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Sleep History and Hypertension Burden in First-Generation Chinese Migrants Settled in Italy: The CHIinese In Prato Cross-Sectional Survey

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Abstract: Migration flows from China are largely directed towards the South of Europe, Chinese being now the third largest overseas-born population in Italy. The aim of the study was to investigate hypertension burden and self-reported sleep disorders among 1608 first-generation Chinese migrants aged 16 to 59 years settled in Prato and recruited in a cross-sectional survey. Hypertension was defined as systolic BP ≥140 mm Hg and/or diastolic BP ≥90 mm Hg or self-reported antihypertensive treatment; potential impact of sleep disorders was analyzed by logistic regression adjusted for age, sex, marital status, education, health insurance, current smoking, parental hypertension, alcohol drinking, overweight or obesity, central obesity, diabetes, high total cholesterol, and high triglycerides. Among the 1608 participants, 21.7% were hypertensive (age-standardized prevalence 19.2%; 95% CI: 18.5–20.0); 54% of hypertensive subjects were aware of their condition; 70% of aware hypertensive subjects received drugs, and 39% of treated subjects had blood pressure controlled. Self-reported snoring increased the risk of hypertension; when compared with no snoring, the age- and sex-adjusted OR for hypertension of snoring 3 to 6 d/week was 2.11 (95% CI: 1.48–3.01) and 2.48 (95% CI: 1.79–3.46) of snoring every day. When compared with a sleep duration ≤5 hours, subjects with sleep duration of 7 hours had reduced risk of high triglycerides (adjusted OR: 0.66; 95% CI: 0.43–0.95).

Despite a high level of awareness, low treatment rates for hypertension were observed among Chinese participants, independently of health insurance. Sleep history is to be considered in screening and prevention programs.

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Abbreviations: BMI = body mass index, BP = blood pressure, CHIP = CHInese In Prato, CI = confidence limits, FG = fasting glucose, OR = odd ratio, UK = United Kingdom, US = United States, WHO = World Health Organization.

INTRODUCTION

In recent decades, the large wave of immigration experienced by most European countries[1] has introduced a new challenge for cardiovascular prevention.[2] Social factors are known to influence incidence, treatment, and outcomes of cardiovascular disease,[3] and cultural factors may limit communication strategies in effectively reaching first-generation migrants.[1,4] New strategies or adaptations of existing ones are thus required to reach these newcomers and integrate them into health services.[5,6] However, some questions remain to be answered. First, the country of origin could influence the ability of the migrant to accept and follow prevention policies in the host country. People who move from China, where epidemiological transition is now a recognized priority [7] and national programs for health promotion were launched in the last decades,[8] might indeed act differently than people who come from countries with poor health standards. Differently from other ethnic groups, Chinese ethnicity in the United States was not significantly associated with treated but uncontrolled hypertension after controlling for socioeconomic factors.[9] Second, limited information is available on health needs of some elusive ethnic minorities in Europe. Hypertension burden in Chinese communities showed a favorable pattern in the United Kingdom (UK).[10,11] However, health policy in UK differs from most European countries where undocumented migrants have limited access to primary care.[2] In the last decades flows from China have been largely directed toward the South of Europe, mainly to Italy and Spain,[12] Chinese being now the third largest overseas-born population in Italy. Information on health needs of Chinese communities settled in South Europe is thus needed.[13] Third, social conditions and working pressure might influence sleep history of first-generation Chinese migrant workers,[14,15] with a final potential influence on risk factors.[16] Chinese individuals settled in the United States (US) were recently found to have higher odds of objectively measured sleep disordered breathing and short sleep than whites.[17] An

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inverse association between snoring frequency and cardiovascular risk was reported.[18] Likewise lack of sleep has been associated with increased risk of metabolic consequences.[19] Little research has however been carried out on the relationship between sleep history and hypertension in first-generation Chinese migrants.

Prato is the Italian province with the highest proportion of Chinese immigrants.[14] The CHInese In Prato (CHIP) cross-sectional survey was thus performed with the support of Chinese Authorities and the major Chinese associations active in the area[20] to define potential targets for health promotion at the community level to be pursued in future health programs.

