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Feature Article

Association of health related quality of life domains with daytime sleepiness among elderly recipients of long-term services and supports

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ABSTRACT

Excessive daytime sleepiness (EDS) is prevalent in older adults; however, data are lacking that examine EDS across living environments. The aims of this secondary data analysis were to identify the prevalence and predictors of EDS among older adults receiving long-term services and supports (LTSS) in assisted living communities (ALCs), nursing homes (NHs), and the community. Participants (n = 470) completed multiple measures including daytime sleepiness. Logistic regression modeling was used to identify EDS predictors. Participants were primarily female and white with a mean age of 81 ± 9 years. The overall prevalence of EDS was 19.4%; the prevalence differed across living environment. Older adults in ALCs and NHs had higher odds of EDS than those living in the community. Also, depressive symptoms and number of bothersome symptoms predicted EDS. Upon admission for LTSS, evaluating older adults, especially those in ALCs and NHs, for depression and bothersome symptoms may reveal modifiable factors of EDS.

Excessive Daytime Sleepiness (EDS) is a significant problem among older adults.[1–3] EDS is characterized as experiencing episodes of an uncontrollable need to sleep daily or falling asleep during the daytime.[4,5] Older adults with EDS in conjunction with disabilities and multiple chronic conditions rate their overall health lower than similar older adults without EDS.[6] EDS negatively impacts clinical and quality of life outcomes; in that, it is associated with falls, greater functional impairment, poorer cognitive functioning and dementia, lower quality of life, and increased mortality.[2,7–9] The presence of chronic conditions not only increases the risk for EDS, but also can lead to the need for assistance with activites of daily living through Long Term Services and Supports (LTSS).[10] Therefore, it is important to identify the predictors of EDS in this unique population with ongoing access to care.

LTSS are designed to facilitate optimal functioning among people with disabilities. LTSS can be provided in assisted living communities (ALC), nursing homes (NH), and home and community-based settings (HCBS). LTSS include a variety of health, health-related, and social services that assist individuals with functional limitations due to physical, cognitive, or mental conditions or disabilities.[10,11] Many common medical conditions among older adults receiving LTSS – such as arthritis, chronic pain, nocturnal angina, chronic obstructive pulmonary disease, and urinary dysfunction[1,12,13]; sleep-related breathing disorders (e.g., obstructive sleep apnea)[1,13]; psychological disorders (e.g., depression)[1,12]; and the effects of the medications[1,12] given to treat these conditions – are recognized risk factors for EDS.

Among older adults in the community the prevalence of EDS is between 20–30%[14,15] but EDS can be as high as 35%[12] in ALC residents and 70%[12,16] in NH residents. ALC and NH residents experience more severe sleep disturbance compared to older adults living at home suggesting that there are factors specific to their environment that may further hamper sleep.[17] For instance, environmental factors such as light and noise disruptions at night are often a result of staff performing their duties.[18] Such disruptive nightly activities within the living environment can contribute to fragmented sleep and EDS[17]; and one night of sleep fragmentation makes older adults sleepier during the day.[18] Specifically, older adults who slept poorly at night slept an average of two hours the following day.[18] ALC and NH providers need to meet regulatory mandates such as medication administration and meals during specific set time frames; as a result, older adults may be awakened for the scheduled services and

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activities and thus have less control over their environment. Many residents in ALCs and NHs also do not participate in the scheduled activities; as a result, many of them are bored during the day which then increase the risk for EDS.[12,13,19] Moyle and colleagues[20] reported that only about 40% of residents participated in group and solo activity. Furthermore, they found that residents were largely inactive during the daytime and engaged in only approximately two hours of light physical activity daily. Some ALCs and NHs may lack trained staff who can plan and facilitate daytime activities because of the large variability of staffing practices and training requirements across states.[21]

The Health-Related Quality of Life (HRQoL) conceptual framework is a multidimensional framework built on the Wilson and Cleary model and adapted by Zubritsky and colleagues to incorporate a broader definition of function, adding behavioral elements and the environment specific to older adults receiving LTSS (see Fig. 1).[22,23] This framework conceptualizes the relationships among individual level characteristics like physical and psychological functioning, and environmental characteristics like the physical environment and the system in which the service is delivered, with symptom status, functional status, general health perceptions, and perceived overall quality of life.[22,23] Sleep is considered an element within Symptom Status (Fig. 1b).

