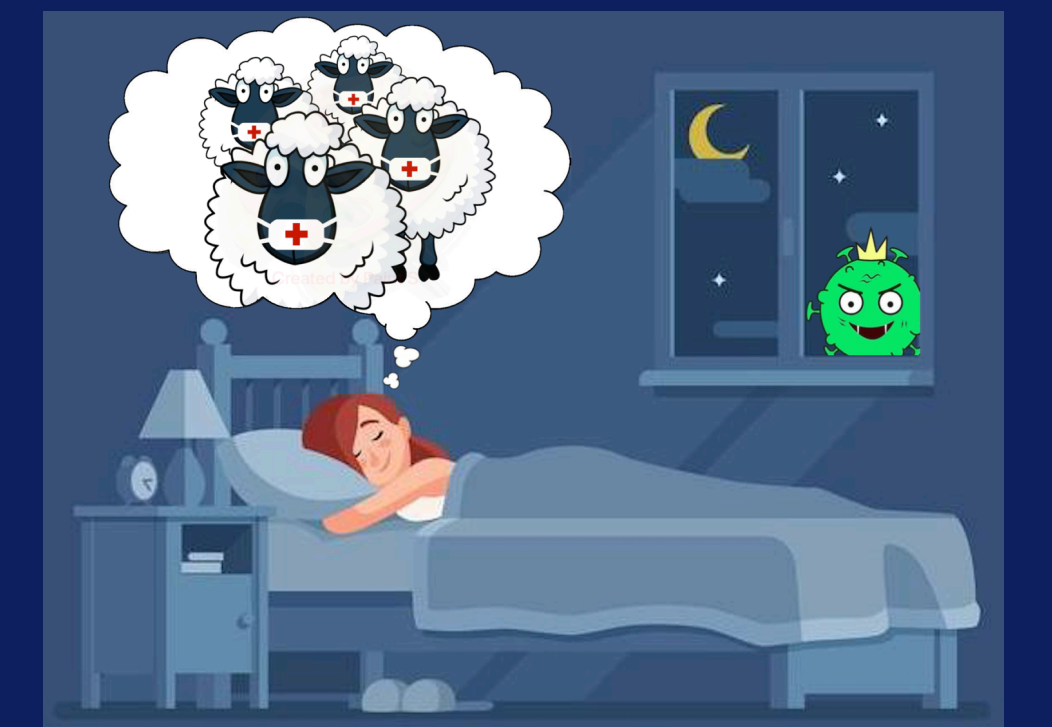# The impact of home confinement due to COVID-19 pandemic on sleep quality and insomnia symptoms among the Italian population

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DIPARTIMENTO DI SCIENZE CLINICHE APPLICATE E BIOTECNOLOGICHE
nam et ipsa scientia potestas est

INTRODUCTION & AIMS

The rapid spread of the COVID-19 pandemic led the Italian government to apply total lockdown measures, implying home confinement of the general population for a dramatically extended period (9 March – 3 May 2020). This extraordinary situation profoundly impacted the everyday life of all the Italian citizens. In a period where the rhythms of life were deeply altered, sleep constitutes one of the primary targets to be affected. The present study aimed to investigate the large-scale implications of this unprecedented situation on sleep of the Italian population.

MATERIALS AND METHODS

Cross-sectional study

A total of 13989 Italian citizens (age 34.8 ± 12.2 yrs, range 18–86, 3223 males) completed a web-based survey from the third week to the end of the home confinement period (25 March – 3 May 2020). The questionnaires have been disseminated through a snowball technique on social networks and via telephone messages. The survey assessed sociodemographic and special-interest information, sleep quality, insomnia symptoms, chronotype, depression symptoms, perceived stress, and anxiety, using the following questionnaires:

- Sociodemographic questionnaire;
- Questionnaire addressing the self-reported consequences of the confinement on sleep;
- Pittsburgh Sleep Quality Index (**PSQI**);
- Insomnia Severity Index (**ISI**);
- Reduced Morningness-Eveningness Questionnaire (**r-MEQ**);
- Beck Depression Inventory-second edition (**BDI-II**);
- 10-item Perceived Stress Scale (**PSS-10**);
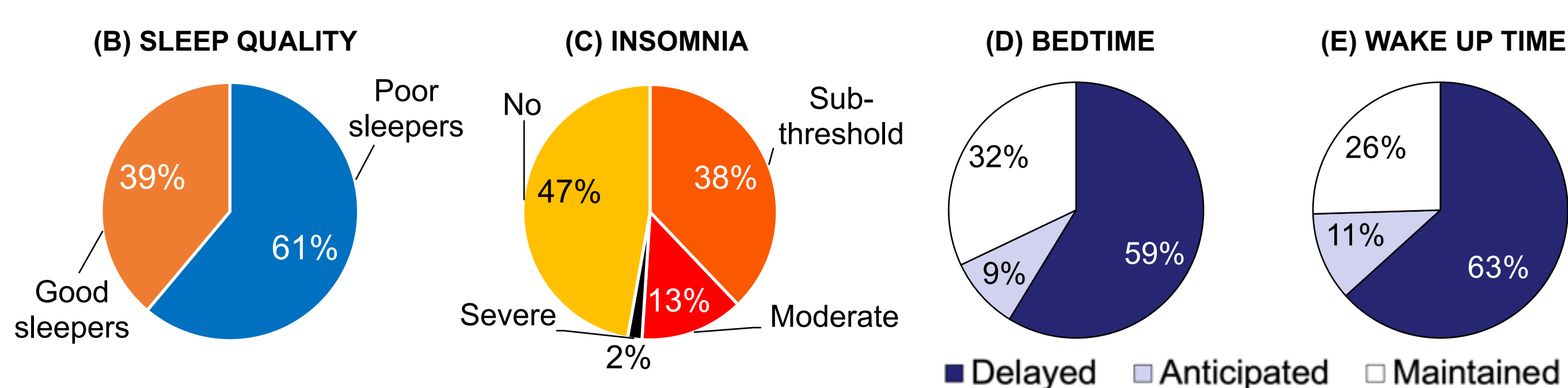- State-Trait Anxiety Inventory (**STAI-X1**).

Longitudinal study

2123 respondents (age 33.1 ± 11.6 yrs, range 18–82, 401 males) who participated in the first four days of data collection (**Test 1**, before Daylight Saving Time) were retested four weeks later (**Test 2**), to evaluate the within-subject changes in the sleep and psychological variables during the protracted home confinement period. Participants were also asked about changes from the first assessment in the duration of the exposure to backlit screens before bedtime.

CROSS-SECTIONAL STUDY RESULTS (N=13989)

Self-reported information and sleep disturbance prevalence

Most respondents reported a sleep quality worsening during the lockdown (**A**). A considerable prevalence of poor sleepers (**B**) and clinical insomnia conditions (**C**) has been observed according to the PSQI and ISI cut-off scores, respectively. The confinement led to widespread changes in the sleep routine (**D,E**).


(A) PERCEIVED IMPACT ON SLEEP — None 24%, Negative 60%, Positive 16%

(B) SLEEP QUALITY — Poor sleepers 39%, Good sleepers 61%

(C) INSOMNIA — No 47%, Sub-threshold 38%, Moderate 13%, Severe 2%

(D) BEDTIME — Delayed 59%, Anticipated 9%, Maintained 32%

(E) WAKE UP TIME — Delayed 63%, Anticipated 11%, Maintained 26%

■ Delayed ■ Anticipated □ Maintained

Predictors of poor sleep and insomnia during the home confinement

Predictor	PSQI B	PSQI P	ISI B	ISI P
Intercept	.232	.323	-1.202	**<.001**
Age	.045	**<.001**	.027	**<.001**
Gender				
Women	*Reference*		*Reference*	
Man	-.690	**<.001**	-.540	**<.001**
Education				
Middle/High school	*Reference*		*Reference*	
Graduated	-.287	**<.001**	-.426	**<.001**
Over graduated	-.481	**<.001**	-.611	**<.001**
Occupation				
Health workers	*Reference*		*Reference*	
Workers	-.514	**<.001**	-.473	**.025**
Student	-.761	**<.001**	-.868	**<.001**
Unemployed	-.255	.161	-.219	.395
r-MEQ				
Intermediate type	*Reference*		*Reference*	
Morning type	-.641	**<.001**	-1.003	**<.001**
Evening type	.248	**.021**	.353	**.019**
BDI-II	.138	**<.001**	.229	**<.001**
PSS-10	.037	**<.001**	.073	**<.001**
STAI-X1	.057	**<.001**	.090	**<.001**

Significant regression equations were found with PSQI and ISI scores as dependent variables (R^2=.30, $F_{13,8556}$=278.58, P<.001; R^2=.35 $F_{13,9050}$=365.66, P<.001; respectively). Female gender, elderly, low education, healthcare working, and evening chronotype were associated with the highest PSQI and ISI scores. Higher level of depression, perceived stress and anxiety predicted higher severity of sleep disturbances and insomnia symptoms.