METHODS

Setting, Study Design, and Participants

Since the 1980s Chinese immigrants come to establish their own business in the textiles industry in the area of Prato (Italy) taking advantage of a migratory chain that exploits networks of existing relationships. The CHIP survey was designed as a cross-sectional investigation among the Chinese community settled in Prato. To be eligible for the study, participants had (1) to self-identify to be born in continental China and to have grandparents born in that country; (2) to be aged 16 to 59 years; and (3) to live permanently in Prato. Exclusion criteria included pregnant women, critically ill individuals, and impaired cognitive ability as judged by clinical staff members. Participants were stratified by age group (16–19 years; 20–24 years; 25–29 years; 30–34 years; 35–39 years; 40–44 years; 45–49 years; 50–54 years; 55–59 years). Response rate of the eligible Chinese subjects approached during recruitment was 97%. The screening phase was performed between July and October 2014.

PROCEDURES

The Ethical Committee of ''Azienda Ospedaliero-Universitaria Careggi'' approved the study protocol (Ref. OSS.14.089). Subjects were provided with a written description of the study in Chinese and written consent was obtained from each participant. Participants with untreated clinical diseases identified during the examinations were referred to the Hospital of Prato.

Fasting individuals attended the research center between 07.00 and 10.00 am. Chinese and Italian staff members, who had attended clinical and laboratory training and were certified to use equipment, administered a written questionnaire and performed measurements.[21,22]

Questionnaire gathered information on basic sociodemographic characteristics and work, education and language, lifestyle and risk factors, sleep history, medical and reproductive history, healthcare use, and personal history of migration.[20,22]

Seated resting BP was then measured three times using a clinically validated semiautomatic digital sphygmomanometer (M6; Omron Matsusaka Co Ltd, Japan) with appropriate cuff size.[23] The average of the last two readings was used for analysis. Body mass index (BMI) and waist and hip circumferences were measured according to standardized protocols.[21,22]

Finger-prick blood samples were then obtained from fasting (>8 hours) participants to measure blood glucose (Accutrend, Roche Diagnostics, Mannheim, Germany), total cholesterol, and triglycerides (MultiCare-in, HPS, Italy) using validated methods.[22,24] Participants with fasting glucose ≥126 mg/dL were asked to return in 2 weeks for confirmatory testing.

MEASURES

The primary outcome variable was the prevalence of hypertension, defined as systolic BP ≥140 mm Hg or diastolic BP ≥90 mm Hg, or being on antihypertensive medication.[23] Among participants with hypertension, awareness was defined as self-report of any previous diagnosis of hypertension by a healthcare professional. Treatment of hypertension was defined as self-reported use of antihypertensive medications at the time of survey. Control of hypertension was defined as antihypertensive treatment associated with average systolic and diastolic BP values <140 mm Hg and <90 mm Hg, respectively. Blood pressure was stratified according to the recommendations of the 2013 ESH-ESC guidelines (grades ESH-ESC).[23]

Among the questions on sleep history were: (a) ''Your average sleep time at night is (hours),'' categorized as ≤5, 6, 7, 8, and ≥9 hours; short sleep duration was defined as having ≤6 hours sleep per night [25]; (b) ''Do you have the habit of nap after lunch ?'', if yes: ''The nap time is (hours),'' categorized as no nap, <1 h, ≥1 ; (c) ''Do you snore?,'' if yes ''How many days you snore per week?,'' categorized as no snoring, snoring 1 to 2 days per week, 3 to 6 days/week, and 7 days/week; (d) ''Do you have difficulty falling asleep?,'' if yes ''how many days per month you have difficulty falling asleep?,'' categorized as never; 1 to 6 days per month; 7 to 19 days/month; 20 to 30 days/month; (e) ''Are you unable to sleep after waking up at midnight?,'' if yes ''how many days per month you are unable to sleep after waking up at midnight?,'' categorized as never; 1 to 6 days per month; 7 to 19 days/month; 20 to 30 days/month; (f)''Do you experience undesired early morning awakening?,'' if yes ''how many days per month do you experience undesired early morning awakening?,'' categorized as never; 1 to 6 days per month; 7 to 19 days/month; 20 to 30 days/month; (g) ''Do you need to use drugs to help sleep?,'' if yes ''how many days per month do you need to use drugs to help sleep?.''

