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# Prevalence and Clinical Correlates of Restless Legs Syndrome in an Elderly French Population: The Synapse Study

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***Background.*** The occurrence of restless legs syndrome (RLS) in elderly individuals is well known but the incidence and the clinical correlates in these subjects are still unclear. The present study explores the prevalence of and assesses symptoms associated with RLS in an older French population.

***Methods.*** The study sample for this study comprised 318 subjects (219 women and 99 men), aged 68.6 ± 0.8 years. All subjects underwent clinical assessment, nocturnal polygraphy, and cognitive and mood disorders evaluation. RLS was assessed with the standard validated criteria and severity was evaluated by the use of International Restless Legs Syndrome Study Group (IRLS) questionnaire.

***Results.*** RLS was present in 24.2% of the sample, prevalence being greater in women (29.7%) than in men (12.1%). The mean IRLS score was 16.6 ± 4.8, 67% of cases having mild to moderate range. Participants with RLS reported greater hypnotic ($p < .001$) and antidepressant medication intake ($p < .001$) and had higher anxiety ($p < .001$) and depression ($p < .001$) scores. Participants with RLS had lower cognitive performances at Stroop and Verbal fluency tests than participants without RLS ($p < .05$ and $p = .002$, respectively). These associations remained significant after multivariate adjustment for medication, depression, and subjective sleep.

***Conclusions.*** Presence of undiagnosed RLS is higher in healthy elderly participants without previously diagnosed sleep disorders, affecting women more often than men. The presence of RLS increased the risk of anxiety and mood disorders and predispose to preclinical cognitive decline independently of anxiety, mood disorders, duration and quality of sleep, and medication.

***Key Words:*** Aging—Restless legs—Sleep—Cognitive function—Anxiety—Depression.

RESTLESS legs syndrome (RLS) is a neurological disorder characterized by an irresistible desire to move the lower limbs, usually associated with paresthesia and/or dysesthesia and motor restlessness. RLS affects 5%–15% of the adult population, prevalence being greater in the elderly individuals (1,2). Studies analyzing the age distribution of RLS revealed a strong increase of prevalence in the elderly individuals, the prevalence rate ranging from 10.5% in the Swedish study (3), up to 18% in the Canadian survey (4) and 20% in the German survey (1). It is generally admitted that the clinical history and the presence of the four major criteria proposed by the International Restless Legs Syndrome Study Group (IRLSSG) (5) are sensitive and sufficiently specific for diagnostic purposes. However, in the elderly individuals, other neurological or medical disorders may mimic symptoms of the RLS (6) and the real prevalence might be masked by the presence of concomitant disorders predisposing to RLS, such as Parkinson's disease and diabetes and hypnotic, antidepressant, or neuroleptic treatments (7). Comparison of the studies conducted so far is complicated by the inclusion of elderly participants with associated sleep-related breathing disorders (SDB), the prevalence rate of SDB being 44%–62% in an elderly community when, respectively, a respiratory disturbances index (RDI) greater than 20 or 10 is used. Therefore, only studies conducted in a community-based population free of neurological and cardiovascular disease, and without SDB, may have clinical relevance in defining the role of RLS on general well-being, quality of life, and cognitive-executive dysfunction (8) in elderly patients.

The present study was undertaken as part of the Proof project (9), a prospective longitudinal study on autonomic nervous system activity changes in the elderly participants conducted in Saint-Etienne, France. The aim of the present study was twofold: first, to assess the prevalence and to identify factors associated with the occurrence of RLS in a

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large prospective community-based cohort of elderly participants and second, to define the clinical differences between participants with and without RLS taking into account gender, SDB, cognitive function, mood disorders, and associated medical diseases.

