

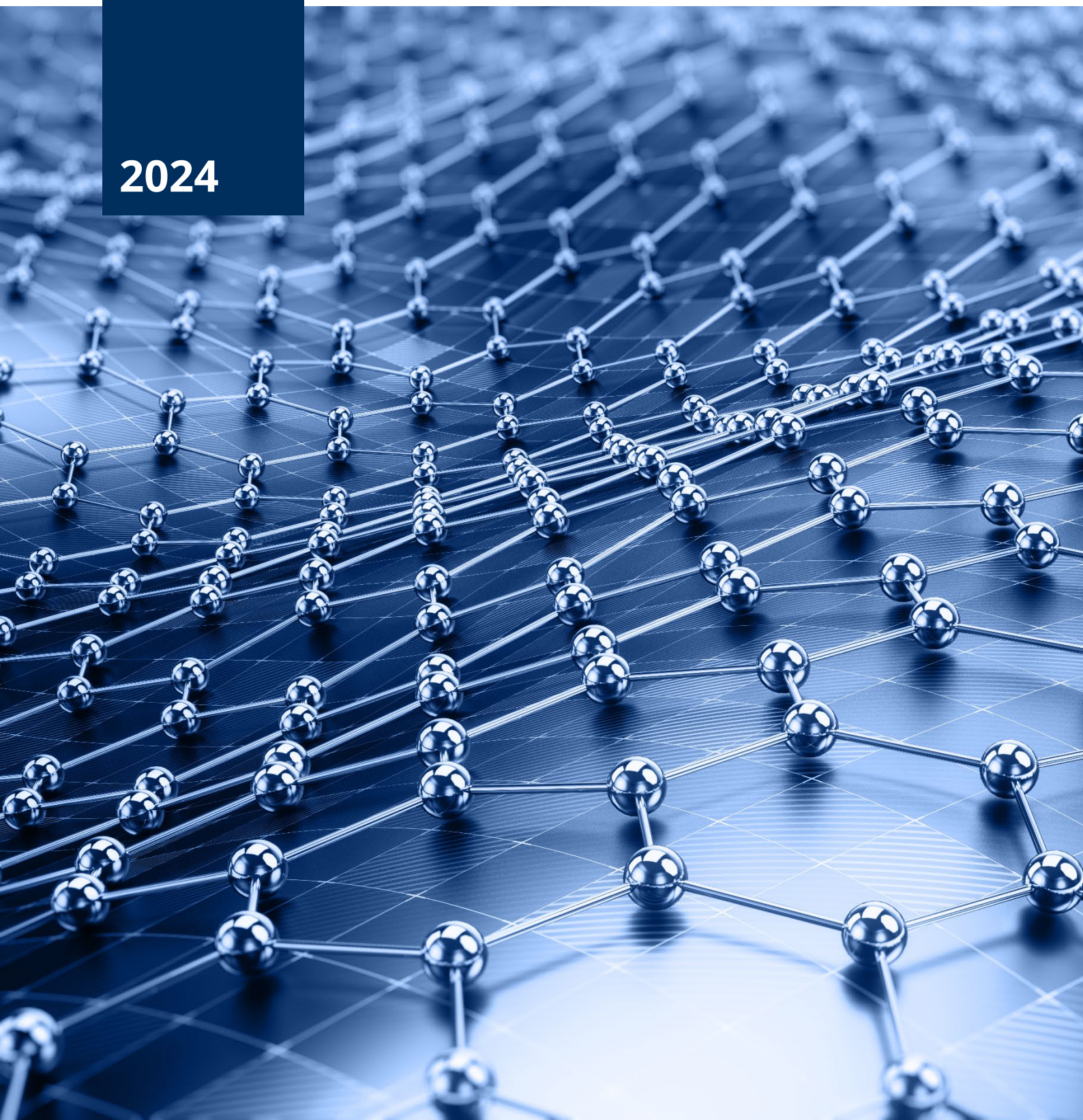
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PRESENTAZIONE