Because of the impact of EDS on older adults receiving LTSS and the lack of clarity in the associations among demographic and clinical characteristics with EDS, the aims of this study are to 1) determine the prevalence of EDS and 2) identify the predictors of EDS among a sample of older adults receiving LTSS in ALCs, NHs, and via HCBS. We hypothesize that the prevalence of daytime sleepiness will be greater

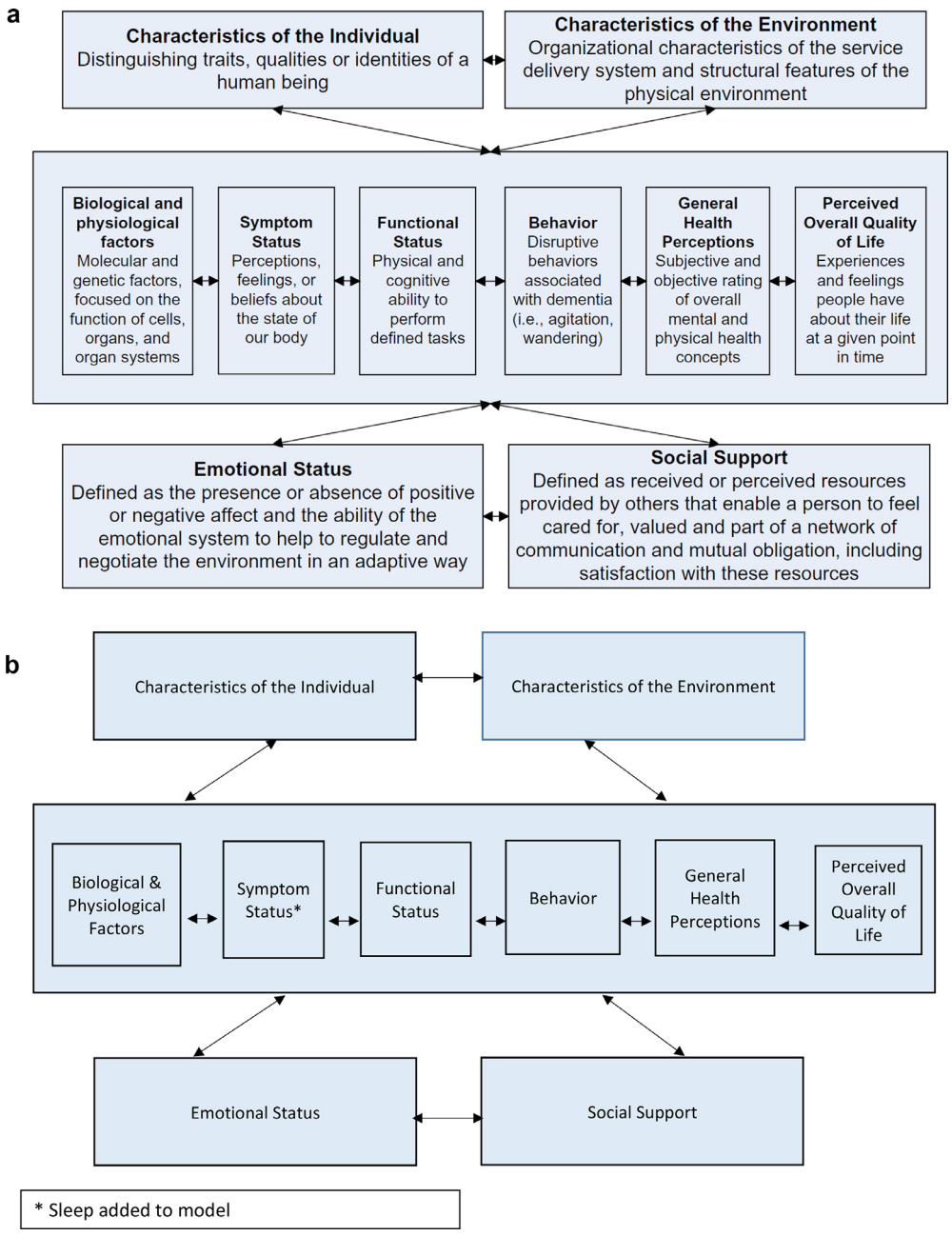

Fig. 1. The long-term services and supports health-related quality of life conceptual model. As developed by Wilson and Cleary (1995) and adapted by Brod and colleagues (1999); with Patrick (1997).

for older adults who receive LTSS in ALCs and NHs compared to older adults in HCBS. We further hypothesize that having multiple chronic conditions and the living environment in which LTSS is received will be the main predictors of EDS.