## Methods

### *Population*

The data were derived from the Proof study (9), a longitudinal study on a population-based cohort of 1,011 volunteers aged 65 ± 1 years (61% women) living in the city of Saint-Etienne (France), enrolled in the study in 2001 to assess the influence of autonomic nervous system activity on cardiovascular and cerebrovascular diseases. An ancillary study addressing the association between SDB, assessed by at-home polygraphic study, and cardiovascular and cerebrovascular morbidity during a 7-year follow-up was proposed to participants (synapse study). Exclusion criteria for synapse study were history of myocardial infarction, heart failure, stroke, pacemaker therapy, previously diagnosed or treated SDB or sleep disorder, diabetes type 1, previous diagnosis of neurological disorders such as Parkinson's disease, dementia, and neuropathy. Presence of psychiatric disease was retained when confirmed by a previous psychiatric assessment. Patients taking hypnotics or antidepressant prescribed by general practitioners without a specific psychiatric assessment were not excluded of the study. Of the original sample of 1,011 healthy elderly participants, 851 participants accepted polygraphic recording. From the synapse study, 667 subjects (396 men and 271 women) aged 68.6 ± 0.8 years completed the RLS evaluation and the cognitive examination and represented the final screened sample for the current study. The study was approved by the local ethics committee (CCPRB Rhone-Alpes Loire; Clinical Trial Gov: NCT00759304), and all subjects gave written consent to study participation.

### *Clinical Data*

All study participants underwent a standard clinical assessment including a questionnaire on demographics, medical history and medication, and a face-to-face-interview for general medical history and neurological and psychiatric diseases. Detailed clinical assessment was specially focused on cardiac and cerebrovascular disease, hypertension, obstructive or restrictive lung disease, metabolic disorders, psychiatric diseases, neurological disorders, previously diagnosed sleep disorders, and current medications with a particular attention to stimulants, sedatives, hypnotics, neuroleptics, or antidepressants. Sociodemographic and clinical characteristics included sex, age, smoking habits, alcohol intake, body mass index (BMI, kg/m$^2$), neck circumference, glycemia, and blood pressure measurements.

The impact of sleepiness during the day was evaluated using the Epworth Sleepiness Scale (ESS), a 4-grade scale (0, non-napping; 3, high chance for napping) in which a maximum of 24 points can be achieved.

Five standardized questions were used to assess RLS: complaint of unpleasant sensation in the legs, urge to move, relief by movements, worsening in the evening or at night, and frequency of symptoms greater than once per week during the last 6 months. These questions differ from the four clinical common criteria proposed by IRLSSG (5) to diagnose RLS only for the inclusion of a question concerning frequency of symptoms. Participants answering affirmatively to all basic symptoms were assigned as having RLS (RLS+). Subjects assigned as RLS+ completed the validated self-administered severity score questionnaire (IRLS) (10) proposed by the IRLSSG. This questionnaire consists of 10 questions about RLS symptoms and their impact on daily activities and mood. All responses are graded in the range 0–4 (0: absence of problem; 4: very severe problem) giving a maximum score of 40. The participants received detailed and individual instructions regarding how to answer the questionnaire, which was filled out at the time of polygraphy. Using an a priori designation of RLS severity (5), we stratified the patients into three groups based on their IRLSSG score (mild cases: scores from 1 to 10, moderate: scores from 11 to 20, severe: scores from 21 to 30, very severe: scores >31).

### *Sleep Study*

Nocturnal unattended sleep study was done in all participants using a polygraphic system (HypnoPTT; Tyco Healthcare, Mallinckrodt, France, Puritan Bennett, Villers-Les-Nancy, France), which included sound measurement, electrocardiography, pulse transit time, R-R timing, nasal pressure, respiratory effort, and body position. Oxygen saturation ($SaO_2$) was measured by pulse oximetry. A software package was used for downloading and analysis of tracings. A recording duration of at least 5 hours was required to be validated. All recordings were visually validated and manually scored for respiratory events and nocturnal $SaO_2$ according to standard criteria. Hypopnea was defined as a 50% or greater reduction in airflow from the baseline value lasting at least 10 seconds and associated with 3% oxygen desaturation. Apneas were defined as the absence of airflow on the nasal cannula lasting for more than 10 seconds. The apnea + hypopnea index (AHI) was established as the ratio of the number of apneas and hypopnea per hour of recording. As indices of nocturnal hypoxemia, we considered the mean $SaO_2$, the minimal value recorded during sleep, and the oxygen desaturation index (ODI). Pulse transit time was continuously monitored and an autonomic arousal index (AAI) was calculated. An AHI greater than 15 was considered diagnostic of SDB according to criteria applied in the elderly participants.

