Table 3—Multiple Linear Regression Analyses: Contribution of Single Co-Variates to the SF-36 Scales Score by Diagnostic Groups

	NA with CA		NA without CA		IHS without LST	
	Standardized β	p value	Standardized β	p value	Standardized β	p value
PF						
gender	—	—	—	—	—	—
age	—	—	—	—	—	—
disease duration	—	—	—	—	—	—
ESS	—	—	—	—	—	—
R^2	—	—	—	—	—	—
RP						
gender	—	—	—	—	—	—
age	—	—	—	—	—	—
disease duration	—	—	—	—	—	—
ESS	-0.504	0.024	—	—	—	—
R^2	—	0.225	—	—	—	—
BP						
gender	—	—	—	—	—	—
age	—	—	—	—	—	—
disease duration	—	—	—	—	—	—
ESS	—	—	—	—	—	—
R^2	—	—	—	—	—	—
GH						
gender	—	—	—	—	—	—
age	—	—	—	—	—	—
disease duration	—	—	—	—	—	—
ESS	—	—	—	—	—	—
R^2	—	—	—	—	—	—
VT						
gender	—	—	—	—	—	—
age	—	—	—	—	—	—
disease duration	—	—	—	—	—	—
ESS	—	—	—	—	—	—
R^2	—	—	—	—	—	—
SF						
gender	—	—	—	—	—	—
age	—	—	—	—	—	—
disease duration	—	—	—	—	—	—
ESS	—	—	—	—	—	—
R^2	—	—	—	—	—	—
RE						
gender	—	—	—	—	—	—
age	—	—	—	—	—	—
disease duration	—	—	—	—	—	—
ESS	—	—	—	—	—	—
R^2	—	—	—	—	—	—
MH	—	—	—	—	—	—
gender	—	—	-0.404	0.017	—	—
age	—	—	—	—	—	—
disease duration	—	—	0.960	0.007	—	—
ESS	—	—	—	—	—	—
R^2	—	—	—	0.551	—	—
	—	—	—	—	—	—

NA, narcolepsy; CA, cataplexy; IHS, idiopathic hypersomnia; LST, long sleep time; ESS, Epworth Sleepiness Scale. PF, physical health; RP, role physical; BP, bodily pain; GH, general health; VT, vitality; SF, social functioning; RE, role emotional; and MH, mental health. Standardized β, Standardized regression coefficietnt. R^2, Coefficient of determination.

at baseline without medication in a clinical trial of modafinil, and showed that RP, VT, SF, and RE were significantly impaired in this group compared to the general US population. However, these studies did not focus on diagnostic categories (particularly the presence or absence of cataplexy in narcolepsy and idiopathic hypersomnia with or without long sleep time). The present study is the first to compare the HRQOL of consecutive drug-naïve patients with hypersomnias of central origin—divided into NA with CA, NA without CA, and IHS without LST—with national normative data, and to investigate the factors influencing the HRQOL in each diagnostic group.

In the present study, drug-naïve patients within the categories of hypersomnias of central origin, showed all domains of HRQOL to be significantly poorer than those of the Japanese population norm

Table 4—Correlation Between the Descriptive Variables and the Involvement of Automobile Accidents or Near-Miss Incidents Among the Subject Patients Having Usual Driving Habits, as Assessed by Logistic Regression Analysis

	Crude			Adjusted		
	OR	95%CI	p value	OR	95%CI	p value
gender						
male						
female	0.88	0.36-2.17	n.s.	0.64	0.22-1.90	n.s.
age						
for every increase of one year	1.03	0.97-1.08	n.s.	1.01	0.92-1.10	n.s.
disease duration						
for every increase of one year	1.04	0.98-1.10	n.s.	1.03	0.95-1.13	n.s.
diagnosis						
IHS without LST						
NA with CA	3.00	0.85-10.58	n.s.	1.74	0.40-7.57	n.s.
NA without CA	1.00	0.31-3.27	n.s.	1.00	0.27-3.69	n.s.
ESS score						
0 - 10						
11 - 15	4.25	0.76-23.81	n.s.	4.68	0.66-33.06	n.s.
16 -24	12.06	2.12-68.54	0.005	14.63	1.97-108.67	0.009

OR, odds ratio; 95% CI, 95% confidence interval. NA, narcolepsy; CA, cataplexy; IHS, idiopathic hypersomnia; LST, long sleep time; ESS, Epworth Sleepiness Scale. n = 80

except for PF and BP. Interestingly, the present study showed that the HRQOL profile did not differ statistically among the 3 diagnostic groups, although patients with NA with CA presented more severe sleepiness than the other groups, demonstrated on both ESS score and mean sleep latency on MSLT. The severity of subjective sleepiness was significantly associated with RP only in the group of patients with NA with CA, but was not associated with any HRQOL domains in the total patient group. These findings suggest that the severity of subjective sleepiness does not act as a main factor for the decrease of HRQOL. The HRQOL profile of the group of NA with CA decreased in a fashion similar to that of the NA without CA group. Vignatelli et al. demonstrated that cataplexy did not show any correlation with SF-36 scales among patients with narcolepsy. These findings might indicate that the presence of cataplexy is unlikely to have an impact on the HRQOL among narcolepsy groups.