Working and sleeping during the lockdown

One-way ANOVA showed that the sleep of respondents differed according to the lockdown-related changes of the working activity (PSQI: $F_{3,8005}$=14.70, P<.001; ISI: $F_{3,8438}$=16.64, P<.001). Smart workers were the best sleepers during the home confinement. (Mean ± SEM) * P<.05

Working activity: Maintained, Suspended, Reduced, Smart working
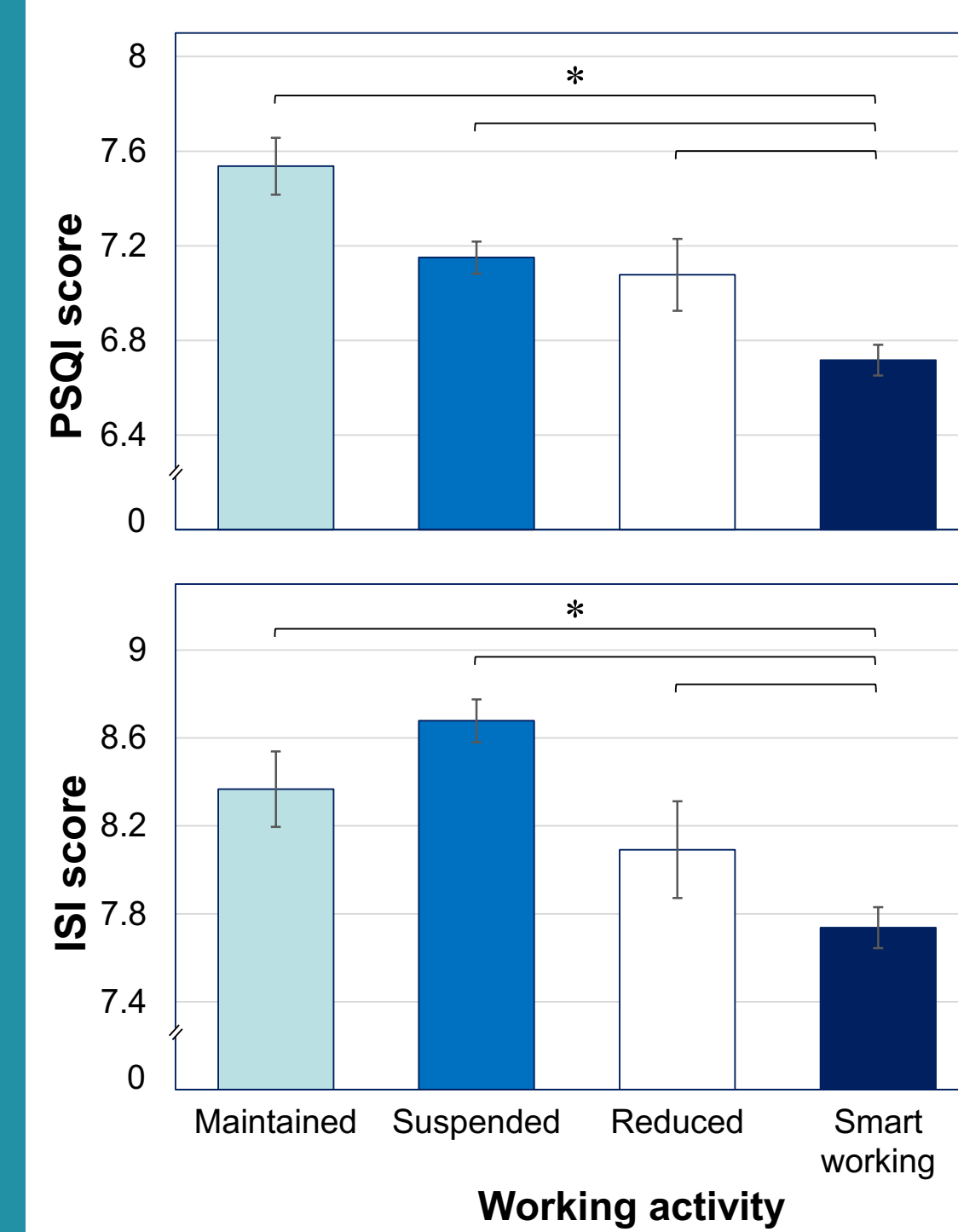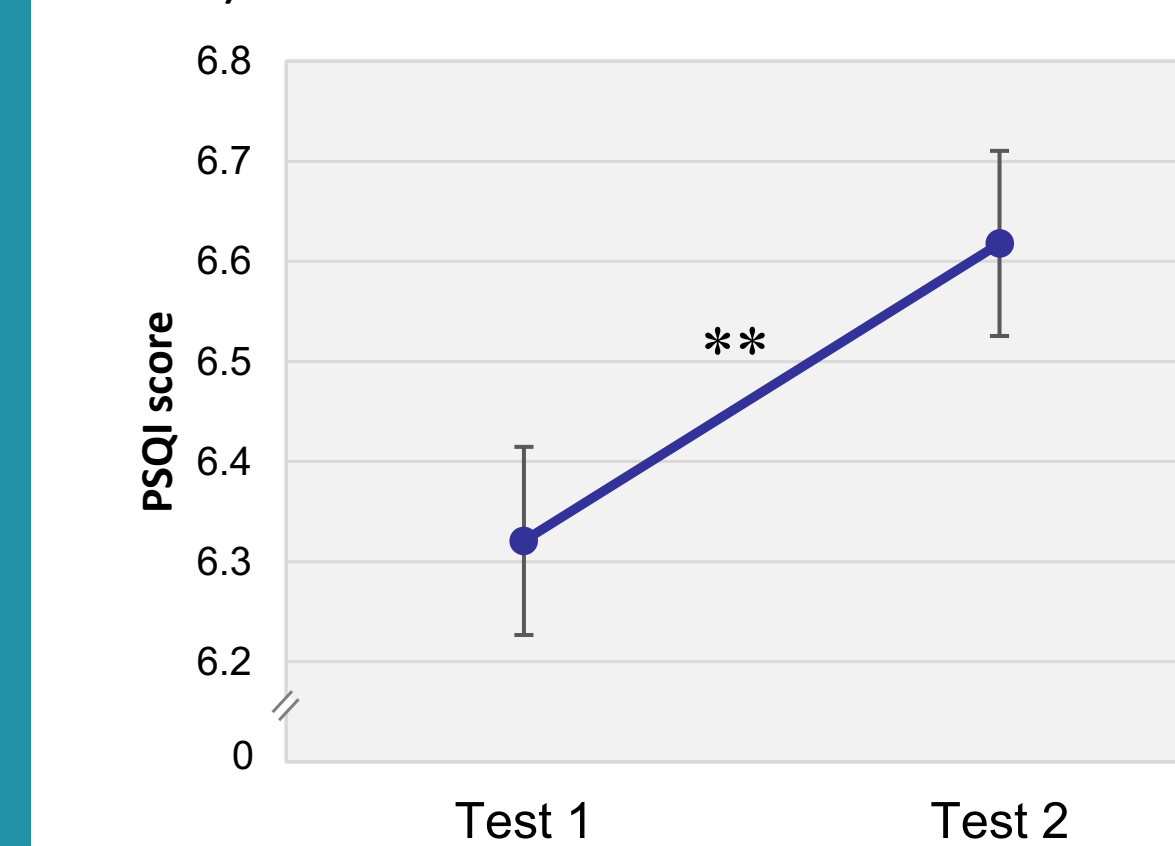
Time course of sleep quality and insomnia symptoms

One-way ANOVA highlighted a significant increase of PSQI and ISI scores throughout the extended home confinement period ($F_{5,13110}$=45.86, P<.001; $F_{5,13921}$=32.96, P<.001; respectively). The Figures below show the trend of PSQI and ISI scores from the third week to the end of the lockdown (Mean ± SEM).