To minimize potential overestimation of sleep duration, subjects completed a sleep diary to exclude wakefulness

Table 1. Clinical, Anthropometric, and Polygraphic Data for the Whole Group Including Patients With Sleep-Disordered Breathing and With and Without RLS Mean (*SD*)

| | Total | RLS− | RLS+ | *p* |
|---|---|---|---|---|
| *N* (%) | 667 (100) | 494 (74.0) | 173 (26.0) | |
| Age (y) | 68.6 (0.8) | 68.6 (0.8) | 68.5 (0.9) | ns |
| Male, *n* (%) | 271 | 214 (79.0) | 57 (21.0) | ns |
| Female, *n* (%) | 396 | 280 (70.7) | 116 (29.3) | |
| Hypertension (%) | 42.1 | 43.1 | 38.7 | ** |
| Diabetes (%) | 5.4 | 6.3 | 2.9 | *** |
| Hyperlipemia (%) | 34.7 | 36.4 | 26.5 | *** |
| Hypnotic treatment (%) | 9.88 | 8.3 | 14.5 | *** |
| Antidepressant treatment (%) | 4.49 | 3.85 | 6.36 | *** |
| Anxiety score | 3.3 (2.8) | 2.8 (2.7) | 4.6 (2.8) | *** |
| Depression score | 2.5 (2.7) | 2.1 (2.3) | 3.7 (3.3) | *** |
| ESS score | 5.7 (3.7) | 5.5 (3.6) | 6.3 (3.7) | ns |
| Alcohol intake, glass/day | 2.8 (1.5) | 2.7 (1.2) | 2.9 (2.1) | ns |
| BMI (kg/m$^2$) | 25.4 (3.7) | 25.2 (3.6) | 26.0 (4.0) | ns |
| ODI (n/h) | 8.9 (9.0) | 8.5 (8.8) | 10.0 (9.6) | * |
| AHI (n/h) | 19.6 (14.3) | 19.5 (14.2) | 20.0 (14.7) | ns |
| AAI (n/h) | 40.1 (19.3) | 39.7 (18.5) | 41.5 (21.3) | ns |

*Notes*: AAI = autonomic arousal index; AHI = apnea + hypopnea index; BMI = body mass index; ESS = Epworth Sleepiness Scale; n/h = number/h (event index/h); ns = not significant; ODI = oxygen desaturation index; RLS = restless legs syndrome.

*$p < .05$; **$p < .01$; ***$p < .001$.

before lights-off from the analysis. Subjective sleep quality, sleep latency, and sleep maintenance were assessed by the St Mary's Hospital Questionnaire.

*Cognitive Assessment*

Self-cognitive assessment was explored with the short form of the French version of the Mac Nair scale (11). This self-rating scale, designed to explore cognitive difficulties in everyday life, consists of 26 questions that essentially assesses memory and attention difficulties in daily activities during the past 3 weeks. Each item was scored on a 5-point scale according to its frequency (from "never" [0 point] to "very often" [4 points]). Total score varied from 0 to 104 points.

An extensive neuropsychological battery assessing principally attention, memory, and executive functions was administered to the participants, including the Mini-Mental State Examination (MMSE), the French version of the Free and Cued Selective Reminding test (FCSR), the Benton visual memory test, the Digit Symbol Substitution test (DSST), the Memory Span and Tracking Baddeley test, the Trail Making Test A and B, the Stroop test, the alphabetic and category fluency tasks, and the Wechsler Adult Intelligence Scale (WAIS) Similarities test.

*Depression and Anxiety*

Depressive symptomatology was measured using the QD2A questionnaire (12) including 13 questions. QD2A scores ranged from 0 to 13 points, and subjects with a score greater than 6 were considered as having depressive symptoms. Anxiety was assessed using the French version of the Goldberg scale (13), a 9-item scale with scores ranging from 0 to 9; individuals with a score greater than 4 were considered as anxious.

*Statistical Analysis*

Participants' characteristics were summarized as means ± *SD* for continuous variables and counts and percentages for categorical variables. Comparisons were performed using the chi-square test for categorical variables and the Student *t* test for normally distributed continuous variables. ANOVA was used to analyze differences in diurnal and nocturnal variables between RLS+ participants stratified according to the IRLS scale. Multiple logistic regression models were used to assess independent associations between the presence of RLS and all putative risk factors. All reported *p* values are two-tailed, with statistical significance set below. All statistical analyses were conducted using the SPSS statistical software package (SPSS for Windows, version 12.0; SPSS, Chicago, IL).