Material and methods

Design and sample

This secondary analysis uses baseline assessment data of 470 enrolled LTSS recipients from the longitudinal cohort study, "*Health-Related Quality of Life: Elders in Long-term Care*."[24] Older adults were recruited from 11 LTSS organizations (59 locations) in three states on the east coast of the U.S.A (New Jersey, New York, and Pennsylvania). Older adults were invited to participate if they met the following criteria: 60 years or older; were receiving any LTSS for the first time and within 60 days of the start of services); could communicate in English or Spanish; and scored 12 or higher on the Mini-Mental State Examination (MMSE).[25] Older adults were ineligible to participate if they had an impaired sense of reality (e.g., diagnosis of paranoia) or were terminally ill (e.g., prognosis of <6 months to live). Interested older adults were identified in person (at Pennsylvania and New Jersey LTSS locations) or using an electronic database (New York) and were visited by a trained research assistant (RA) who explained the study and obtained assent or consent. For individuals who scored between 12–22 on the MMSE,[26] they were asked to provide assent/consent and as an additional layer of protection, informed consent was sought from their legally authorized representative (most often a family member). A total of 1311 older adults were referred by partnering agencies as potential participants, 37% (480/1311) did not meet study eligibility criteria (main reasons: severe cognitive impairment [MMSE < 12] or prior LTSS experience). Of the 831 eligible referrals, 39% (327/831) declined to enroll (main reasons: lack of interest or lack of time to participate), 3% (29/831) had an MMSE score 12–22 but did not have a legally authorized representative to co-sign the informed consent and therefore could not be enrolled, and five had incomplete enrollments.[24]

Among the final sample of 470 LTSS recipients, 158 enrolled from NHs, 156 enrolled from ALCs, and 156 enrolled through HCBS. The parent study was reviewed and approved by three independent Institutional Review Boards at the University of Pennsylvania, the Philadelphia Veterans Affairs Medical Center, and the Visiting Nurse Service of New York. Additional details on the parent study design and methods can be found elsewhere.[24]

Measures

Several standardized instruments and investigator-developed items were used to collect self-reported data via face-to-face interviews with the RA (unless otherwise noted below).

Primary outcome

Excessive Daytime Sleepiness. The outcome variable was captured using the *Epworth Sleepiness Scale* (ESS). This eight-item questionnaire ask respondents to rate their chances of falling asleep in a variety of different situations using a 4-point Likert scale (0 = not likely to 3 = highly likely).[27] Scores range from 0 to 24, with higher scores indicating greater daytime sleepiness. Scores greater than ten on the ESS indicate daytime sleepiness significant enough to suggest the presence of severe obstructive sleep apnea or narcolepsy, which would require clinical intervention.[27] The ESS has acceptable internal consistency, reliability and construct validity when used with older adults.[27] EDS was operationalized by dichotomizing the total score using the clinical cutpoint (ESS > 10; ESS ≤ 10). A score of over 10 is taken to indicate abnormal sleepiness.[28] The ESS has been used to differentiate between levels of EDS in persons with mild cognitive impairment and dementia.[29]

Covariates

Sociodemographic, Biological and Physiological Characteristics. Sociodemographic, biological and physiological characteristics (e.g., race, gender, age, education, weight and height to calculate Body Mass Index [BMI], number of chronic conditions, number of medications [total, pain, psychiatric], use of assistive devices [hearing or visual devices, ambulatory devices]) were collected from enrollees using investigator-developed items and LTSS chart review.

Control of Physical Environment. Three questions developed for this study were used to evaluate how much control an enrollee had in their physical environment such as having "enough private space," "regular control over room temperature" and "regular control over lights." Each item was rated on a 4-point Likert scale from strongly agree (1) to strongly disagree (4).