L'idea di una rassegna degli articoli scientifici pubblicati dai ricercatori su riviste internazionali, peer-reviewed e indicizzate, nasce dalla necessità di dare visibilità a questo tipo di trasferimento dei risultati delle attività di ricerca anche al di fuori della comunità scientifica. Infatti, questa produzione, benché contribuisca significativamente al prestigio dell'Istituto, è difficilmente fruibile al di fuori di un ristretto gruppo di specialisti, in quanto gli argomenti sono molto tecnici, viene pubblicata in lingua inglese, e non sempre le riviste sono accessibili gratuitamente. Gli articoli vengono menzionati, solo con la citazione, nei consuntivi annuali dei piani di attività, che hanno però ben una diversa finalità e diffusione.

La raccolta degli articoli pubblicati nel primo trimestre 2024 consta di 32 articoli, nei quali almeno uno degli autori è un ricercatore Inail. La multidisciplinarietà che caratterizza le tematiche affrontate, il cui filo conduttore è sempre la salute e sicurezza del lavoro, rispecchia la natura dei dipartimenti scientifici.

L'indice degli articoli è presentato in ordine alfabetico e contiene i collegamenti ipertestuali alle schede riassuntive, che riportano il titolo, i nomi degli autori, l'abstract in inglese, un breve sunto in italiano che ne rende il contenuto fruibile ad una ampia platea di lettori e il link al full text (nel caso di riviste open access) per consentire la lettura dell'articolo originale a chi sia interessato.

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TITOLO	PAG.
A polyvinylpyrrolidone nanofibrous sensor doubly decorated with mesoporous graphene to selectively detect acetic acid vapors	6
A real-time biphasic Kalman filter-based model for estimating human core temperature from heart rate measurements for application in the occupational field	7
Adaptive lifting index (aLI) for real-time instrumental biomechanical risk assessment: concepts, mathematics, and first experimental results	8
Allergenic pollen monitoring at Sapienza University Campus (Rome, Italy): patterns of pollen dispersal and implications for human health	9
Asbestos detection in construction and demolition waste by different classification methods applied to short-wave infrared hyperspectral images	10
Association between sex hormones and anti-S/RBD antibody responses to Covid-19 vaccines in healthcare workers	11
Cause specific mortality in an Italian pool of asbestos workers cohorts	12
Development of a methodology for assessing radiological dose due to use of norm sludge as fertilizer	13
Editorial: job integration/reintegration of people with neuromuscular disorders in the epoch of 'industry 4.0'	14
Exploiting immersive virtual reality for investigating the effects of industrial noise on cognitive performance and perceived workload	15
Exposure to airborne mycotoxins: the riskiest working environments and tasks	16
Job demands and resources and their association with employee well-being in the European healthcare sector: a systematic review and meta-analysis of prospective research	17
Local dynamic stability of trunk during gait is responsive to rehabilitation in subjects with primary degenerative cerebellar ataxia	18
Low transition temperature mixture-based extraction of 14 pesticides from tomato samples and their high-performance liquid chromatography-tandem mass spectrometry analysis	19
Maternal exposure to zinc oxide nanoparticles causes cochlear dysfunction in the offspring	20
Mitigating heat effects in the workplace with a ventilation jacket: Simulations of the whole-body and local human thermophysiological response with a sweating thermal manikin in a warm-dry environment	21
NMR untargeted and HPLC-MS/MS targeted metabolomic approaches for evaluating styrene exposure in the urine of shipyard workers	22
Non-malignant occupational respiratory diseases and climate change	23