## Results

*Clinical and Sleep Study Data*

The characteristics of the total sample are shown in Table 1. In the group of patients as a whole, participants meeting minimal criteria for RLS represented 25.8% of the general sample, with a prevalence higher in women (29.9%) than in men (21%) and with a mean IRLS scale score of 17.1 ± 4.8. In this sample, the presence of anxiety and depression was higher in RLS+ participants and this subgroup reported more frequently hypnotic and antidepressant treatment. No differences in RDI, BMI, and ESS were present. RLS+ participants reported lower incidence of hypertension, diabetes, and hyperlipidemia.

Table 2 shows associated factors, clinical, biological, and polygraphic data for the subset of 318 participants without SDB. This group consisted of 219 women and 99 males aged 68 ± 0.8 years at the time of evaluation. The mean ODI was 3.9 ± 3.9 and the mean AHI 8.5 ± 3.9. Of this subset, 24.2% were diagnosed as having RLS, their mean IRLS score being 16.6 ± 4.8. Disease severity according to a standard rating scale was classified as mild to moderate in, respectively, 30% and 36.6%, 18 subjects (23.4%) reporting scores higher than 20. None of the subjects reported scores higher than 31. Incidence was again higher in women (29.7%) than in men (12.1%). Participants taking hypnotics and antidepressants were more likely to have RLS, 17% of the sample receiving hypnotic treatment and 8% antidepressants. Anxiety (4.8 ± 3.0) and depression (3.8 ± 3.6) scores were higher ($p < .001$) in RLS+ participants when compared with participants without RLS, and their anxiety ($r = .35$, $p < .05$) and depression ($r = .28$, $p = .05$) scores were related to RLS severity score. There were no significant differences in terms of age, incidence of hyperlypemia, alcohol intake, daytime sleepiness, and BMI. Subjects with RLS tended to

Table 2. Clinical, Anthropometric, and Polygraphic Data for Patients Without Sleep-Disordered Breathing Classified on the Basis of Clinical Criteria for RLS Mean (*SD*)

| | Total | RLS− | RLS+ | *p* |
|---|---|---|---|---|
| *N* (%) | 318 (100) | 241 (75.9) | 77 (24.2) | |
| Age (y) | 68.6 (0.8) | 68.6 (0.7) | 68.5 (0.9) | ns |
| Male, *n* (%) | 99 | 87 (87.9) | 12 (12.1) | *** |
| Female, *n* (%) | 219 | 154 (70.3) | 65 (29.7) | |
| Hypertension (%) | 35.8 | 36.5 | 33.8 | * |
| Diabetes (%) | 4.4 | 5.4 | 1.3 | *** |
| Hyperlipemia (%) | 36.5 | 36.9 | 35.1 | ns |
| Hypnotic treatment (%) | 11.3 | 9.5 | 16.9 | *** |
| Antidepressant treatment (%) | 4.40 | 3.32 | 7.79 | *** |
| Anxiety score | 3.4 (2.9) | 2.9 (2.7) | 4.8 (3.0) | *** |
| Depression score | 2.5 (2.8) | 2.1 (2.4) | 3.8 (3.6) | *** |
| Alcohol intake, glass/day | 2.6 (1.5) | 2.6 (1.2) | 2.7 (1.9) | ns |
| ESS score | 5.2 (3.4) | 5.0 (3.4) | 5.6 (3.5) | ns |
| BMI (kg/m$^2$) | 24.6 (3.4) | 24.6 (3.2) | 24.7 (3.8) | ns |
| SBP (mmHg) | 140.2 (17.4) | 140.7 (17.8) | 138.3 (16.2) | ns |
| DBP (mmHg) | 86.0 (9.8) | 86.1 (9.6) | 84.8 (7.7) | ns |
| Glycemia (g/L) | 0.98 (0.2) | 0.99 (0.2) | 0.96 (0.1) | ns |

*Notes*: BMI = body mass index; DBP = diastolic blood pressure; ESS = Epworth Sleepiness Scale; ns = not significant; RLS = restless legs syndrome; SBP = systolic blood pressure.

*$p < .05$; **$p < .01$; ***$p < .001$.

report lower incidence of hypertension and diabetes but their glycemia and arterial blood pressure levels did not differ compared with RLS− subjects. Polygraphic data showed no significant difference between RLS− (ODI: 3.7 ± 3.0, AHI: 8.6 ± 4.0, AAI: 34.8 ± 19.6) and RLS+ participants (ODI: 3.4 ± 4.3, AHI: 8.2 ± 4.0, AAI: 35.9 ± 16.3).