Symptom Status. The *Symptom Bother Scale* is a 13-item tool that assesses the current presence and severity of physical symptoms (i.e., aching, itching, indigestion, getting tired easily, weakness, pain, stiffness, shortness of breath, poor vision, poor hearing, trouble concentrating, memory problems, incontinence).[30] Reliability scores range from 0.78 to 0.85.[31] The total number of bothersome symptoms was generated for modeling by summing the number of symptoms reported (range: 0–13).

Functional status. Cognitive and physical functional status were collected using the *MMSE* and the *Katz Basic Activities of Daily Living* (BADL). The MMSE, an 11-item instrument, assesses several aspects of cognition (e.g., orientation to place and time, registration, attention and concentration, delayed recall, language, and visual construction).[25] MMSE scores range from 0 to 30, with lower scores indicating greater cognitive impairment.[25] The MMSE has well-established internal consistency (α = 0.96), test–retest reliability (α = 0.82–0.98) and construct validity (r = 0.80).[32,33] The Katz BADL tool assesses the ability to perform basic self-care activities using a 6-item scale (including bathing, dressing, toileting, transferring, continence, and feeding).[34] Each item is rated based on need for assistance (yes = 0, no = 1) with higher scores indicate fewer functional deficits in BADLs (range: 0–6; inter-rater reliability, α = 0.96).[35] Formal and informal caregivers provided information on BADLs for any LTSS recipient with MMSE scores <23. The Katz BADL tool was the only assessment tool collected from a source other than the LTSS recipient.

General Health Perception: Self-reported general health was captured using the *Medical Outcomes Survey Short Form* (version 2) - Physical and Mental Composite Scores [SF-12 PCS; SF-12 MCS, respectively]. The SF-12 provides a global assessment of eight domains: physical functioning, role limitations (physical and emotional), social functioning, pain, mental health, physical health, and vitality.[36,37] The SF-12 scale has been found to be reliable with older adults (α = 0.70–0.89).[38] Higher SF-12 scores indicate higher self-reported or perceived physical (SF-12 PCS) or mental health or emotional well-being (SF-12 MCS).[37] The SF-12 physical and mental composite scores were weighted and summed using the formulas provided by the scale developers.[37]

Perceived Overall Quality of Life. Overall quality of life was measured using a single question used in prior research: "*How would you rate your overall quality of life at the present time?*" rated on a 5-point Likert scale (1 = poor, 5 = excellent; reliability, α = 0.81–0.88).[39,40] The *Dementia Quality of Life* (D-QoL) questionnaire was also used to assess quality of life domains.[41,42] The D-QoL contains 29 items and incorporates five subscales: self-esteem, positive affect/humor, negative affect, feelings of belonging, and sense of aesthetics.[42] The tool has adequate internal consistency reliabilities (0.67–0.90; median 0.80) and has

been tested with older adults with an MMSE score ≥12.[41,42] All LTSS recipients completed both QoL measures.

Emotional Status. The *Geriatric Depression Scale – Short Form* (GDS-SF) was completed to assess the presence of depressive symptoms.[43] Scores range from 0 to 15; higher scores indicate greater depressive symptoms and scores ≥5 indicate clinically meaningful findings which warrant further evaluation.[43] The GDS-SF has good sensitivity (α = 0.84–0.89), specificity (α = 0.73–0.95), and discriminant validity for the clinical diagnosis of depression (0.84).[43] The GDS-SF is a valid and reliable instrument to assess depression among older adults.[44]

Social Support. Four types of social support (emotional or informational, tangible, affection, and positive social interaction) were measured using the *Medical Outcomes Survey-Social Support* [MOS-SS].[45] A total of 19 items, each rated using a scale ranging from "none of the time" (1) to "all of the time" (5), were used to generate subscales. The subscale items were summed and then divided by the total number of items used to create the summary score. A final summary score range from 1 to 5 with higher scores indicating more of social support. The MOS-SS measures have consistently had high internal consistency ($\alpha > 0.90$).[45]

Statistical analyses

Independent variables of interest included sociodemographic as well as biological and physiological characteristics, control of physical environment, symptom status, functional status, general health perception, perceived overall quality of life, emotional status, and social support. Descriptive statistics were used to characterize all variables. Means and standard deviations were used to describe continuous variables, and frequencies and percentages were used to describe categorical variables. To manage missing data, multiple imputation by fully conditional specification and assuming an arbitrary missing pattern was employed and compared to the complete-case analysis as a sensitivity analysis.