Covariates included type 2 diabetes mellitus, defined as increased fasting glucose (FG) ≥126 mg/dL at two visits (confirmed), or current use of medication prescribed to treat diabetes;[26] high total cholesterol (≥240 mg/dL),[27] and high triglycerides (≥200 mg/dL).[27]

Overweight or obesity was defined as BMI >24 kg/m^2.[28] Subjects were also stratified as underweight (BMI <18 kg/m^2), normal (BMI ≥18 and <24 kg/m^2), overweight (BMI ≥24 and <28 kg/m^2), or obese (BMI ≥28 kg/m^2).[28] Central obesity was defined as waist circumference ≥85 cm in men or ≥80 cm in women.[28] Sociodemographic characteristics included age, sex, education level (illiterate, primary school, middle school, college, or more), marital status (single, married), health insurance (none, registration to Health System, or private), Italian speaking (yes and no), and years of stay in Italy (quartiles).

Among assessed health behaviors were alcohol consumption (yes, at least once a month in the past year, or no, fewer than once a month in the past year),and smoking (current smokers and noncurrent smokers defined as those who never smoked and former smokers who quit smoking).

Statistical Analysis

The sample size was based on an estimated hypertension prevalence of 22%.[29] Considering a 95% CI precision of 3%, the estimated sample size was 707 individuals by gender. We

added 10% of the sample size to compensate for any eventual attrition, which resulted in a final sample of at least 1555 individuals.

Crude prevalence of hypertension was estimated by sex and overall. For hypertension awareness and treatment, the analysis was done on the subpopulation of subjects with hypertension; for hypertension control, analysis was done on the subpopulation of participants treated for hypertension. Values are expressed as mean ± SD for continuous variables or n cases (%) for categorical variables. Analyses were stratified by age group (16–19 years; 20–24 years; 25–29 years; 30–34 years; 35–39 years; 40–44 years; 45–49 years; 50–54 years; 55–59 years). Age standardization was calculated using the 2001 World Health Organization (WHO) standard world population.[30]

Bivariate analyses were performed using Yates's χ^2 tests for categorical variables and one-way analysis of variance for continuous variables.

Multivariate linear regression (with Odd Ratio, OR, and 95% confidence limits, 95% Cl) was used to identify the influence of sleep characteristics (categories) on systolic BP (mm Hg). Adjusted models included age, sex, BMI, waist to hip ratio, type 2 diabetes, and parental history of hypertension as specified.

Factors associated with hypertension were investigated with logistic regression. Adjusted models included potential confounders (age and sex) and possible mediators (parental history of hypertension, education, marital status, overweight or obesity, central obesity, characteristics of sleep history, health insurance, smoking, alcohol consumption, type 2 diabetes, Italian speaking, and quartiles of time of stay in Italy) as specified.

All analyses were performed using IBM SPSS version 22.0 (SPSS Inc, Chicago, IL, USA). A P-value of < 0.05 was considered as statistically significant.

RESULTS

Hypertension Burden in the Chinese Community

Main characteristics of subjects investigated are reported in Table 1. Participants were mainly occupied in light manual works in the textile industry (666 men and 803 women), only a minority being self-employed professionals (11 men and 14 women) or students (12 men and 17 women).

Overall, 348 out of the 1608 participants in the CHIP survey (21.7%) fulfilled criteria for hypertension (Table 1). As expected, age-specific prevalence of hypertension increased with age from 3.4% (95% Cl 1.8 to 5.0) in subjects aged 20 to 25 years to 47.4% (95% Cl 43.7–51.2) among subjects aged 55 to 59 years ($P < 0.001$) (Figure 1). For systolic and diastolic blood pressure values (mm Hg) in Chinese participants by age group and sex see Supplemental Digital Content (Table S1, http://links.lww.com/MD/A864). Age-standardized (WHO 2001 population) prevalence of hypertension was 19.2% (95% Cl: 18.5–20.0), being 21.7% (95% Cl: 20.5%–22.9%) in men and 17.3% (95% Cl: 16.3%–18.3%) in women. Overall, 177 participants had type 2 diabetes with an age-standardized prevalence of 9.6% (95% Cl: 9.1%–10.2%).