### *Subjective Sleep Evaluation*

Subjectively, patients with RLS rated their sleep quality and continuity worse compared with RLS− participants (Figure 1): Their sleep was perceived as being lighter and not refreshing; they reported more difficulties to fall asleep, longer sleep latency, and lower sleep satisfaction.

### *Cognitive Function Testing*

Neuropsychological tests and results according to presence or absence of RLS are presented in Table 3. RLS participants did not differ from participants without RLS for level of education (RLS− = 11.4 ± 2.8, RLS+ = 10.6 ± 2.5). In test evaluating episodic memory, visual memory, digit span, and WAIS, no differences between groups were found. For Trail making tests A and B, RLS+ subjects did less well than RLS− subjects without, however, statistically significant differences. Word time and color time Stroop tests ($p < .05$) as well as verbal fluency tests ($p = .002$) were significantly altered in participants reporting RLS, associated with greater subjective difficulties in performing cognitive test. Neither the visual fluency test nor Stroop performance was affected by quality of sleep, sleep latency, ESS score, AAI, and severity of RLS score.

Multiple logistic regression analysis showed that, after full adjustment for gender, age, smoking and alcohol use, hypertension, diabetes, anxiety and depression scores, hypnotic or antidepressant medication intake, duration and quality of sleep, subjects reporting RLS demonstrated lower performance in verbal phonemic (odds ratio [OR], 95% confidence interval [CI]: 0.93, 0.87–0.97; $p < .003$) and semantic (OR, 95% CI: 0.95, 0.92–0.99; $p < .05$) fluency. After full adjustment, again, a statistically significant relationship was found between RLS+ and Stroop word time (OR, 95% CI: 0.97, 0.95–0.99; $p = .02$) and Stroop color time (OR, 95% CI: 0.95, 0.93–0.99; $p = .01$).

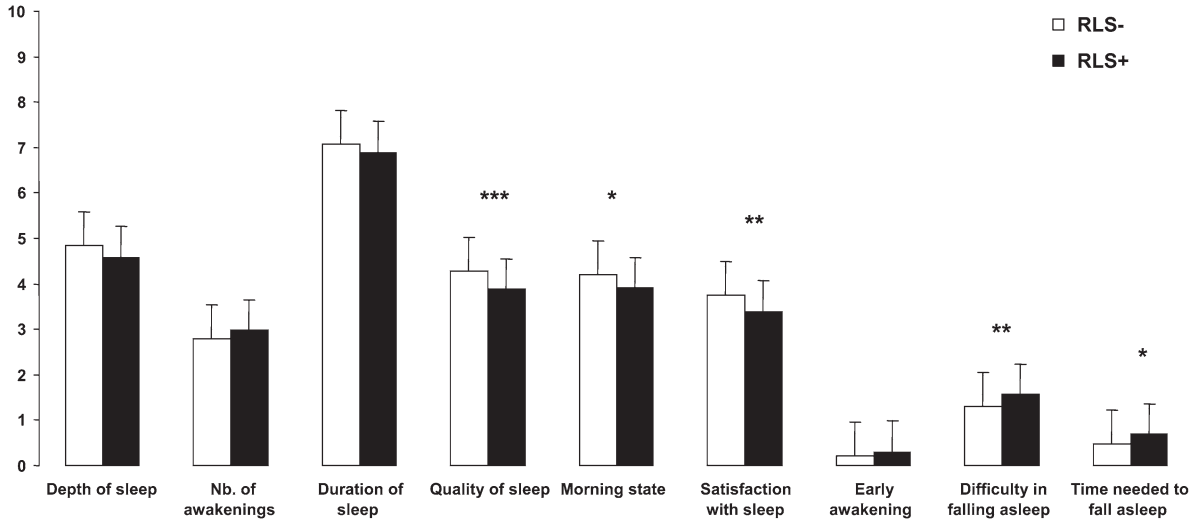


Figure 1. Quality of sleep assessed by St Mary's Hospital Questionnaire in subjects without (RLS−) and with (RLS+) restless legs syndrome (RLS). *$p$ value for student's $t$ test and $\chi^2$.*$p < .05$; **$p < .005$; ***$p < .001$.