Simple univariate logistic regression models were used to quantify the individual impact of each predictor of interest on the odds of EDS (ESS > 10) among a sample of older adults who were new recipients of LTSS. Variables demonstrating significance at the 0.20 level in the univariate models were included into an initial multivariable logistic regression model.[46,47] Using site as a cluster variable, variables were then removed in sequential order until only those remaining in the final multivariable model demonstrated significance at the 0.05 level. Race and ethnicity were correlated with LTSS setting. Specifically, 94% of ALC recipients reported being white (vs. NH, 33%; HCBS, 27%) and 54% of the HCBS recipients reported being Hispanic (vs. NH, 4%; ALC, 2%). Due to issues of confounding between LTSS options (NH, ALC, and HCBS) and race and ethnicity, only LTSS was included in the modeling process. Independent variables were examined for multicollinearity using an analysis of variance inflation factors. Statistical significance was taken at $p \leq 0.05$ as proposed prior to data collection. Post-hoc power analyses with 19% EDS suggest an ability to detect 6–9 independent predictors in a single model with 80% power and 5% type I error. All statistical analyses were conducted using SAS 9.4.

Results

LTSS recipient characteristics (sociodemographic, biological and physiological characteristics), as well as, control of physical environment, symptom status, functional status, general health perception, perceived overall quality of life, emotional status, and social support are presented in Table 1. There were differences on most of these variables (except for ethnicity) among the participants in the different LTSS settings.

Participants were primarily female (71.1%) and white (51.2%) with a mean (±SD) age of 80.9 (±8.7) years. On average, participants had a high school education (11.9 ± 4.4 years of education). 42.8% (201/470) had depressive symptoms present (GDS-SF ≥ 5) (mean GDS-SF score: 4.6 ± 3.4). On average, enrollees had 8.6 (±4.0) chronic medical conditions, reported an average of 6.1 (±3.2) bothersome symptoms, and reported using an average of 11.3 (±4.8) medications.

The mean EDS score was 6.4 (±4.6), suggesting that on average the older adults receiving LTSS did not have excessive daytime sleepiness (EDS >10). However, approximately one-fifth (19.4%) of the LTSS

Table 1
Demographic, clinical, and daytime sleepiness characteristics of participants (N = 470).

Variables	*N*	n (%) or Mean ± SD (range)
Demographic and clinical characteristics		
Race	470	
White		239 (51.2%)
Black or African American		162 (34.7%)
Asian		2 (0.4%)
American Indian		4 (0.9)
Other		60 (12.9%)
Non-Hispanic	463	370 (79.9%)
Age, *years**	470	80.9 ± 8.7 (60–98)
Female*	470	334 (71.1%)
Education, *years*	469	11.9 ± 4.4 (0–26)
Body Mass Index*	342	26.7 ± 7.3 (14.4–61.8)
Total # of chronic conditions/diagnosis*	470	8.6 ± 3.9 (1–27)
Medications		
Total*	466	11.1 ± 4.8 (0–31)
Pain*	462	1.0 ± 3.0 (0–62)
Psychiatric	464	1.1 ± 2.9 (0–60)
Use of assistive devices		
Use of hearing or visual assistive devices, *yes**	467	324 (69.4%)
Use of ambulatory assistive devices, *yes*	467	367 (78.6%)
Control of physical environment		
Enough private space*	465	1.8 ± 0.8 (1–4)
Regular control over room temperature*	463	2.0 ± 0.8 (1–4)
Regular control over lights	464	1.8 ± 0.7 (1–4)
Symptom status		
Total number of bothersome symptoms*	452	6.1 ± 3.2 (0–13)
Memory problems		52 (23.7%)
Poor vision		40 (18.3%)
Incontinence		27 (12.3%)
Functional status		
Cognition – Mini Mental State Examination	466	24.0 ± 4.3 (12–30)
Basic activities of daily living*	453	4.3 ± 1.9 (0–6)
Perceived health status		
SF-12 Physical composite score*	453	37.3 ± 11.0 (12.6–61.3)
Quality of Life		
Overall Quality of Life rating*	460	3.0±1.1 (1–5)
Dementia Quality of Life (D-QoL) Subscales		
Feelings of belonging *	462	3.3 ± 0.8 (1.7–5)
Negative affect *	463	2.5 ± 0.7 (1–4.5)
Positive affect/ humor *	463	3.4 ± 0.8 (1.2–5)
Self-esteem *	463	3.5 ± 0.8 (1–5)
Sense of aesthetics	458	3.45 ± 1.0 (1–5)
Emotional status		
Depressive symptoms - GDS-SF*	470	4.6 ± 3.4 (0–15)
GDS-SF ≥5 (suggestive of depression)		201 (42.8%)
SF-12 Mental composite score*	453	49.0 ± 10.5 (13.9–76.2)
Social support subscales		
Affectionate support *	465	2.8±1.2 (0–4)
Emotional - informational support *	465	2.7 ± 1.0 (0–4)
Positive social interaction support *	465	2.5 ± 1.1 (0–4)
Tangible support *	465	3.0 ± 1.0 (0–4)
Setting in which long-term services and supports received, 470*		
Assisted living community		156 (33.2%)
Nursing home		158 (33.6%)
Home and community-based services		156 (33.2%)
Daytime Sleepiness		
Excessive Sleepiness Scale (ESS)	470	6.4 ± 4.6 (0–22)
ESS total > 10		91 (19.4%)