The proportion of hypertensive subjects aware of their condition was 54.3% (52.7% in men and 55.9% in women). This

TABLE 1. Sociodemographic and Clinical Characteristics of Participants in the Whole Group and by Gender

Variables	All (1608)	Men (n = 713)	Women (n = 895)	*P*
Age (years)	41.7 ± 10.2	41.6 ± 10.2	41.8 ± 10.2	0.653
Married	93.6%	91.3%	95.4%	0.002
Years in Italy	10.2 ± 5.2	10.1 ± 4.8	10.3 ± 5.4	0.446
Italian speaking	31.6%	32.6%	30.8%	0.474
Current smoker	18.7%	39.1%	2.3%	0.001
Alcohol drinkers	10.3%	18.5%	3.8%	0.001
Waist (cm)	81.3 ± 10.0	85.2 ± 9.0	78.2 ± 9.6	0.001
Waist to hip ratio	0.855 ± 0.072	0.883 ± 0.062	0.832 ± 0.072	0.001
BMI (kg/m^2)	23.3 ± 3.3	24.0 ± 3.1	22.9 ± 3.3	0.001
Overweight (BMI ≥24 kg/m^2)	39.7%	46.7%	34.2%	0.001
Central obesity (M ≥85; F ≥80)	46.3%	54.2%	40.0%	0.001
Systolic BP (mm Hg)	117.5 ± 18.7	121.0 ± 16.5	114.6 ± 19.9	0.001
Diastolic BP (mm Hg)	78.7 ± 11.6	80.6 ± 10.9	77.1 ± 11.8	0.001
Parental history of high BP	30.4%	29.6%	31.1%	0.520
Hypertension	21.7%	23.7%	20.0%	0.073
Aware of hypertension	54.3%	52.7%	55.9%	0.549
BP treated with drugs	70.4%	65.2%	75.0%	0.187
BP controlled with drugs	39.1%	43.1%	36.0%	0.405
Fasting glucose (mg/dL)	115.4 ± 30.1	118.8 ± 31.5	112.6 ± 28.7	0.001
Diabetes	11.0%	13.7%	8.8%	0.002
Total cholesterol (mg/dL)	232.4 ± 62.9	238.0 ± 67.6	227.8 ± 58.4	0.001
Triglycerides (mg/dL)	192.1 ± 107.8	195.7 ± 112.1	189.2 ± 104.2	0.236
High cholesterol	31.0%	37.0%	26.2%	0.001
High triglycerides	33.4%	33.9%	33.0%	0.702

BMI = body mass index; BP = blood pressure.

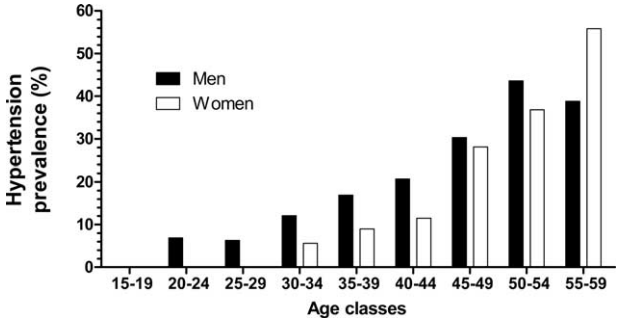

FIGURE 1. Age-specific prevalence of hypertension in the CHIP study population by gender. CHIP = CHInese In Prato.

proportion did not vary during the survey when data were stratified in 2-week periods (Chi-Square: 4.19; $P = 0.242$). Among aware hypertensives, 70.4% were treated with antihypertensive drugs (65.2% of men and 75.0% of women). Overall, 52 out of the 133 patients treated with drugs (39%) had their BP values controlled (43% and 36% of treated men and women, respectively) (Table 1). Hypertension awareness was not associated with healthcare insurance (OR adjusted for age and sex 1.21; 95% Cl: 0.78–1.90). Also, allocation to drug treatment among participants aware of hypertension was not associated with healthcare insurance (OR adjusted for age and sex 1.12; 95% Cl: 0.58–2.16). Importantly, hypertension was not associated with quartiles of years in Italy (age- and sex-adjusted OR: 0.99; 95% Cl: 0.84–1.18).

