was "night sweats," answered "yes" or "no."

Age, sex, race, body mass index (BMI), number of grades completed in school, current cigarette use (yes/no), activities of daily living (ADLs) and instrumental activities of daily living (IADLs; 14-point scale for each), and several selected medical problems were also available for analysis. Frequencies and measures of central tendency were calculated for all variables. Fifty-eight questionnaires that were missing information about night sweats were dropped from the study.

Bivariate associations between reported night sweats (yes/no) and death were tested for statistical significance using the χ^2 test. Bivariate analyses and logistic regression were used to identify other potential predictors of mortality. The Cox proportional hazards method was used to identify associations between night sweats and earlier mortality, controlling for variables associated with death in the bivariate and/or logistic analyses. We were concerned that controlling for measures of health and functional status might obscure actual associations between night sweats and mortality through a causal chain. We therefore initially examined models that included only age, sex, income, education, BMI, and diagnosis of dementia (plus night sweats), and then examined more complete models that also included measures of health status and disability. We repeated the analyses for patients without dementia because their ability to report symptoms could be questioned.

Oklahoma Longitudinal Assessment of the Health Outcomes of Mature Adults Studies Dataset

The Oklahoma Longitudinal Assessment of the Health Outcomes of Mature Adults (OKLAHOMA) Studies dataset has been described previously.[2–4] Briefly, 834 individuals 65 years of age and older were recruited from the billing record lists of 23 family physicians in central Oklahoma in 1999 and 2000. Patients with known dementia and those living in nursing homes were specifically excluded. Those who chose to participate in the OKLAHOMA Studies were more likely than non-

participants to be younger ($P < .001$); men (43% vs 37%; $P = .002$); better educated ($P < .0001$); and have better (self-reported) health ($P < .0001$).

Each participant completed a lengthy questionnaire that included sociodemographic information, health habits, past medical problems, current symptoms, self-rated health (100-point rating scale), and functional status instruments (ADLs and IADLs). A trained research nurse conducted several tests, including a 50-foot timed walk (at usual pace). Participants were re-enrolled annually for 4 years, at which times the questionnaires and examinations were repeated.

The following question about night sweats was included in the questionnaires completed in years 1 and 2: "During the last month, how much trouble have you had with night sweats?" Response options included, "no trouble," "a little trouble," "some trouble," "a fair amount of trouble," and "a great deal of trouble." We converted these responses to 2 dichotomous variables called "night sweats" (including those with some, a fair amount, or a great deal of trouble with night sweats) and "severe night sweats" (including only those with a fair amount or a great deal of trouble with night sweats). An insufficient number of participants (n = 12) reported having "a great deal of trouble" with night sweats, so we were unable to accurately analyze this group separately. Deaths have been tracked by the study coordinator from participant contacts, primary care clinician reports, and the social security death index. Permission was granted by the University of Oklahoma Health Sciences Center's Institutional Review Board to conduct the analyses.

Descriptive statistics were calculated for all variables. Bivariate analyses were used to identify potential associations between "night sweats" and "severe night sweats" and mortality. We then conducted Cox proportional hazards analyses to determine whether either of the night sweats variables were associated with earlier mortality after controlling for other predictors. Again, we examined models that included only age, sex, income, education, and BMI (plus night sweats), as well as more complete models including measures of health status and disability.

Results

GCC Data Analyses

Descriptive statistics for relevant variables can be found in Table 1. This was, on average, a very old population of patients. Their mean age was 84.1 years (SD, 7.2 years) and their mean BMI was 25.6 (SD, 5.5). The average duration of participation in the cohort from enrollment in the GCC through November 1, 2008 or until death was 7.3 years.

Fourteen percent of patients in the cohort reported having experienced night sweats. Patients with dementia were less likely to report night sweats, presumably because of a lowered ability to report symptoms. Having reported night sweats was not associated with age, sex, race, BMI, education, or functional status (ADLs, IADLs). Eighty-one percent died during the study period. Bivariate associations between categorical variables and death are shown in Table 1. Both younger age ($P = .02$) and lower BMI ($P < .001$) were also associated with death in these analyses.