TITOLO	PAG.
Oxidative stress and inflammation cause auditory system damage via glial cell activation and dysregulated expression of gap junction proteins in an experimental model of styrene-induced oto/neurotoxicity	24
Oxidative stress in occupational exposure to styrene vapours and dangerous chemicals in shipbuilding industry	25
Prevention-through-design approach to mitigate workers' exposure in the graphene production processes	26
Promoting safety, security, awareness and productivity in port plants	27
Proposal and practicality of an alternative blue-light hazard risk assessment method for high-intensity white-light sources at workplaces	28
Quality management practices. Impact of iso 9001:2015 certification on directive 2014/68/UE (PED)	29
Review of NORM occurrence and application of a tailored graded approach for the radiation protection in geothermal plants	30
Risk assessment for workers with wearable medical devices exposed to electromagnetic fields	31
Studies of potential migration of hazardous chemicals from sustainable food contact materials	32
Targeting glucosylceramide synthase induces antiproliferative and proapoptotic effects in osimertinib-resistant NSCLC cell models	33
Targeting metabolic adaptive responses induced by glucose starvation inhibits cell proliferation and enhances cell death in osimertinib-resistant non-small cell lung cancer (NSCLC) cell lines	34
The impact of toxic metal bioaccumulation on colorectal cancer: Unravelling the unexplored connection	35
The lower limb muscle co-activation map during human locomotion: from slow walking to running	36
Use di BIG data per la valutazione degli effetti sanitari acuti e cronici dell'inquinamento atmosferico nella popolazione italiana	37

A POLYVINILPYRROLIDONE NANOFIBROUS SENSOR DOUBLY DECORATED WITH MESOPOROUS GRAPHENE TO SELECTIVELY DETECT ACETIC ACID VAPORS

Papa P, Zampetti E, Molinari FN, De Cesare F, Di Natale C, Tranfo G, Macagnano A.

SUMMARY

An original approach has been proposed for designing a nanofibrous (NF) layer using UVcured polyvinylpyrrolidone (PVP) as a matrix, incorporating mesoporous graphene carbon (MGC) nanopowder both inside and outside the fibers, creating a sandwich-like structure. This architecture is intended to selectively adsorb and detect acetic acid vapors, which are known to cause health issues in exposed workers. The nanocomposite MGC-PVP-NFs layer was fabricated through electrospinning deposition onto interdigitated microelectrodes (IDEs) and stabilized under UV-light irradiation. To enhance the adhesion of MGC onto the surface of the nanocomposite polymeric fibers, the layer was dipped in a suspension of polyethyleneimine (PEI) and MGC. The resulting structure demonstrated promising electrical and sensing properties, including rapid responses, high sensitivity, good linearity, reversibility, repeatability, and selectivity towards acetic acid vapors. Initial testing was conducted in a laboratory using a bench electrometer, followed by validation in a portable sensing device based on consumer electronic components (by ARDUINO®). This portable system was designed to provide a compact, cost-effective solution with high sensing capabilities. Under room temperature and ambient air conditions, both laboratory and portable tests exhibited favorable linear responses, with detection limits of 0.16 and 1 ppm, respectively.

BREVE SINTESI

È stato progettato un sensore utilizzando polivinilpirrolidone polimerizzato con UV e incorporando nanopolvere di carbonio mesoporoso di grafene nelle fibre, per assorbire e rilevare selettivamente i vapori di acido acetico, che sono noti causare problemi di salute nei lavoratori esposti. La struttura ha dimostrato proprietà elettriche e di rilevamento promettenti, tra cui risposte rapide, elevata sensibilità, buona linearità, reversibilità, ripetibilità e selettività verso i vapori di acido acetico. Il sistema portatile e quello di laboratorio hanno limiti di rilevamento rispettivamente di 0,16 e 1 ppm.

CITAZIONE BIBLIOGRAFICA

Papa P, Zampetti E, Molinari FN, De Cesare F, Di Natale C, Tranfo G, Macagnano A. A Polyvinylpyrrolidone Nanofibrous Sensor Doubly Decorated with Mesoporous Graphene to Selectively Detect Acetic Acid Vapors. *Sensors*. 2024;24:2174.

DOI: <https://doi.org/10.3390/s24072174>

A REAL-TIME BIPHASIC KALMAN FILTER-BASED MODEL FOR ESTIMATING HUMAN CORE TEMPERATURE FROM HEART RATE MEASUREMENTS FOR APPLICATION IN THE OCCUPATIONAL FIELD

Falcone T, Del Ferraro S, Molinaro V, Zollo L, Lenzuni P.