Sleep History and Risk Factors

Participants self-reporting histories of disturbed sleep (difficulty falling asleep and undesired early morning awakening) were more frequently women, whereas snorers were more frequently men than women (50.3% vs 26.9%, respectively) (Table 2).

At multivariate linear regression analysis, systolic BP values were positively associated with snoring frequency, a negative association being observed with categories of sleepless after awaking (Table 3).

ORs for the association between risk factors and hypertension at multivariable adjusted logistic regression analysis are reported in Table 4. Snoring frequency was associated with an increased risk of hypertension. In particular, when compared with no snoring, the OR for hypertension of snoring 3 to 6 days per week (adjusted for age and sex) was 2.11 (95% Cl: 1.48–3.01) and 2.48 (95% Cl: 1.79–3.46) of snoring every day (Figure 2). ORs for the relationship between snoring and blood pressure levels classified according to European Society of Hypertension/European Society of Cardiology guidelines ($P = 0.003$ for trend) is shown in Figure S1 in Supplemental Digital Content, *http://links.lww.com/MD/A864*. ORs for the relationship between snoring (snoring vs nonsnoring) and cardiovascular risk factors are reported in Supplemental Digital Content (Table S2, *http://links.lww.com/MD/A864*).

The relationship between sleep duration and high triglycerides is shown in Figure 3 and in Supplemental Digital Content (Table S3, *http://links.lww.com/MD/A864*). When compared with a sleep duration of ≤5 hours, sleep duration of 7 hours was associated with a reduced risk of high triglycerides (OR adjusted for age and sex: 0.66; 95% Cl: 0.43–0.95) (Figure 3). The relationship between sleep duration and high fasting glucose is shown in Figure 4. In particular, subjects who slept 8 hours per night had a reduced risk of having blood glucose values ≥126 mg/dL at the screening visit when compared with subjects with a sleep duration of ≤5 hours (OR adjusted for age and sex: 0.57; 95% Cl: 0.33–0.99) (Figure 4).

DISCUSSION

According to the present findings: (1) age-standardized prevalence of hypertension in our cohort of first-generation Chinese workers aged 16 to 59 years was 21.7% (95% Cl:

TABLE 2. Sleep Characteristics of Participants in the Whole Group and by Gender

	All		Men		Women		
	n	Mean ± SD or %	n	Mean ± SD or %	n	Mean ± SD or %	*P*
Sleep time (h)	1608	7.0 ± 1.1	713	7.1 ± 1.1	895	6.9 ± 1.1	0.009
Daytime nap (h)	164	1.3 ± 0.6	59	1.2 ± 0.5	105	1.3 ± 0.6	0.026
Difficulty falling asleep (days/month)	267	14.8 ± 10.5	88	13.5 ± 10.1	179	15.4 ± 10.6	0.249
Sleepless after awaking (days/month)	181	18.2 ± 10.5	63	17.4 ± 10.6	118	18.6 ± 10.5	0.527
Wake up early (days/month)	113	17.2 ± 10.2	40	13.9 ± 9.4	73	19.0 ± 10.2	0.007
Drug to sleep (days/month)	9	16.3 ± 11.0	2	21.0 ± 12.7	7	15.0 ± 11.2	0.535
Snore frequency							
0 days/week	953	63.2	336	50.2	616	73.5	0.001
1–2 days/week	61	4.0	34	5.1	27	3.2	–
3–5 days/week	230	15.3	132	19.7	98	11.7	–
7 days/week	264	17.5	167	25.0	97	11.6	–
Sleep time							
≤5 h	112	7.0	45	6.3	67	7.5	0.071
6 h	345	21.5	135	19.0	210	23.5	–
7 h	660	41.1	293	41.2	367	41.0	–
8 h	411	25.6	199	27.9	212	23.7	–
≥9 h	79	4.9	40	5.6	39	4.4	–