Dates: 25–28 March, 29 March–4 April, 5–11 April, 12–18 April, 19–25 April, 26 April–3 May
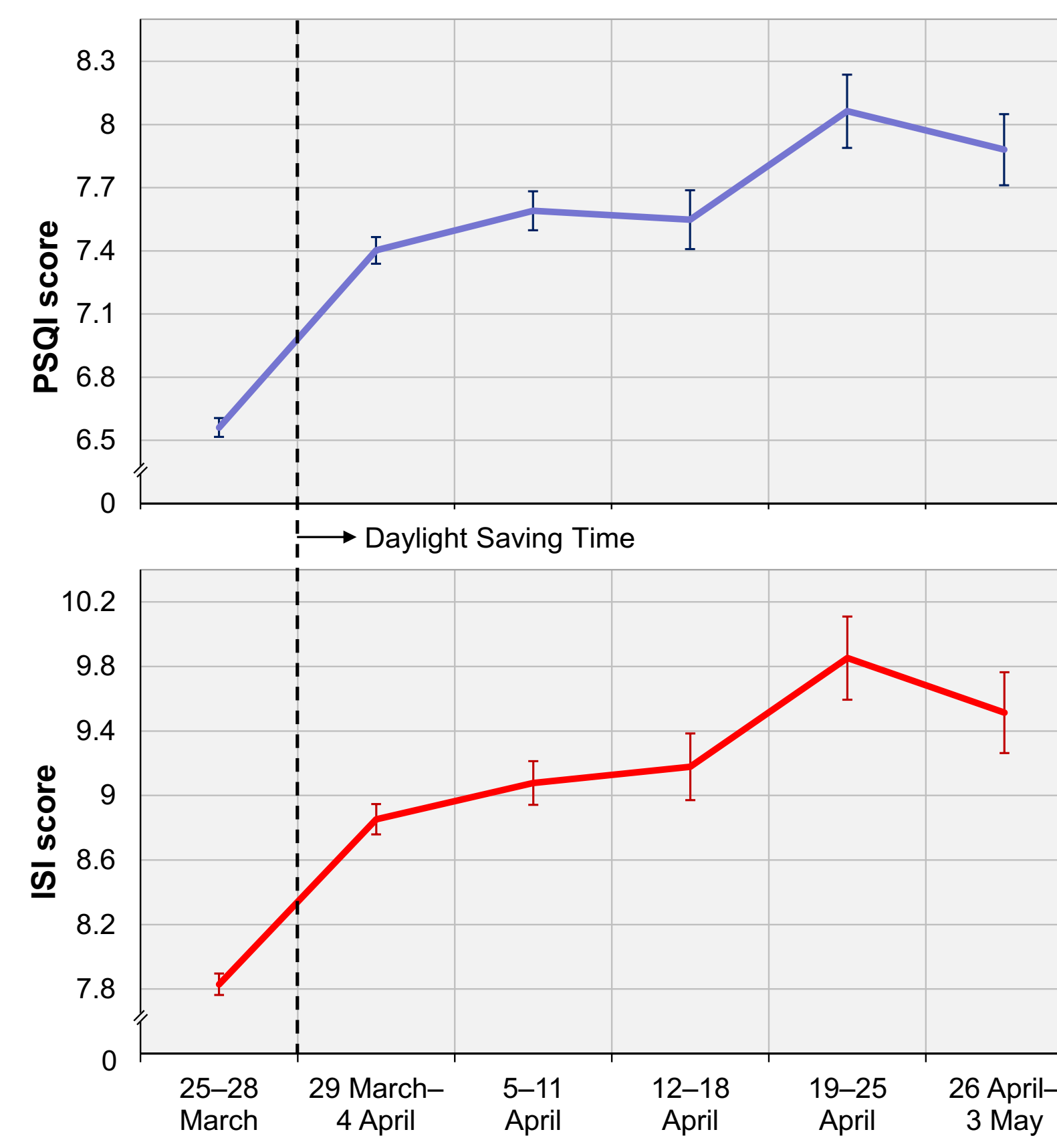
## LONGITUDINAL STUDY RESULTS (N=2123)