Based on the logistic models, predictors of death included younger age, male sex, a lower BMI, a lower ADL score, a lower IADL score, and a diagnosis of dementia. Night sweats was not a predictor ($P = .61$). The results were the same for patients without dementia except that age dropped out of the model.

The most parsimonious proportional hazards models included younger age, male sex, lower BMI, lower ADL and IADL scores, and dementia but not night sweats. Once again, removal of patients with dementia did not substantially affect the models. The models are shown in greater detail in Table 2.

OKLAHOMA Studies Data Analyses

Data from 843 patients were analyzed. The average duration of participation in the cohort from enrollment through November 1, 2008, or death was 7.5 years. At baseline, the mean age of this cohort was 80.9 years (SD, 6.2 years). Their average BMI was 28.7 (SD, 5.6) and their average self-rated health status, on a 0 to 100 scale, was 76.14 (SD, 17.02). It took them an average of 17.1 seconds (6.8 seconds) to walk 50 feet at their usual pace.

Ninety-one participants (9.7%) reported night sweats and 31 (3.3%) reported severe night sweats at baseline. Of the 59 patients reporting night sweats at baseline who re-enrolled in year 2, 28 (47%) still reported night sweats. Of the 22 reporting "severe night sweats" at baseline and who were re-enrolled, 13 (59%) still reported night sweats in year 2, and 8 (36%) still reported severe night sweats. Of the 566 re-enrolled participants who did

Table 1. Descriptive Statistics for Geriatric Continuity Clinic Variables Versus Mortality (n = 682)

Variable	Patients (n)	Overall Frequency (%)	Proportion Dead (%)	Proportion Alive (%)	*P*
Age (years)					
60–74	69	10.2	94.2	5.8	
75–84	287	42.5	79.8	20.2	
85+	320	47.3	80.6	19.4	.017
Sex					
Female	508	73.8	78.9	21.1	
Male	179	26.2	88.8	11.2	.003
Race					
White	504	76.2	83.3	16.7	
Nonwhite	161	23.8	75.2	24.8	.036
Education					
<High school	224	37.7	88.0	12.0	
High school	186	31.3	78.5	21.5	
>high school	184	31.0	75.0	25.0	.002
Smoker					
Yes	97	14.4	81.0	19.0	
No	579	85.6	84.5	15.5	.41
ADL categories					
0–6	43	6.5	100	0	
7–13	326	49.4	87.7	12.3	
14	291	44.1	71.8	28.2	<.0001
IADL categories					
0–6	149	22.6	96.0	4.0	
7–13	292	44.2	87.0	13.0	
14	219	33.2	64.4	35.6	<.0001
Diabetes mellitus					
Yes	106	15.6	82.1	17.9	
No	575	84.4	81.4	18.6	.87
Dementia					
Yes	250	36.7	94.8	5.2	
No	431	63.3	73.8	26.2	<.001
Night sweats					
Yes	98	14.4	77.6	22.4	
No	584	85.6	82.2	17.8	.27

ADL, activities of daily living; IADL, instrumental activities of daily living.

not report night sweats at baseline, 27 (5%) reported night sweats in year 2.

During the period of time included in this study, 204 participants (24%) died. Descriptive statistics and bivariate associations between relevant categorical variables and mortality are shown in Table 3. Both younger (65–74 years old) and older (85+) participants were more likely to die. Lower BMI ($P = .05$), longer time to walk 50 feet ($P < .0001$), and lower health rating ($P < .0001$) were also associated with death. Neither night sweats nor severe night sweats were associated with death.

Variables associated with night sweats included younger age ($P = .04$), less education ($P = .02$), lower ADL score ($P < .0001$), lower IADL score ($P = .002$), and lower self-rated health ($P < .0001$). Having severe night sweats was associated with nonwhite race ($P = .04$), lower income ($P = .04$), lower ADL ($P = 0005$) and IADL ($P = .003$) scores, and lower self-rated health ($P = .03$).