SD = standard deviation

TABLE 3. Association Between Characteristics of Sleep History and Systolic BP Values (mm Hg) at Linear Regression Analysis

	Model 1		Model 2		Model 3	
Variables of Sleep History	**OR (95% CI)**	***P***	**OR (95% CI)**	***P***	**OR (95% CI)**	***P***
Sleep time (5 categories)	−0.52 (−1.39 to 0.35)	0.244	−0.37 (−1.30 to 0.56)	0.436	−0.23 (−1.15 to 0.69)	0.625
Daytime nap (3 categories)	0.49 (−1.61 to 2.58)	0.649	−0.59 (−2.71 to 1.54)	0.589	−0.66 (−2.77 to 1.45)	0.541
Difficulty falling asleep (4 categories)	−1.25 (−2.22 to −0.28)	0.012	−0.84 (−1.82 to 0.13)	0.091	−0.81 (−1.78 to 0.16)	0.101
Sleepless after awaking (4 categories)	−1.43 (−2.49 to −0.36)	0.009	−1.19 (−2.26 to −0.12)	0.030	−1.21 (−2.28 to −0.15)	0.025
Wake up early (4 categories)	0.33 (−1.00 to 1.66)	0.626	0.73 (−0.59 to 2.05)	0.279	0.65 (−0.66 to 1.96)	0.330
Snoring (4 categories)	2.31 (1.58 to 3.04)	0.001	1.44 (0.66 to 2.23)	0.001	1.43 (0.65 to 2.20)	0.001

Model 1: age, and sex.
Model 2: model 1, all variables included in the table, and body mass index.
Model 3: model 2, glucose categories, parental hypertension, current smoking, alcohol use, marital status, and education categories.
CI = confidence interval, OR = odd ratio.

20.5%–22.9%) in men, and 17.3% (95% Cl: 16.3%–18.3%) in women; (2) rate of awareness and treatment were not associated with free access to health services (health insurance); (3) a potential impact of sleeping history on health was observed, more precisely snoring frequency being independently and positively associated with hypertension and short sleep duration being associated with increased metabolic risk.

Data on the prevalence of hypertension among Chinese living in Europe are available for UK.[10,11,31] In the Health Survey for England the age-standardized prevalence of hypertension in Chinese immigrants (aged 16 and over) was 20.2% in men and 16.2% in women.[31] The comparable values we found in Prato, give the first estimation in the South Europe. In our CHIP survey age, parental history of hypertension, overweight or obesity, and diabetes were independent predictors of hypertension. The association with central obesity was indeed lost when overweight or obesity was included in the model. Most importantly, the capability to speak Italian was associated with quartiles of years in Italy (age- and sex-adjusted OR: 1.25; 95% Cl: 1.06–1.46), whereas hypertension was not influenced by duration of stay in the host Country (age- and sex-adjusted OR: 0.99; 95% Cl: 0.84–1.18). It seems thus conceivable that first-generation Chinese immigrants do not assimilate Western (Italian) lifestyle. Subjects might rather keep much of their native country's traditions, including behavioral and nutritional habits. Of course these comments are only referred to first-generation Chinese migrants. However, second-generation subjects, born in the host country and with greater possibility of social exchange and understanding of the language, might follow different behaviours.[32]

Health insurance coverage plays an important role in reducing health disparities, though it does not ensure access to equivalent healthcare resources. In the CHIP survey, the use of antihypertensive treatment was independent of being entitled

TABLE 4. Odd Ratios for the Association Between Risk Factors and Hypertension Among Chinese Participants at Logistic Regression Analysis