Table 3. Scores of Cognitive Function Tests of Participants Mean (*SD*) in the Total Group of Cases Without Sleep-Disordered Breathing and in Patients With and Without RLS

| | Total | RLS+ | RLS− | *p** |
|---|---|---|---|---|
| MMSE of Folstein (/30) | 28.7 ± 1.4 | 28.6 ± 1.4 | 28.7 ± 1.6 | ns |
| Episodic memory (free and cued test) | | | | |
| Immediate recall (/16) | 15.4 ± 0.9 | 15.3 ± 1.0 | 15.4 ± 0.9 | ns |
| Delayed recall (/16) | 15.7 ± 0.9 | 15.6 ± 1.2 | 15.7 ± 0.8 | ns |
| Visual memory (Benton memory test) | 12.6 ± 1.5 | 12.5 ± 1.6 | 12.6 ± 1.5 | ns |
| Semantic memory | | | | |
| Verbal fluency Phonemic | 19.5 ± 6.5 | 17.5 ± 6.0 | 20.1 ± 6.6 | .002 |
| Verbal fluency Semantic | 29.8 ± 7.6 | 27.5 ± 7.1 | 30.6 ± 7.7 | .002 |
| Stroop | | | | |
| Word time | 98.4 ± 13.4 | 95.2 ± 14.1 | 99.4 ± 13.0 | .02 |
| Color time | 70.7 ± 10.4 | 68.6 ± 10.9 | 71.4 ± 10.2 | .04 |
| Color word time | 34.5 ± 7.6 | 34.3 ± 8.6 | 34.6 ± 7.2 | ns |
| Trail Making Test A (s) | 47.0 ± 14.2 | 48.7 ± 16.8 | 46.4 ± 13.3 | ns |
| Trail Making Test B (s) | 100.2 ± 41.4 | 102.6 ± 38.4 | 99.5 ± 42.3 | ns |
| Digit span forward (/16) | 5.5 ± 1.0 | 5.4 ± 0.9 | 5.5 ± 1.1 | ns |
| Digit span backward (/14) | 4.2 ± 1.0 | 4.1 ± 1.1 | 4.2 ± 1.0 | ns |
| WAIS Similarities test (/33) | 17.0 ± 5.1 | 16.6 ± 5.1 | 17.1 ± 5.1 | ns |
| Subjective cognitive difficulties (/104) | 28.0 ± 12.2 | 31.8 ± 15.4 | 26.8 ± 10.8 | .002 |

*Note*: MMSE = Mini-Mental State Examination; ns = not significant; RLS = restless legs syndrome; WAIS = Wechsler Adult Intelligence Scale.

## Discussion

This study aimed to explore the prevalence of RLS in an elderly general population without previously diagnosed sleep disorders and without sleep apnea. Using a large sample of participants in that SDB was excluded by polygraphy, we conclude that RLS is significantly higher in healthy elderly participants affecting more frequently women and with mild to moderate severity. Participants with RLS reported poorer sleep quality and higher drug intake to improve their sleep compared with participants without RLS. Depression and anxiety scale differs in RLS+ participants stressing the potential role of RLS in appearance of anxiety and reduced mood. Finally, we found a relationship between RLS and cognitive functions, participants having RLS showing an impairment at the Stroop and verbal fluency tests. These associations remained after multivariate adjustment for depression, medication, and subjective sleep. These findings suggest that undiagnosed RLS could predispose older participants to mood and cognitive impairment and stress the need to search such sleep disorder in elderly patients.

The first finding of the current study reveals that RLS symptoms were very frequent in our sample, 24% of our group having the minimal diagnostic criteria. If in mildly aged populations the overall RLS prevalence is between 11% and 15% (1–4,8,14,15), the prevalence rates in the elderly participants are highly variable, ranging from 9% to 20% (1,15,16). In our study, RLS symptoms were reported by 24% of the original sample, with a higher incidence in women (17) and with a mild to moderate severity. Our prevalence was higher than the findings reported by some community-based studies (2–4,7,17) and near to that reported by Rothdach et al. (1) and Nichols and coworkers (18). Possible explanations for differences lay in diagnostic criteria and population. First, the specificity of the questions to assess RLS may be considered. We used the four minimal criteria to diagnose RLS as proposed by IRLSSG but we included subjects reporting symptoms for at least one night a week. We choose to add this question because it is common a weekly occurrence in older patients (19) and frequency is not a specific criterion to define the presence of RLS or its severity (18). Therefore, we cannot exclude that a significant number of false positive are present, the higher prevalence related to inclusion of participants with few symptoms. Second, our group of RLS+ participants is not necessarily representative of a healthy population because our participants voluntarily participated to the study. Moreover, within our population, we have a high number of women, a bias probably related to the tendency of women to participate more frequently than men in medical studies or to have medical disorders more frequently associated with RLS, such as depression.