SUMMARY

Early identification of hypothermia or hyperthermia is of vital importance, and real-time monitoring of core temperature (*CT*) of the workers exposed to thermal environments is an extremely valuable tool. From the existing literature studies, the model developed by Buller et al. in their study of 2013, that generates real-time estimates of *CT* from heart rate (*HR*) measurements using the Kalman filter (KF), shows good potential for occupational application. However, some aspects could be improved to reliably handle the existing very wide range of workers and work activities. This study presents a real-time *CT* estimation model, called the Biphasic Kalman filter-based (BKFB) model, based on *HR* measurement, with characteristics suited to application in the occupational field. Thirteen healthy subjects (six female and seven male) were included in the study to perform three consecutive tasks simulating work activities. During each test, an ingestible *CT* sensor was used to measure *CT* and a *HR* sensor to measure *HR*. The KF methodology was used to develop the BKFB model. An algorithm with a biphasic structure was developed using two different models for the increasing and decreasing phases of *CT*, with the ability to switch between the two based on an *HR* threshold. *CT* estimates were compared with *CT* measurements, and with respect to overall root mean square error (RMSE), the BKFB model achieved a sizeable reduction ($0.28 \pm 0.12^{\circ}\text{C}$) compared to the Buller et al. model ($0.34 \pm 0.16^{\circ}\text{C}$). The BKFB model introduced some modifications over the Buller et al. model for a more effective application in the occupational field. It was developed using data collected from a sample of workers (heavily weighted toward middle-aged, not very fit, and with a considerable fraction of female workers), and it also included two different modelling of *CT* (for the up- and down-phases), which allowed for better behavioural modelling in the two different stages. The BKFB model provides *CT* estimates reasonably in comparison to the measured intra-abdominal temperature values in both the activity and recovery phases but is more practical and easier to use for a real-time monitoring system of the workers' thermal states.

BREVE SINTESI

Lo studio presenta il modello predittivo bifasico sviluppato per la stima in real - time della temperatura centrale a partire dalla misura non invasiva della frequenza cardiaca e utile per realizzare un monitoraggio termofisiologico di un lavoratore.

CITAZIONE BIBLIOGRAFICA

Falcone T, Del Ferraro S, Molinaro V, Zollo L, Lenzuni P. A real-time biphasic Kalman filter-based model for estimating human core temperature from heart rate measurements for application in the occupational field. *Front Public Health*. 2024;12:1219595.

DOI: <https://doi.org/10.3389/fpubh.2024.1219595>

ADAPTIVE LIFTING INDEX (ALI) FOR REAL-TIME INSTRUMENTAL BIOMECHANICAL RISK ASSESSMENT: CONCEPTS, MATHEMATICS, AND FIRST EXPERIMENTAL RESULTS

Ranavolo A, Ajoudani A, Chini G, Lorenzini M, Varrecchia T.

SUMMARY

When performing lifting tasks at work, the Lifting Index (LI) is widely used to prevent work-related low-back disorders, but it presents criticalities pertaining to measurement accuracy and precision. Wearable sensor networks, such as sensorized insoles and inertial measurement units, could improve biomechanical risk assessment by enabling the computation of an adaptive LI (aLI) that changes over time in relation to the actual method of carrying out lifting. This study aims to illustrate the concepts and mathematics underlying aLI computation and compare aLI calculations in real-time using wearable sensors and force platforms with the LI estimated with the standard method used by ergonomists and occupational health and safety technicians. To reach this aim, 10 participants performed six lifting tasks under two risk conditions. The results show us that the aLI value rapidly converges towards the reference value in all tasks, suggesting a promising use of adaptive algorithms and instrumental tools for biomechanical risk assessment.

BREVE SINTESI

Questo studio mira a illustrare i concetti e la matematica alla base del calcolo di un Lifting Index adattativo (aLI) con reti di sensori indossabili, come solette sensorizzate e unità di misurazione inerziali. Il valore aLI converge rapidamente verso il valore di riferimento in tutte le attività, suggerendo un uso promettente di algoritmi adattivi e strumenti strumentali per la valutazione del rischio biomeccanico.