	At Risk	Model 1		Model 2	
Risk Factors	**n**	**OR (95% Cl)**	***P***	**OR (95% Cl)**	***P***
Gender (male)	1608	1.30 (1.00 to 1.67)	0.047	1.08 (0.78 to 1.49)	0.666
Age (5-year categories)	1606	1.67 (1.54 to 1.80)	0.001	1.59 (1.45 to 1.75)	0.001
Education (categories)	1606	0.90 (0.75 to 1.08)	0.246	0.92 (0.75 to 1.11)	0.378
Parental history of Hypertension	1532	1.78 (1.36 to 2.34)	0.001	1.94 (1.45 to 2.61)	0.001
Alcohol use	1608	1.39 (0.93 to 2.08)	0.106	0.89 (0.64 to 1.22)	0.450
Overweight or obesity (BMI >24 kg/m^2)	1608	2.57 (1.98 to 3.33)	0.001	1.76 (1.24 to 2.49)	0.001
Central obesity	1602	2.04 (1.56 to 2.66)	0.001	1.07 (0.75 to 1.53)	0.696
Diabetes	1608	1.97 (1.38 to 2.79)	0.001	1.69 (1.14 to 2.52)	0.010
High total cholesterol (>240 mg/dL)	1603	0.90 (0.68 to 1.19)	0.459	0.83 (0.61 to 1.13)	0.225
High triglycerides (>200 mg/dL)	1603	1.28 (0.98 to 1.67)	0.068	1.06 (0.79 to 1.43)	0.692
Italian speaking	1473	0.90 (0.67 to 1.21)	0.481	0.98 (0.72 to 1.34)	0.917
Health insurance	1603	0.97 (0.75 to 1.25)	0.800	0.97 (0.73 to 1.29)	0.834
Snoring (categories)	1505	1.37 (1.24 to 1.53)	0.001	1.29 (1.14 to 1.45)	0.001
Sleepless after awaking (categories)	1491	0.91 (0.78 to 1.07)	0.264	0.92 (0.77 to 1.09)	0.309

Model 1: adjusted for age, sex.
Model 2: adjusted for all variables included in the table (1454 participants included in analysis).
BMI = body mass index, CI = confidence interval, OR = odd ratio.

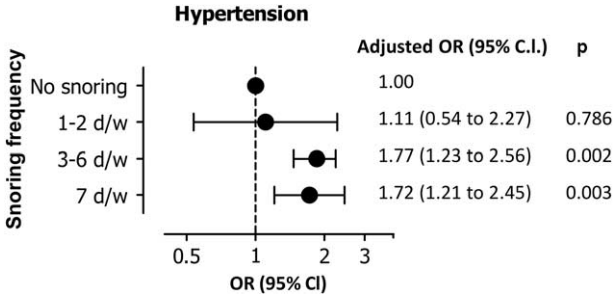

FIGURE 2. Association between hypertension and categories of snoring frequency (days/week) at logistic regressions analyses adjusted for age, sex, sleep duration, and body mass index (including 1505 participants).

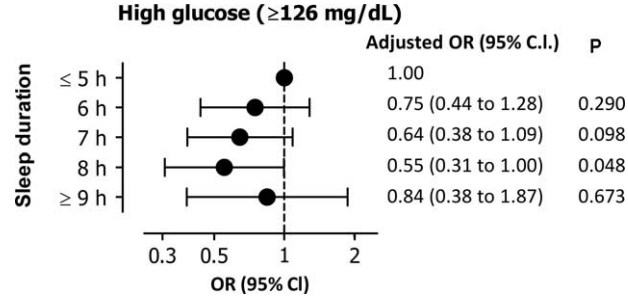

FIGURE 4. Association between high glucose (≥126 mg/dL) at screening visit and categories of sleep duration (hours) at logistic regressions analyses adjusted for age, sex, snoring frequency, and BMI (including 1456 subjects not treated with hypoglycemic drugs). BMI = body mass index.

to a free access to the healthcare system. Equal provision of care, with the removal of the administrative burden currently limiting the access to health services to undocumented migrants in the majority of European countries,[33] might thus be insufficient to reduce hypertension burden in the absence of specific information programs. Prevention programs addressed to resident population might be inefficient for ethnic minorities.[34] In the present survey, also to be confident with Italian language was not associated with being active participants in care planning and self-management. Investing in a multiethnic perspective is thus necessary for eliminating inequities in hypertension also in Europe.[2]