This survey is the first systematic study of RLS in elderly individuals in that the population-based design of the synapse study, polygraphic examination, homogenous age at the study entry, availability of detailed information about current and past drug treatment, clinical information on the presence of other diseases allow us to better define factors influencing RLS in an older community-based population and to define the clinical correlates of the disease. Although prevalence of RLS increases with age, there is still a debate as to whether the significance of RLS in older participants is equal to that of RLS in middle-aged patients, issue crucial to answer the question of whether or not treatment is necessary in elderly individuals. Significant associations between RLS, disrupted sleep (20), impaired mood (21), cardiovascular disease (22), and cognitive dysfunction (23,24) have been shown in patient-based studies. Because these studies were based on patients referred to a Sleep Clinic, the association may be overstated and may not be applicable in the community-based population. The high incidence of RLS symptoms in our sample was associated with poorer sleep quality, altered sleep continuity, and greater hypnotic prescription suggesting that in the elderly participants, more than in middle-aged participants, RLS remains undiagnosed as a cause of insomnia. When the clinical correlates of RLS were considered, the first interesting finding was that diabetes and hypertension were poorly reported by our participants and, in contrast with the patient-based studies (22), no association was found between RLS and these comorbidities. Moreover, neither glycemia nor blood pressure measurement differed between participants with and without RLS, and AAI detected by polygraphy did not differ between participants. These data open debate as to whether diabetes type 2 and autonomic changes occurring during periodic leg movements really contributed to greater incidence of

cardiovascular disease in elderly RLS patients, selected population, small sample size, and inclusion of other sleep disorders such as SDB probably affecting results in previous clinical studies (19,22).

In our community-dwelling adult population, the main clinical parameters that separate participants with and without RLS were emotional status, mood disorders, and cognitive dysfunction. RLS+ subjects show higher depressive and anxiety score, and cognitive dysfunction independent of other sleep complaints. These findings confirm previous data suggesting that in RLS+ participants, mood disorders may mask an underlying sleep disorder (25) and RLS remains more frequently undiagnosed when depressive symptoms are evident (26). However, in some cases, RLS can also be induced by antidepressant treatment or may be an associate symptom of depression. In our sample, however, after adjustment for history of depression and anxiety and drug intake, presence of RLS was associated with higher depression and anxiety score, suggesting a causal relation between mood disorders and RLS. Further longitudinal studies are, however, necessary to confirm the role of RLS in mood disorder occurrence. Moreover, we have to consider that sleepiness and sleep disturbances may contribute to cognitive dysfunction, as consequences of impaired vigilance and sleep fragmentation on the refreshing function of sleep (23,24). In our subjects, neither RLS severity score nor degree of nocturnal sleep disturbances and ESS were associated with the degree of cognitive dysfunction, suggesting either that these factors may mediate some but not all aspects of cognitive decline in RLS+ cases (24) or a progressive adaptation to sleep loss and sleep fragmentation occurs in elderly subjects. In addition, the negative impact of RLS on verbal fluency and Stroop test is still present after adjustment for hypnotic and/or antidepressant medication use, quality perception and duration of sleep, anxiety, and depression scores, stressing the independent effect of RLS on such cognitive tasks.

In conclusion, this study represents the largest epidemiological community-based investigation on the incidence of RLS in the elderly participants without SDB and on its consequences on psychological and cognitive function. From our results, we demonstrate that RLS is more prevalent in older adults, 24% of our population having RLS symptoms. The clinical presentation is not necessarily the same as in middle-aged subjects, mood disorders, and cognitive deficit representing the major consequence of the sleep disorder. Therefore, any older participant presenting with insomnia, depressive traits, and deficit in executive function may be screened not only for sleep-disordered breathing but also for RLS. The identification of the disorder and its treatment could reverse the sleep complaints and reduce the cognitive dysfunction. The causal relationship between cognitive decline, mood disorders, and RLS in the elderly individuals needs to be clarified by future longitudinal studies to identify the factors underlying this association and the effects of efficacious treatment.

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Conflict of Interest

The authors report no conflicts of interest.

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