CITAZIONE BIBLIOGRAFICA

Ranavolo A, Ajoudani A, Chini G, Lorenzini M, Varrecchia T. Adaptive Lifting Index (aLI) for Real-Time Instrumental Biomechanical Risk Assessment: Concepts, Mathematics, and First Experimental Results. *Sensors (Basel)*. 2024;24(5):1474.

DOI: <https://doi.org/10.3390/s24051474>

ALLERGENIC POLLEN MONITORING AT SAPIENZA UNIVERSITY CAMPUS (ROME, ITALY): PATTERNS OF POLLEN DISPERSAL AND IMPLICATIONS FOR HUMAN HEALTH

Lancia A, Di Rita F, Ariano R, Vonesch N, D'Ovidio MC, Magri D.

SUMMARY

The Campus of the Sapienza University of Rome, frequented daily by several thousands of students and workers, collects allergenic airborne pollen from many sources. Here, we report the results of detailed pollen monitoring of 49 pollen types within the University Campus, allowing us to trace the main local and regional sources of airborne pollen throughout the year. The amount of allergenic pollen has been calculated for each daily record to evaluate the risk of exposure for students and workers on Campus in relation to academic activities and to suggest possible mitigation measures. Our results show that the maximum pollen concentrations are recorded from March to May, and the highest floristic richness occurs in April–June. We distinguish massive local pollen producers from pollen of regional origin and local ornamental and invasive taxa. Pollen with extreme allergenicity is dominant from mid-January to mid-March and in May with Cupressaceae/Taxaceae, *Corylus* and *Olea*; high allergenicity from late March to late April with *Platanus*, *Ostrya*, *Ginkgo* and Moraceae; and medium allergenicity from late April to the beginning of May with *Quercus* and *Pinus*. In August–December, pollen concentration is relatively low. Diversified mitigation actions are suggested in relation to the provenance, allergenicity and emission period of pollen.

BREVE SINTESI

Le fonti di esposizione ambientale in grado di indurre effetti allergici sono state valutate attraverso monitoraggio aerobiologico presso Sapienza Università di Roma.

Il monitoraggio ha portato all'identificazione di tipologie di pollini utili a tracciare le principali fonti di pollini aerodispersi nel corso dell'anno.

Particolare importanza assume la pianificazione delle misure di mitigazione anche in relazione alla provenienza, allergicità e periodo di emissione dei pollini.

CITAZIONE BIBLIOGRAFICA

Lancia A, Di Rita F, Ariano R, Vonesch N, D'Ovidio MC, Magri D. Allergenic pollen monitoring at Sapienza University Campus (Rome, Italy): patterns of pollen dispersal and implications for human health. *Atmosphere*. 2024;15:347.

DOI: <https://doi.org/10.3390/atmos15030347>

ASBESTOS DETECTION IN CONSTRUCTION AND DEMOLITION WASTE BY DIFFERENT CLASSIFICATION METHODS APPLIED TO SHORT-WAVE INFRARED HYPERSPECTRAL IMAGES

Bonifazi G, Capobianco G, Serranti S, Trotta O, Bellagamba S, Malinconico S, Paglietti F.

SUMMARY

In this study, different multivariate classification methods were applied to hyperspectral images acquired, in the short-wave infrared range (SWIR: 1000–2500 nm), to define and evaluate quality control actions applied to construction and demolition waste (C&DW) flow streams, with particular reference to the detection of hazardous material as asbestos. Three asbestos fibers classes (i.e., amosite, chrysotile and crocidolite) inside asbestos containing materials (ACM) were investigated. Samples were divided into two groups: calibration and validation datasets. The acquired hyperspectral images were first explored by Principal Component Analysis (PCA). Three multivariate classification methods were selected in order to verify and compare their efficiency and robustness. The classification results obtained for the three models were evaluated by prediction maps and the values of performance parameters (Sensitivity and Specificity). Micro-X-ray fluorescence (micro-XRF) maps confirmed the correctness of classification results. The results demonstrate how SWIR-HSI technology, coupled with multivariate analysis modelling, is a promising approach to develop both 'off-line' and 'online' fast, reliable and robust quality control strategies, finalized to perform a quick assessment of ACM presence.