Note. * Significant in univariate logistic regression modeling of EDS and used to build final model presented in Table 2.

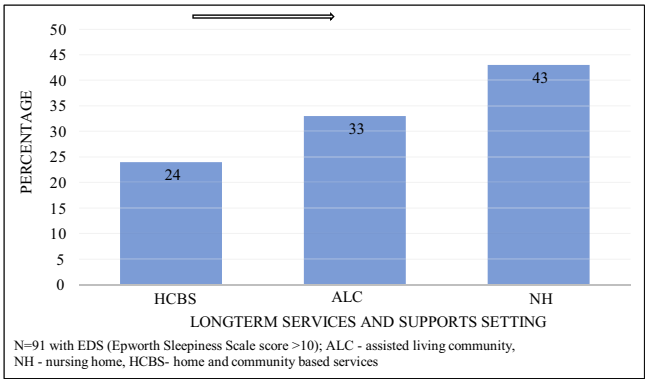

Fig. 2. Percentage of Older Adults by setting with Excessive Daytime Sleepiness (EDS).

recipients had an ESS score >10. Of the 91 older adults with excessive daytime sleepiness, 43.0% (39/91) received LTSS in NHs, 33.0% (30/91) received LTSS in ALCs, and 24.0% (22/91) received LTSS in the HCBS, suggesting that EDS increased based on their living environment, see Fig. 2.

Several LTSS recipient sociodemographic characteristics as well as, control of physical environment, symptom status, functional status, general health perception, perceived overall quality of life, emotional status, and social support measures were significantly associated with EDS in the univariate models and were included in the final multivariable model (See Table 1 variables with *). Specific characteristics significant at the 0.20 level included age (p = 0.004), gender (p = 0.05), BMI (p = 0.04), total number of chronic conditions (p = 0.07), use of hearing or visual assistive devices (p = 0.13), medications (total [p = 0.008], pain [p = 0.10]), LTSS type (p = 0.06), control over physical environment (e.g., having enough private space [p = 0.05], regular control over room temperature [p = 0.03]), symptom status (number of bothersome symptoms, $p < 0.001$), functional status (basic activities of daily living, $p < 0.001$), perceived general health status (SF-12 physical composite score [p = 0.01]), quality of life (both an overall rating of QoL [p = 0.004] and four of the Dementia Quality of Life subscales: feelings of belonging [p = 0.06], negative affect [$p < 0.001$], positive affect/ humor [p = 0.05], self-esteem [$p < 0.001$]), emotional status (SF-12 mental composite score [$p < 0.001$] and depressive symptoms [$p < 0.001$]), and social support (affectionate [p = 0.007], emotional – informational [p = 0.02], positive social interaction [p = 0.13], tangible [p = 0.07]). Based on results from a Fisher's Exact Test, there was no relationship between race/ethnicity and EDS.

Table 2
Multivariable logistic regression for excessive daytime sleepiness among older adults new to long-term services and supports.