In our results, only disease duration was positively correlated with the MH among the total subjects. When multiple linear regression analyses were conducted in each diagnostic category, this tendency was significant in patients with NA without CA. This finding is in line with the previous report in which disease duration positively influenced the RP and the RE among drug-naïve patients with narcolepsy.[9] Considering that the illness remains stable for several years in the majority of patients with narcolepsy,[31] prolongation of morbidity might bring patients certain kinds of coping skills to manage disadvantage with the disorder.

The present study could not find common factors responsible for the decrease of SF-36 domains among 3 diagnostic groups, even in SF-36 scale scores which showed clearly lower values than that of the general population. We speculate that the decrease of HRQOL could be attributed to psychological, social, and environmental factors, such as lifestyle or social support rather than subjective sleepiness.

Several studies have reported on the risk of automobile accidents in patients with narcolepsy or idiopathic hypersomnia.[14,32,33] In the present study, 55% of current drivers had at least one automobile accident or near-miss incident in the last 5 years. This finding is comparable to a study reported by Aldrich et al. in which 20% to 49% of current drivers with hypersomnia including narcolepsy or idiopathic hypersomnia had accidents, and 54% to 74% had near-miss incidents due to sleepiness.[33] Early diagnosis and treatment of patients with hypersomnias of central origin is important in prevention of automobile accidents. In the present study, multiple logistic analyses revealed that severe EDS was an independent factor for the experience of accidents while driving. Further studies are needed to determine whether effective treatment of hypersomnia reduces the occurrence of automobile accidents among the patients of this category.

In our results, the experience of automobile accidents or near-miss incidents was not associated with any SF-36 scale scores among the current drivers with hypersomnia. This finding might indicate that accidents and/or near-miss incidents themselves do not act as a associated factor for the deterioration of HRQOL among the participants with hypersomnia. However, it is possible that automobile accidents of our patients were not sufficiently serious to cause persistent damage to physiological and/or mental function of the participants. In addition, we should consider the possibility that those who died in an accident or those who had serious handicaps due to injuries in crashes were not included in the present study.

In conclusion, the present study demonstrated impairment in the mental component but not the physical component of the HRQOL among drug-naïve patients with hypersomnias of central origin. The impact on the magnitude of impairment of HRQOL was not different among the disease categories. The aggravation of the severity of subjective sleepiness was significantly associated with the increased risk of automobile accidents. Our findings strongly support the necessity of early treatment of patients with hypersomnia. Further prospective study on larger samples should be done to establish the strategies for both improving HRQOL and preventing automobile accidents among the patients of this category.

ABBREVIATIONS

HRQOL	health-related quality of life
SF-36	36-item short form health survey

ICSD-2	2nd edition of the *International Classification of Sleep Disorders*
NA with CA	narcolepsy with cataplexy
NA without CA	narcolepsy without cataplexy
IHS without LST	idiopathic hypersomnia without long sleep time
MLST	multiple sleep latency test
SOREMP	sleep onset rapid eye movement period
ESS	Epworth Sleepiness Scale
ANOVA	analysis of variance
PF	physical functioning
RP	role limitations due to physical problems
RE	role limitations due to emotional problems
SF	social functioning
MH	mental health
VT	energy/vitality
BP	bodily pain
GH	general health perceptions

DISCLOSURE STATEMENT

This was not an industry supported study. The authors have indicated no financial conflicts of interest.