BREVE SINTESI

In questo studio, diversi metodi di classificazione multivariata sono stati applicati alle immagini iperspettrali acquisite, nell'intervallo dell'infrarosso SWIR per valutare le azioni di controllo della qualità di rifiuti contenenti amianto (RCA). Sono stati analizzati amosite, crisotilo e crocidolite all'interno di RCA e selezionati tre metodi di classificazione multivariata per verificarne e confrontarne l'efficienza e la robustezza. I risultati ottenuti dimostrano che è un approccio promettente per un controllo della qualità di RCA veloci, affidabili e robusti.

CITAZIONE BIBLIOGRAFICA

Bonifazi G, Capobianco G, Serranti S, Trotta O, Bellagamba S, Malinconico S, Paglietti F. Asbestos detection in construction and demolition waste by different classification methods applied to short-wave infrared hyperspectral images. *Spectrochim Acta A Mol Biomol Spectrosc.* 2024;307:123672.

DOI: <https://doi.org/10.1016/j.saa.2023.123672>

ASSOCIATION BETWEEN SEX HORMONES AND ANTI-S/RBD ANTIBODY RESPONSES TO COVID-19 VACCINES IN HEALTHCARE WORKERS

Anticoli S, Dorrucchi M, Iessi E, Chiarotti F, Di Prinzio RR, Vinci MR, Zaffina S, Puro V, Colavita F, Mizzoni K, Meschi S, Vonesch N, Albano C, Ortona E, Ruggieri A, Tomao P.

SUMMARY

Healthcare workers (HCWs) are the target population for vaccination against coronavirus disease (COVID-19) as they are at a high risk of exposure and transmission of pathogens to patients. Neutralizing antibodies developed after COVID-19 vaccination decline within few months of vaccination. Several factors, including age and sex, can affect the intensity, efficacy, and duration of immune response to vaccines. However, sex-specific analyses of humoral responses to COVID-19 vaccines are lacking. This study aimed to evaluate sex-based differences in anti-S/RBD (Receptor Binding Domain) responses at three different time points after the second dose of mRNA COVID-19 vaccine in HCWs in relation to age, and to investigate the role of sex hormones as potential markers of response. Anti-S/RBD levels after two doses of the mRNA vaccine were collected from 521 HCWs naïve to COVID-19, working at two Italian Clinical Centers. Multiple regression analysis was applied to evaluate the association between anti-S levels and sex, age, and plasma levels of sex hormones. Significantly higher anti-S/RBD response to the COVID-19 vaccination was found in female HCWs, and a significant and more abrupt decline in response with time was observed in women than that in men. A novel, positive association of testosterone plasma levels and higher anti-S levels in male HCWs was found, suggesting its potential role as sex specific marker in males. In conclusion, understanding the sex-based differences in humoral immune responses to vaccines may potentially improve vaccination strategies and optimize surveillance programs for HCWs.

BREVE SINTESI

Diversi fattori, come età e genere, possono influenzare l'intensità, l'efficacia e la durata della risposta immunitaria ai vaccini. Lo studio valuta le diverse risposte anticorpali in base al genere dopo la seconda dose di vaccino mRNA COVID-19 negli operatori sanitari. I risultati mostrano che la risposta anticorpale è maggiore nelle donne e che c'è un'associazione positiva tra i livelli plasmatici di testosterone e gli anticorpi prodotti negli uomini. Questi dati possono migliorare i programmi di sorveglianza sanitaria.

CITAZIONE BIBLIOGRAFICA

Anticoli S, Dorrucchi M, Iessi E, Chiarotti F, Di Prinzio RR, Vinci MR, Zaffina S, Puro V, Colavita F, Mizzoni K, Meschi S, Vonesch N, Albano C, Ortona E, Ruggieri A, Tomao P. Association between sex hormones and anti-S/RBD antibody responses to COVID-19 vaccines in healthcare workers. *Hum Vaccin Immunother.* 2023;19(3):2273697.