Sleep quality changes

Mixed model analysis comparing Test 1-Test 2 PSQI scores highlighted a sleep quality deterioration controlling for the covariance of age, gender, depression, stress, and anxiety. No differences on ISI scores have been obtained. (Mean ± SEM) ** P<.001.
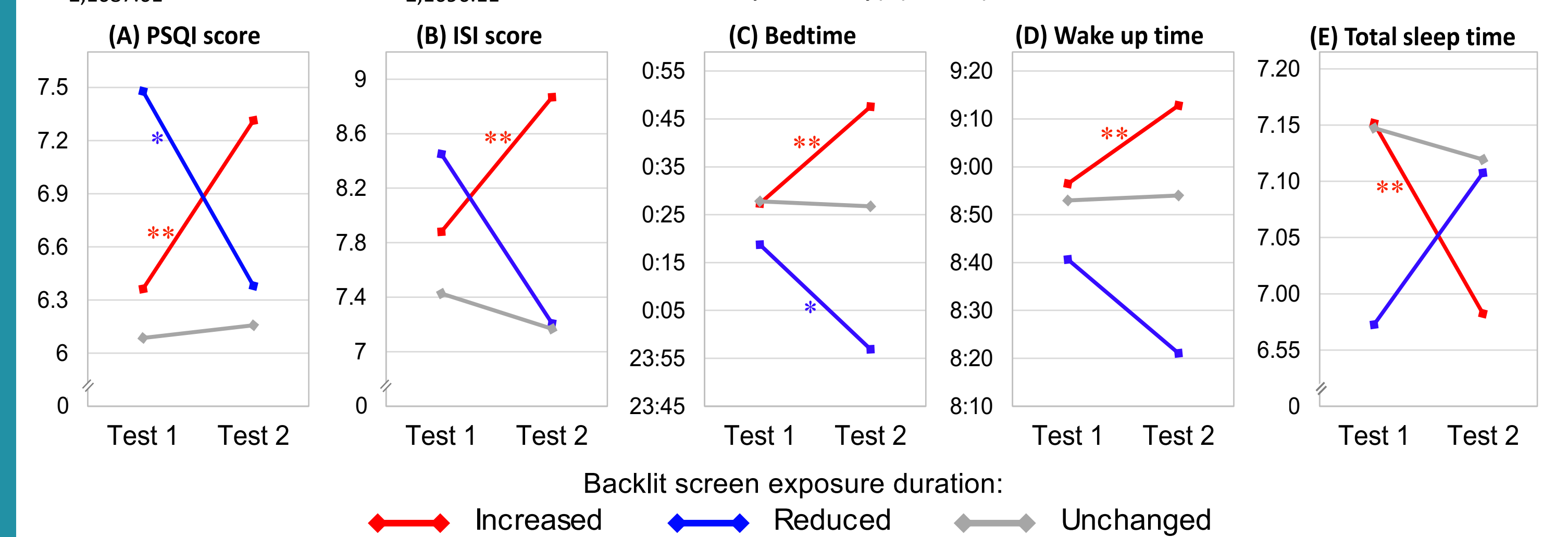

Gender-related effects

Women presented the highest PSQI and ISI scores in both the assessments. After four weeks, male participants showed a worsening of sleep quality and insomnia symptoms. On the other hand, women reported a reduction of insomnia severity symptoms (Mean ± SEM) ** P<.001.