After controlling for age, sex, BMI, education, and income, individuals who reported night sweats or severe night sweats were no more likely to die (Table 4). The most parsimonious proportional hazards models are shown in Table 4. Adding measures of functional status (ADL and IADL scores and gait time) to the logistic and proportional hazards models further reduced the strength of asso-

Table 2. Logistic and Cox Proportional Hazards Models for Mortality from the Geriatric Continuity Clinic Data Set

	Without Function Variables		With Function Variables	
	Mortality*	*P*	Mortality*	*P*
Logistic model				
Age	0.95 (0.92–0.98)	.002	0.96 (0.92–0.99)	.015
Sex (female)	0.45 (0.24–0.81)	.009	0.42 (0.24–0.75)	.005
BMI	0.91 (0.87–0.95)	<.0001	0.92 (0.88–0.96)	.0002
ADL			0.83 (0.65–1.04)	.03
IADL			0.88 (0.78–0.99)	.03
Dementia	6.62 (3.45–14.08)	<.0001	4.10 (2.03–8.30)	<.0001
Night sweats	1.25 (0.68–2.38)	.48	1.14 (0.60–2.24)	.70
Cox proportional hazards model				
Age	0.96 (0.95–0.97)	<.0001	0.96 (0.95–0.98)	<.0001
Sex (female)	0.74 (0.61–0.89)	.002	0.75 (0.61–0.90)	.003
BMI	0.95 (0.94–0.97)	<.0001	0.96 (0.94–0.98)	<.0001
ADL			0.88 (0.85–0.95)	<.0001
Dementia	2.02 (1.68–2.43)	<.0001	1.75 (1.45–2.12)	<.0001
Night sweats	1.29 (1.00–1.67)	.054	1.21 (0.93–1.57)	.16

*Data in Mortality columns provided as odds ratio (95 CI).
BMI, body mass index; ADL, activities of daily living; IADL, instrumental activities of daily living.

ciation between the night sweats variables and mortality.

Discussion

Having reported night sweats on a health questionnaire was not associated with increased mortality in a geriatric clinic population and in a cohort of older patients drawn from the rolls of primary care physicians in central Oklahoma. Because only 12 individuals in the OKLAHOMA Studies cohort reported "a great deal of trouble" with night sweats and there was no further description available (eg, soaked bedclothes, etc), we are unable to conclude that very severe, soaking night sweats are not associated with increased mortality. However, individuals reporting either "a fair amount" or "a great deal of trouble" with night sweats did not die sooner or at an increased rate, on average, after controlling for sociodemographic variables. This should be reassuring to clinicians and patients with this symptom.

We know clinically that excessive sweating at night can be a symptom of serious, life-threatening diseases (eg, cancer, tuberculosis, autoimmune disease, etc). However, in primary care settings the vast majority of patients with night sweats probably do not have these conditions. Whether the severity of night sweats can be used to identify a high risk subgroup of patients is still unclear.

We were able to learn a little more about the annual incidence and duration of night sweats using the OKLAHOMA Studies cohort. The prevalence was approximately 13% (previously reported) and the annual incidence was approximately 5%. The symptom lasted for more than a year in approximately 50% of patients.

Limitations

Our study has obvious limitations. Neither cohort was representative of the general population of the United States. The GCC cohort was essentially a referral population, even although most patients were self-referred. The OKLAHOMA Studies cohort, which was drawn from 9 different primary care practices, was biased toward healthier women with more education. The fact that night sweats were not associated with increased mortality in either cohort suggests that the same might be true of other populations of older individuals, but it certainly does not prove it.

Both cohorts were quite old. Other causes of death may have diluted the impact of less lethal conditions causing night sweats. Older people are less likely to sweat excessively for a variety of reasons, which could have skewed our results in either direction. Our ability to identify patients with severe night sweats was limited by the data and by the small number of people in the category of patients

Table 3. Descriptive Variables for the Oklahoma Longitudinal Assessment of the Health Outcomes of Mature Adults Studies Data Set