DOI: <https://doi.org/10.1080/21645515.2023.2273697>

CAUSE SPECIFIC MORTALITY IN AN ITALIAN POOL OF ASBESTOS WORKERS COHORTS

Ferrante D, Angelini A, Barbiero F, Barbone F, Bauleo L, Binazzi A, Bovenzi M, Bruno C, Casotto V, Cernigliaro A, Ceppi M, Cervino D, Chellini E, Curti S, De Santis M, Fazzo L, Fedeli U, Fiorillo G, Franchi A, Gangemi M, Giangreco M, Rossi PG, Girardi P, Luberto F, Massari S, Mattioli S, Menegozzo S, Merlo DF, Michelozzi P, Migliore E, Miligi L, Oddone E, Perneti R, Perticaroli P, Piro S, Addario SP, Romeo E, Roncaglia F, Silvestri S, Storchi C, Zona A, Magnani C, Marinaccio A.

SUMMARY

Background: Asbestos is a known human carcinogen and is causally associated with malignant mesothelioma, lung, larynx and ovarian cancers. Methods: Cancer risk was studied among a pool of formerly asbestos-exposed workers in Italy. Fifty-two Italian asbestos cohorts (asbestos-cement, rolling-stock, shipbuilding, and other) were pooled and their mortality follow-up was updated to 2018. Standardized mortality ratios (SMRs) were computed for major causes of death considering duration of exposure and time since first exposure (TSFE), using reference rates by region, age and calendar period. Results: The study included 63,502 subjects (57,156 men and 6346 women): 40% who were alive, 58% who died (cause known for 92%), and 2% lost to follow-up. Mortality was increased for all causes (SMR: men = 1.04, 95% confidence interval [CI] 1.03 – 1.05; women = 1.15, 95% CI 1.11 – 1.18), all malignancies (SMR: men = 1.21, 95% CI 1.18 – 1.23; women = 1.29, 95% CI 1.22 – 1.37), pleural and peritoneal malignancies (men: SMR = 10.46, 95% CI 9.86 – 11.09 and 4.29, 95% CI 3.66 – 5.00; women: SMR = 27.13, 95% CI 23.29 – 31.42 and 7.51, 95% CI 5.52 – 9.98), lung (SMR: men = 1.28, 95% CI 1.24 – 1.32; women = 1.26, 95% CI 1.02 – 1.53), and ovarian cancer (SMR = 1.42, 95% CI 1.08 – 1.84). Pleural cancer mortality increased during the first 40 years of TSFE (latency), reaching a plateau thereafter. Conclusions: Analyses by time-dependent variables showed that the risk for pleural neoplasms increased with latency and no longer increases at long TSFE, consistent with with asbestos clearance from the lungs. Peritoneal neoplasm risk increased over all observation time.

BREVE SINTESI

L'analisi dell'insieme delle coorti dei lavoratori esposti ad amianto (complessivamente 63.502 soggetti) ha mostrato un profilo di mortalità con eccessi significativi per tumore della pleura, del polmone e dell'ovaio. È stato evidenziato un ruolo essenziale della latenza che risulta elevatissima. I risultati confermano l'effetto cancerogeno dell'esposizione ad amianto e l'importanza della sorveglianza sanitaria negli ex-esposti.

CITAZIONE BIBLIOGRAFICA

Ferrante D, Angelini A, Barbiero F, Massari S, Marinaccio A et al. Cause specific mortality in an Italian pool of asbestos workers cohorts. *Am J Ind Med.* 2024;67(1):31-43.

DOI: <https://doi.org/10.1002/ajim.23546>

DEVELOPMENT OF A METHODOLOGY FOR ASSESSING RADIOLOGICAL DOSE DUE TO USE OF NORM SLUDGE AS FERTILIZER

Venoso G, Nuccetelli C, Di Carlo C, Trotti F, Ugolini R, Trevisi R, Leonardi F, Urso L.

