

# A biomonitoring pilot study in workers exposed to pigment-grade titanium dioxide (TiO<sub>2</sub>) during paints production

**M. Buglisi**, E. Bergamaschi, V. Bellisario, G. Garzaro, G. Squillacioti, F. Ghelli, C. Riganti, I. Fenoglio, G. Castrignanò, M. Macrì, S. Bonetta, E. Carraro.  
Department of Public Health and Pediatrics, Department of Oncology and Department of Chemistry, University of Torino, Italy.

## BACKGROUND

TiO<sub>2</sub> is broadly used in many applications, although it is classified as suspected carcinogen via inhalation. A NIOSH REL for UF TiO<sub>2</sub> has been set at 0.30 mg/m<sup>3</sup>, whereas the ANSES has proposed a Toxicological Reference Value of 0.12 µg/m<sup>3</sup> for TiO<sub>2</sub>-NPs as a threshold to prevent chronic lung effects.

## AIM OF THE STUDY

To assess early pulmonary and systemic effects in workers with mild TiO<sub>2</sub> exposure during paint production.

## STUDY GROUPS

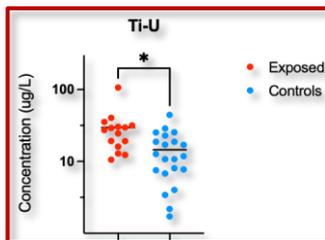
- 15 workers employed for 3-32 years in a plant producing paints and handling TiO<sub>2</sub> powders (SSA – BET: 56.2 m<sup>2</sup>/g) as a pigment
- 20 not exposed volunteers as a control group

## EXPOSURE

- Respirable fraction of dusts in specific working areas and in the personal breathing zone (pbz) of workers.
- A NanoTracer™ was used to record background and pnc of UFP generated during the activities.

Company area / Type of sampling	Water based paint system	Quartz production plants	Grinding and dispersion	Admin. Office	Outdoor
Area monitoring Respirable dusts (mg/m <sup>3</sup> 8h-TWA)	0.064	0.013	0.112 – 0.137	0.033	
Area monitoring Respirable TiO <sub>2</sub> (µg/m <sup>3</sup> 8h-TWA)	0.018	0.018 – 0.114	0.012 – 0.024	0.013	
PBZ - TiO <sub>2</sub> µg/m <sup>3</sup> 8h-TWA	0.104 – 0.462	0.011 – 0.012	0.007 – 0.014	0.012	
Particle number concentration (avg aerod. diameter)	24,981-54,681 (64-73)	20,800 – 27,680 (78-93)	40,720-46,404 (65)	16,973 (71)	8,162 (72)

- Ti in urine as biomarker of exposure (ICP-MS)

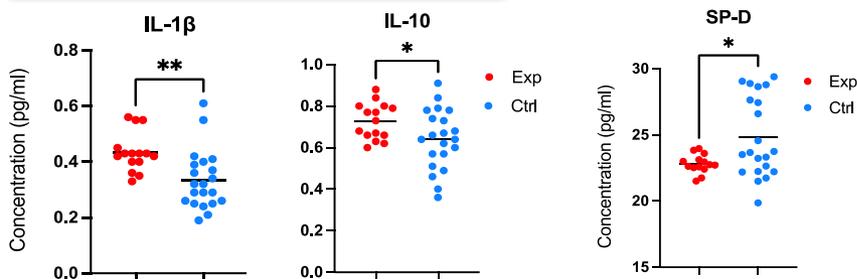


## CONCLUSIONS

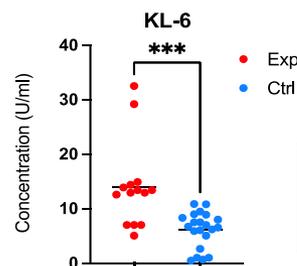
## Biological sampling: exhaled breath condensate (EBC) by TURBO-DECCS™



## Pro-inflammatory biomarkers in EBC



Surfactant protein D (SP-D) acts as a lung host defence protein and affects lung surfactant homeostasis



KL-6, a mucin-like glycoprotein reflecting changes of lung interstitium (pro-fibrogenic)

- ✓ Exposure to TiO<sub>2</sub> containing dusts well below the OELs, but close to the threshold for preventing fibro-proliferative and progressive alteration of epithelium, can result in subtle lung changes, as reflected by the increase in KL-6 and decrease of SP-D.
- ✓ A combined approach relying on both exposure assessment and biomarkers of effect can improve the risk assessment in occupational settings in which TiO<sub>2</sub> is handled, even though under strict control measures.
- ✓ Owing to the small number of subjects evaluated and the intrinsic variability of biomarkers, the observed changes along with their health significance must be assessed in a long-term perspective.