Variable	Patients (n)	Overall Frequency (%)	Proportion Dead (%)	Proportion Alive (%)	*P*
Age (years)					
60–74	99	11.6	38	62	
75–84	522	62.0	21	79	
85+	222	26.4	31	69	<.0002
Sex					
Female	488	57.3	77	23	
Male	364	42.7	71	29	.04
Race					
White	703	91.2	25	75	
Nonwhite	139	8.8	32	68	.19
Education					
<High school	170	16.7	27	73	
High school	209	24.6	24	76	
>high school	464	58.7	26	74	.71
Annual income					
<$15,000	159	19.6	33	67	
$15,000-$35,000	362	44.6	28	72	
>$35,000	291	35.8	19	81	.003
Smoker					
Yes	61	7.6	33	67	
No	736	92.4	24	76	.15
ADL categories					
0–6	2	0.3	50	50	
7–13	278	33.7	33	67	
14	555	66.0	21	79	.0005
IADL categories					
0–6	3	0.5	75	25	
7–13	244	29.1	38	62	
14	589	70.4	20	80	<.0001
Night sweats					
Yes	91	10.7	34	66	
No	758	89.3	25	75	.05
Severe night sweats					
Yes	31	3.7	39	61	
No	818	96.4	25	75	.09

ADL, activities of daily living; IADL, instrumental activities of daily living.

most bothered by night sweats within the OKLAHOMA Studies cohort.

The questions asked about "night sweats" were nonspecific. In other studies we have used the following definition: "sweating at night even when it isn't excessively hot in your bedroom." Others have used more narrow and precise definition, "episodes of significant nighttime sweating that soaks your bed clothes or bedding"[8] or "drenching sweats that require the patient to change bedclothes."[9] Because the data used in this study had already been collected and was not specifically obtained for the purpose of studying night sweats, we had no way to influence the wording of the questions.

Regarding unexpected or confusing findings, we assume that the association between younger age and mortality in the GCC cohort reflected the fact that people chose to come to this special geriatric clinic for different reasons. Those who came at a younger age were evidently sicker. In the OKLAHOMA Studies sample female sex was associated with increased mortality, after controlling for other predictors. That was unexpected and must have something to do with selection bias. Women were

Table 4. Logistic and Cox Proportional Hazards Models for Mortality from the Oklahoma Longitudinal Assessment of the Health Outcomes of Mature Adults Studies Data Set

	Without Function Variables		With Function Variables	
	Mortality*	*P*	Mortality*	*P*
Logistic models				
Age	0.99 (0.97–1.02)	.88	0.96 (0.94–0.98)	.001
Sex (female)	1.67 (1.18- 2.37)	.004	2.28 (1.52–3.42)	<.0001
BMI	0.96 (0.93–0.99)	.02	0.93 (0.90–0.96)	<.0001
Education	1.12 (1.01–1.22)	.03	1.16 (1.04–1.29)	.006
Income	0.83 (0.75–0.91)	.0002	0.89 (0.80–0.99)	.03
IADL score			0.78 (0.67–0.91)	.002
50-foot timed walk			1.13 (1.09–1.18)	<.0001
Night sweats†	0.72 (0.43–1.22)	.25	0.98 (0.54–1.80)	.95
Severe night sweats†	0.66 (0.29–1.48)	.31	0.95 (0.36–2.53)	.91
Cox proportional hazards models				
Age	0.99 (0.97–1.02)	.47	0.96 (0.94–0.98)	.001
Sex (female)	1.56 (1.17–2.09)	.003	1.65 (1.20–2.26)	.002
BMI	0.96 (0.94–0.99)	.009	0.94 (0.92–0.97)	<.0001
Education	1.10 (1.02–1.19)	.02	1.11 (1.03–1.21)	.01
Income	0.84 (0.77–0.91)	<.0001	0.89 (0.81–0.98)	.01
IADL score			0.80 (0.73–0.88)	<.0001
50-foot timed walk			1.04 (1.03–1.05)	<.0001
Night sweats†	1.28 (0.84–1.95)	.26	1.13 (0.71–1.79)	.62
Severe night sweats†	1.51 (0.79–2.86)	.21	1.25 (0.61–2.58)	.54

*Data in Mortality columns provided as odds ratio (95 CI).
†The variables "night sweats" and "severe night sweats" were added separately.
BMI, body mass index; IADL, instrumental activities of daily living.

evidently more willing to participate in the study despite their illnesses than were men, who may have used illness as a reason not to enroll. The association between more education and mortality in the OKLAHOMA Studies cohort is harder to explain, but suggests some more complex form of selection bias or an interaction not obvious to us.

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