● Women ● Men
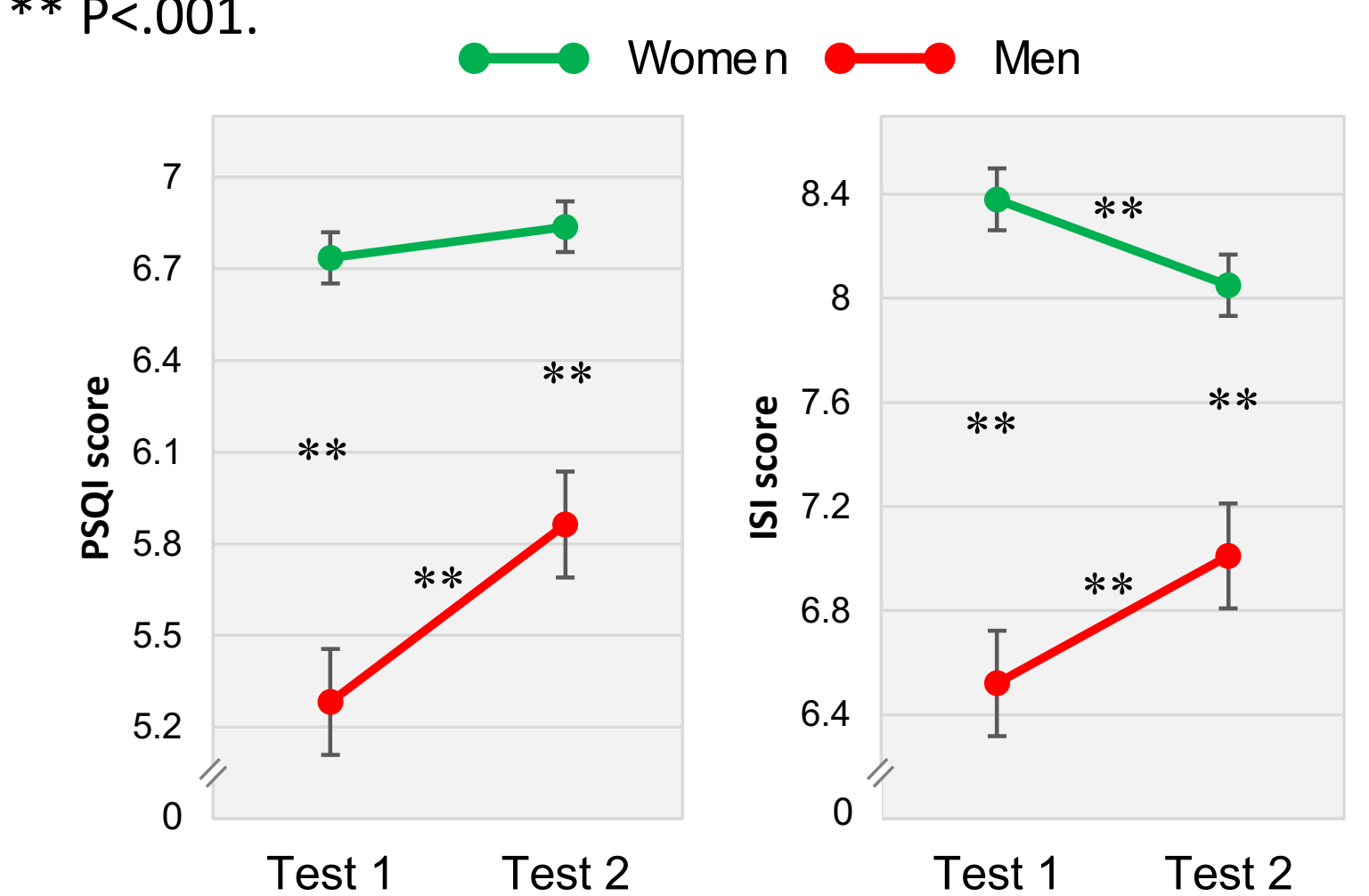
Backlit screen exposure duration and sleep

The retrospectively reported changes between Test 1 and Test 2 of the duration of backlit screen exposure in the 2-3 hours before bedtime are associated with specific changes of PSQI and ISI scores, controlling for the covariance of age, gender, depression, stress, and anxiety ($F_{2,1607.10}$=17.45, P<.001; $F_{2,1685.30}$=14.03, P<.001; respectively). The increase/decrease of backlit screen exposition is associated with coherent changes of PSQI and ISI scores (**A,B**). At Test 2, respondents modified their bedtime, wake up time, and total sleep time according to the changes in the backlit screen use ($F_{2,1692.57}$=17.43, P<.001; $F_{2,1687.61}$=13.19, P<.001; $F_{2,1696.11}$=8.37, P<.001; respectively) (**C,D,E**). * P<.05, ** P<.001.

(A) PSQI score (B) ISI score (C) Bedtime (D) Wake up time (E) Total sleep time

Backlit screen exposure duration:
— Increased — Reduced — Unchanged

CONCLUSIONS

- ❖ The restraining measures negatively impacted the sleep of the Italian population. Specific sociodemographic categories confirmed their vulnerability during the lockdown;
- ❖ Smart working emerges as a potential protective factor;
- ❖ Both the cross-sectional and the longitudinal study point to a cumulative detrimental effect of the prolongation of this extraordinary situation of home confinement;
- ❖ The deterioration over time of sleep quality is independent of the effects on depression, stress, and anxiety;
- ❖ A different time course of sleep problems distinguishes the genders during the extension of the home confinement period;
- ❖ The backlit screen exposition before bedtime appears as a crucial mediator of the sleep outcomes.

Interventions aimed to raise public awareness about healthy sleep behaviors are fundamental to prevent and counteract the occurrence and exacerbation of sleep disturbances and to foster well-being during the home confinement due to COVID-19 pandemic.