Variable	Odds ratio	95% Confidence interval		*P*-value
		Lower limit	Upper limit	
Male vs. Female (ref)	1.94	[1.10,	3.40]	0.02
LTSS type				
ALC vs. NH	1.76	[0.90,	3.48]	0.10
NH vs. HCBS	2.98	[1.83,	4.86]	<0.001
ALC vs. HCBS	5.26	[3.03,	9.14]	<0.001
Total number of bothersome symptoms	1.21	[1.09,	1.33]	<0.001
Depressive symptoms*	1.15	[1.06,	1.24]	0.001

* Depressive symptoms were measured using the Geriatric Depression Scale short form. Higher scores indicate greater presence of depressive symptoms. ALC = assisted living communities; NH = nursing homes; HCBS = home and community-based services. Total number with ESS>10 = 91.

Using site as a cluster variable and with inclusion criteria of p≤0.05 for the final multivariable model, gender, the environment in which the LTSS service was received, symptom status, and emotional status were significant predictors of EDS (Table 2). Specifically, the odds of EDS were 93% greater in males than females (Males: OR = 1.93, 95% CI: 1.10–3.40, p = 0.02). Older adults in NHs and ALCs were significantly more likely to report EDS compared to older adults new to LTSS in the community (NH: OR = 2.98, 95% CI: 1.83–4.86, $p < 0.001$; ALC: OR = 5.26, 95% CI: 3.03–9.14, $p < 0.001$). The odds of EDS increased 21% with each self-reported bothersome symptom (OR = 1.21, 95% CI:1.10–1.33, $p < 0.001$). Lastly, the odds of EDS increased by 15% with each 1-point increase in the GDS-SF score indicating that an individual with higher depressive symptom scores had increased odds of experiencing EDS (OR = 1.15, 95% CI:1.06–1.24, p = 0.001).

Discussion

The purpose of this study was to identify the prevalence of EDS among older adults receiving LTSS and the predictors of EDS for this group. We found that approximately 19% of this sample of older adults had an Epworth Sleepiness Scale score more than 10; a score suggestive of EDS that would require clinical intervention. Gender, a non-modifiable factor, and environment in which LTSS is received, number of bothersome symptoms, and emotional status (modifiable factors) predicted EDS. Interventions can be developed within the setting in which LTSS is received and for the modifiable factors in order to reduce EDS among this population.

Previous studies have found lower or similar EDS prevalence in community-dwelling older adults.[48] However, the prevalence of EDS in this study is lower than other studies with ALCs, NHs, and community-dwelling participants,[12,16,49,50] which have reported prevalence of EDS up to 70% in NHs,[16,49] up to 35% in ALCs,[12] and up to 31% in the community.[50] The lower prevalence rate could be due to having a heterogenous sample of older adults from all three settings. When we examine only the sample with EDS, the rate of EDS increases based on the setting in which LTSS is received, which mirrors what is reported in the literature with homogenous samples.

Among older adults new to LTSS, we found several modifiable and treatable clinical factors associated with EDS. Many of the correlates of EDS are associated with acuity of illness; older adults in ALCs and NHs have more comorbidities compared to older adults in the community. While number of chronic conditions did not predict EDS, the number of bothersome symptoms and depressive symptoms predicted EDS. Our findings are supported by previous studies which have reported a relationship between bothersome symptoms and EDS[12,13] and depressive symptoms and EDS[12,51] in older adults in a variety of long-term care settings. Bothersome symptoms such as incontinence and vision problems contribute to EDS. Incontinence can lead to fragmented sleep due to multiple nightly awakenings for toileting or bed-wetting.[52] Vision problems disrupt the circadian rhythm; as a result, older adults are no longer entrained and have disrupted sleep schedule thus are asleep and awake at different times during the day.[53]

While, independent community-dwelling older adults generally often report lower rates of EDS than those who reside in residential care communities,[54] community-based prevention strategies are still important to prevent or reduce EDS. Interventions that target specific symptoms may differ by setting. For example, in the community, family members and even the older adult can be taught bladder training techniques or sleep hygiene techniques. In ALCs and NHs, the development of a continence schedule along with orienting the residents to the time of the day and keeping them involved in daily activities are common interventions. Interventions to promote improved nighttime sleep such as a set sleep schedule, a dark and quiet

nighttime environment, completion of essential nighttime care duties before the residents have fallen asleep, and participation in physical and meaningful activities during the day can be facilitated by ALC and NH staff.[17]