REFERENCES

1. D'Alessandro R, Rinaldi R, Cristina E, Gamberini G, Lugaresi E. Prevalence of excessive daytime sleepiness an open epidemiological problem. Sleep 1995;18:389-91.
2. Hara C, Lopes Rocha F, Lima-Costa MF. Prevalence of excessive daytime sleepiness and associated factors in a Brazilian community: the Bambui study. Sleep Med 2004;5:31-6.
3. Ng TP, Tan WC. Prevalence and determinants of excessive daytime sleepiness in an Asian multi-ethnic population. Sleep Med 2005;6:523-9.
4. Takegami M, Sokejima S, Yamazaki S, Nakayama T, Fukuhara S. [An estimation of the prevalence of excessive daytime sleepiness based on age and sex distribution of Epworth Sleepiness Scale scores: a population based survey]. Nippon Koshu Eisei Zasshi 2005;52:137-45.
5. Broughton WA, Broughton RJ. Psychosocial impact of narcolepsy. Sleep 1994;17:S45-9.
6. Goswami M. The influence of clinical symptoms on quality of life in patients with narcolepsy. Neurology 1998;50:S31-6.
7. Dodel R, Peter H, Spottke A, et al. Health-related quality of life in patients with narcolepsy. Sleep Med 2007;8:733-41.
8. Daniels E, King MA, Smith IE, Shneerson JM. Health-related quality of life in narcolepsy. J Sleep Res 2001;10:75-81.
9. Vignatelli L, D'Alessandro R, Mosconi P, et al. Health-related quality of life in Italian patients with narcolepsy: the SF-36 health survey. Sleep Med 2004;5:467-75.
10. Beusterien KM, Rogers AE, Walsleben JA, et al. Health-related quality of life effects of modafinil for treatment of narcolepsy. Sleep 1999;22:757-65.
11. Ervik S, Abdelnoor M, Heier MS, Ramberg M, Strand G. Health-related quality of life in narcolepsy. Acta Neurol Scand 2006;114:198-204.
12. American Academy of Sleep Medicine. International classification of sleep disorders, 2nd ed.: Diagnostic and coding manual. Westchester, IL: American Academy of Sleep Medicine, 2005.
13. Broughton R, Ghanem Q, Hishikawa Y, Sugita Y, Nevsimalova S, Roth B. Life effects of narcolepsy in 180 patients from North America, Asia and Europe compared to matched controls. Can J Neurol Sci 1981;8:299-304.
14. Broughton R, Ghanem Q, Hishikawa Y, Sugita Y, Nevsimalova S, Roth B. Life effects of narcolepsy: relationships to geographic origin (North American, Asian or European) and to other patient and illness variables. Can J Neurol Sci 1983;10:100-4.
15. Carskadon MA, Dement WC, Mitler MM, Roth T, Westbrook PR, Keenan S. Guidelines for the multiple sleep latency test (MSLT): a standard measure of sleepiness. Sleep 1986;9:519-24.
16. Fukuhara S, Bito S, Green J, Hsiao A, Kurokawa K. Translation, adaptation, and validation of the SF-36 Health Survey for use in Japan. J Clin Epidemiol 1998;51:1037-44.
17. Fukuhara S, Ware JE, Jr., Kosinski M, Wada S, Gandek B. Psychometric and clinical tests of validity of the Japanese SF-36 Health Survey. J Clin Epidemiol 1998;51:1045-53.
18. Fukuhara S, Suzukamo Y, Bito S, Kurokawa K. Manual of SF-36 Japanese version 1.2.. Tokyo: Public Health Research Foundation, 2001.
19. Johns MW. Reliability and factor analysis of the Epworth Sleepiness Scale. Sleep 1992;15:376-81.
20. Takegami M, Suzukamo Y, Wakita T, et al. Developement of a Japanese version of the Epworth Sleepiness Scale (JESS) based on Item Response Theory. Sleep Med (in press).
21. Young T, Peppard PE, Gottlieb DJ. Epidemiology of obstructive sleep apnea: a population health perspective. Am J Respir Crit Care Med 2002;165:1217-39.
22. Johns MW. Sensitivity and specificity of the multiple sleep latency test (MSLT), the maintenance of wakefulness test and the epworth sleepiness scale: failure of the MSLT as a gold standard. J Sleep Res 2000;9:5-11.
23. Liu GF, Han S, Liang DH, et al. Driver sleepiness and risk of car crashes in Shenyang, a Chinese northeastern city: population-based case-control study. Biomed Environ Sci 2003;16:219-26.
24. Leger D, Scheuermaier K, Philip P, Paillard M, Guilleminault C. SF-36: evaluation of quality of life in severe and mild insomniacs compared with good sleepers. Psychosom Med 2001;63:49-55.
25. Zammit GK, Weiner J, Damato N, Sillup GP, McMillan CA. Quality of life in people with insomnia. Sleep 1999;22 Suppl 2:S379-85.
26. Chesson AL Jr, Anderson WM, Littner M, et al. Practice parameters for the nonpharmacologic treatment of chronic insomnia. An American Academy of Sleep Medicine report. Standards of Practice Committee of the American Academy of Sleep Medicine. Sleep 1999;22:1128-33.
27. Morin CM, Hauri PJ, Espie CA, Spielman AJ, Buysse DJ, Bootzin RR. Nonpharmacologic treatment of chronic insomnia. An American Academy of Sleep Medicine review. Sleep 1999;22:1134-56.
28. Briones B, Adams N, Strauss M, et al. Relationship between sleepiness and general health status. Sleep 1996;19:583-8.
29. Baldwin CM, Griffith KA, Nieto FJ, O'Connor GT, Walsleben JA, Redline S. The association of sleep-disordered breathing and sleep symptoms with quality of life in the Sleep Heart Health Study. Sleep 2001;24:96-105.
30. Akashiba T, Kawahara S, Akahoshi T, et al. Relationship between quality of life and mood or depression in patients with severe obstructive sleep apnea syndrome. Chest 2002;122:861-5.
31. Billiard M, Dauvillers, Y. Narcolepsy. In: Michel B, ed. Sleep: Physiology, investigations, and medicine. New York: Kluwer Academic / Plenum Publishers, 2003:403-28.
32. Garbarino S, Nobili L, Beelke M, De Carli F, Ferrillo F. The contributing role of sleepiness in highway vehicle accidents. Sleep 2001;24: 203-6
33. Aldrich MS. Automobile accidents in patients with sleep disorders. Sleep 1989;12:487-94.