Snoring is a recognized predictor of obstructive sleep apnea,[35] and an independent correlation between greater apnea–hypopnea index and high BP was consistently observed.[35,36] The diagnosis of obstructive sleep apnea requires polysomnography, so interest exists for an inexpensive strategy to be adopted on a population-wide level.[37] An independent association between snoring and hypertension was reported,[38,39] although the confounding effect of age, sex, or obesity was also observed.[40] According to the present findings, the first obtained in a migrant cohort exposed to high demanding work, snoring frequency was associated with enhanced risk of hypertension at logistic regression adjusted for age, sex, and BMI.

There is also growing concern among patients and health care providers regarding the potential medical sequelae of insomnia, especially on hypertension.[41] Studies investigating self-reported data at population-level reported conflicting results,[42,43] whereas objective short sleep duration was found to be associated with hypertension.[41,44] According to our findings, self-reported symptoms of insomnia were not independently associated with hypertension diagnosis. Short sleep duration was however associated with enhanced metabolic risk and high blood levels of triglycerides and glucose. However, there were no associations between short sleep and obesity or diabetes. Although the reason for this discrepancy is not fully understood, probably influenced by differences in unexplored lifestyle factors and eating behaviors, the association with high glucose and high triglycerides carries potential social and health implications. High age-standardized prevalence of diabetes was recently reported in China,[45] and we found a comparable value in Italy. The potential impact of working hours and shift-work is thus to be considered in future public health promotion program specifically addressed to Chinese migrant workers.

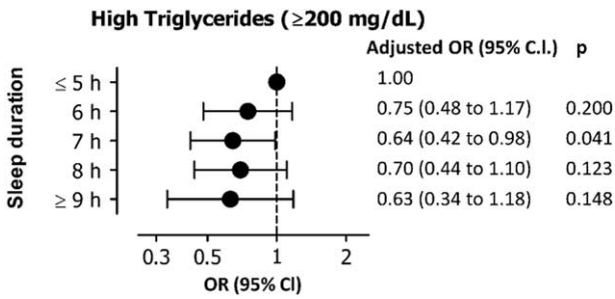

FIGURE 3. Association between high triglycerides and categories of sleep duration (hours) at logistic regressions analyses adjusted for age, sex, snoring frequency, and body mass index (including 1500 participants).

This study has several potential limitations. The recruiting procedure followed for Chinese participants might result in a potential selection bias. However, the conventional sampling procedure adopted in epidemiological studies would have led to the exclusion of undocumented migrants because the ability to go back to a list of subjects in some form was lacking. Undocumented migrants are also excluded from healthcare provision for chronic disease in most European countries even if the same countries offer to migrants free access for acute complication of such as myocardial infarction and stroke. To have the possibility to collect health needs on this group, we adopted a network sampling procedure, in which the identified informants served as recruiters between relatives, friends, or neighbors, to produce a sample matching the target population for age groups and gender.[46] A second limitation is that most of the subjects are selected from a textile industrial environment which is a peculiarity of the area of Prato. The city is now home to the largest concentration of Chinese in Europe. This is the reason why we decided to investigate risk factors in this area. A third limitation of the study is that only self-reported data on sleep were used, which is subject to recall bias. In addition, the questionnaire did not include a specific question on daytime sleepiness. However, the study cohort involves a large number of participants. Fourth, the sample was limited to subjects aged ≤59 years so that information on elderly subjects are lacking. Although additional studies with larger sample sizes are needed to evaluate hypertension burden at older ages, the present study was specifically aimed at investigating subjects in working ages. In addition, the creation of a cohort composed by young subjects offers the opportunity to follow the same subjects in the future.

In conclusion, in the present survey performed on young and middle-aged first-generation Chinese migrants living in Italy, hypertension prevalence was not influenced by the duration of stay in Italy, and drug treatment was not affected

by health insurance. These aspects are to be taken into account to devise strategies to reach the Chinese community and the importance of integrating them into health services.

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