Actigraphic findings from research in ALCs and NHs indicate that these populations experience more nighttime awakenings and disruptions than those in the community[16] which may contribute to higher rates of EDS in the older adults living in these settings. While environmental factors such as less bright light exposure, less physical activity, fewer social activities, extended time in bed and disrupted sleep due to night time care or checks often found among ALCs and NHs residents, may further affect sleep at nights and increase the risk for EDS[16,55] control over environment covariates were not significant in the multivariable modeling. It is possible that these covariates could be embedded within the living environment setting that it is not easily detangled as a separate variable. However, future research into the relationship of changes over time in control of the environment variable and EDS in these settings is needed to detangle these potential effects.

Gender was the only non-modifiable predictor of EDS; males were more likely to be sleepy during the day. Current research is conflicting regarding associations were reported between EDS and male gender.[13,49,56] While there is no current evidence for pathophysiological mechanisms underlying age and gender difference in EDS,[57] men, up to age 70, and older adults have a higher incidence of obstructive sleep apnea and nocturia, both of which are risk factors for EDS.[58,59] It is also possible that these findings may be due to the small sample of male participants in the study.

The findings of the study should be viewed in relation to the limitations. First, while this cross-sectional, secondary data analysis used a standardized assessment of daytime sleepiness, additional sleep related data such as frequency of daytime napping were not available. Older adults living in ALCs and NHs may have limited experience with some of the situations on the ESS like those related to driving once they transition to ALCs or NHs for long term care. Future research should include other instruments which assess sleep patterns in addition to sleepiness, such as sleep diary or polysomnography. These instruments allow for the identification of sleep problems that may cause ESS and for the differentiation between actual clinical factors and boredom as the cause of ESS.[13] Boredom was not captured with a specific item in the parent study. Second, 40% of our population scored in the mild to moderate range of cognitive impairment using the MMSE which raises the question about self-report data. We found one cross-sectional study from France in which the findings suggest that the ESS may underestimate EDS in older individuals including persons with mild cognitive impairment (MMSE between 19 and 24).[60] Since the MMSE dropped out of our final model we performed a sensitivity analysis on the subset of older adults with mild to moderate cognitive impairment (MMSE: 12–23) which revealed similar odds ratio estimates for this subgroup compared to the full sample final model and remained statistically significant. While additional supportive data such as sleep diaries or other objective measures of sleep were not available in this dataset, our finding implies and supports other literature that adults with mild to moderate cognitive can complete the ESS.[50,61] Future research is needed to explore the use of this tool in this population over time. In addition, while the MMSE was used to capture overall cognitive impairment among this population, a more detailed executive function assessment may be necessary to show an association with EDS.[62] Finally, since ethnicity was not included in the model, a sensitivity analysis of the final model for only Hispanic LTSS recipients was performed and revealed no statistically significant differences in the odds ratio estimates; therefore, we feel confident in our results.

Implications for practice

Although the etiology of EDS in older adults is likely multifactorial, healthcare providers should evaluate new LTSS recipients for their sleep routine, physical and emotional symptoms, and functional deficits. Within the first 60 days of the start of LTSS, a review of environmental and clinical factors that may disturb sleep patterns should be conducted so as to provide targeted interventions. Ongoing assessments of these factors should then be included in the care plan. For example, if an older adult is experiencing EDS due to an inability to fall asleep, treatment options would be significantly different from an older adult who is experiencing EDS due to lack of daytime activities or multiple nightly awakenings. Proper sleep hygiene, cognitive behavioral therapy for insomnia, light therapy, positive airway pressure, and exercise all have the potential to mitigate EDS in older adults.[63,64] A comprehensive approach, which may entail multicomponent therapy, is recommended to reduce sleep disturbances in older adults.[65]

Conclusion

In this study of older adults receiving LTSS in ALCs, NHs, and HCBS, we found that participants' and environmental characteristics, number of bothersome symptoms, and emotional status predicted EDS. Many of these factors are modifiable and treatable; therefore, it is important that gerontologists and healthcare providers conduct timely assessments for the presence of EDS and the identified risk factors for EDS. Initial and ongoing assessments allow for the implementation of targeted interventions to decrease EDS and the risks factors of EDS so as to promote a high quality of life among recipients of LTSS.

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