SUMMARY

In Europe, the general obligation to recycle drives for increased reuse of residues containing Naturally Occurring Radioactive Material (NORM). In agriculture, this has led to the reuse of sludge produced by groundwater filtration facilities as a means of fertilization. In the frame of the RadoNorm project, a methodology was developed for dose assessment of agricultural workers and other members of the public living near agricultural fields in which NORM-containing sludge is applied. Appropriate exposure scenarios were identified and modelled for each relevant NORM decay segment of both U-238 and Th-232 series, as well as for K-40. Dose assessments were performed using the software RESRAD-ONSITE with dose coefficients for external and internal exposure taken from the latest publications from the International Commission on Radiological Protection (ICRP). The objective was to develop a generic methodology to quantify exposure and to obtain screening values – so-called Operational Levels (OLs). These OLs pertain to the activity concentration of natural radionuclides (in terms of kBq kg⁻¹) present in sludge that is reused in agriculture, for which dose criterion of 1 mSv year⁻¹ is complied with. OLs can be used as screening tools by an authority/operator, even non-experts in the field of radiation protection. Results showed that the most critical decay segments are Ra-226+ and Ra-228+, for which OLs of the order of 1 kBq kg⁻¹ were estimated. For all the other radionuclides, the calculated OLs are much higher than the activity concentrations typically found in sludge from water treatment facilities, and the radiological impact expected is well-below 1 mSv year⁻¹. The methodology and results of this study could contribute to the update of the Clearance Levels and discharge levels reported in the European guidelines RP 122 Part II and RP 135, respectively.

BREVE SINTESI

A livello europeo è sempre più forte l'indicazione generale di riciclare il più possibile anche al fine di eliminare le discariche. In questa pubblicazione, nell'ottica di promuovere l'economia circolare, viene affrontato, il tema del riutilizzo dei residui contenenti materiale radioattivo di origine naturale (NORM); in particolare, viene affrontato il tema del riutilizzo in agricoltura dei fanghi prodotti dagli impianti di filtrazione delle falde acquifere come fertilizzanti.

Nell'ambito del progetto RadoNorm è stata sviluppata una metodologia per la valutazione della dose dei lavoratori agricoli e di altri membri del pubblico che vivono in prossimità di campi agricoli in cui vengono applicati fanghi contenenti NORM.

CITAZIONE BIBLIOGRAFICA

Venoso G, Nuccetelli C, Di Carlo C, Trotti F, Ugolini R, Trevisi R et al. Development of a methodology for assessing radiological dose due to use of NORM sludge as fertilizer. *Sci Total Environ.* 2024;912:168934.

DOI: <https://doi.org/10.1016/j.scitotenv.2023.168934>

EDITORIAL: JOB INTEGRATION/REINTEGRATION OF PEOPLE WITH NEUROMUSCULAR DISORDERS IN THE EPOCH OF 'INDUSTRY 4.0'

Ranavolo A, Ajoudani A, Bonnet V, De Nunzio AM, Draicchio F, Sartori M, Serrao M.

SUMMARY

Degenerative and acquired neurological diseases can affect the motor function (reaching, grasping, balance, locomotion) during working age, limit the autonomy of workers and reduce productivity, thereby increasing costs. People with neurological disorders need to be integrated, or reintegrated, into workplaces through the design of rehabilitation, pharmacological and surgical treatments as well as innovative ergonomic interventions. The latter are represented, among the others, by miniaturized wearable monitoring/feedback devices and human-robot collaborative (HRC) technologies, such as WearBots (i.e. exoskeletons) and Cobots. The current- and next-generation of sensing technologies should be able to continuously decode and/or classify workers' residual motor function and monitor pre-post job integration programs. The HRC technologies should dynamically adapt to the workplace to support physically weak and disabled workers in performing several lower and upper limbs and trunk motor activities such as walking. In order to plan a reasonable, efficient and cost-effective job integration plan for people with neuromuscular impairment in the new 'Industry 4.0' it is necessary to define the concept and roadmap to 'return-to-work rehabilitation' as well as to detect and optimize human-machine interaction technologies useful for job Integration/Reintegration (i.e. miniaturization, communication protocols, human-robot interfaces) and design appropriate training strategies for employees and employers. The Research Topic has the scope to define all the steps necessary to make a qualified and modern Job Integration/Reintegration of people with neuromuscular disorders. For this purpose it is necessary to investigate all the factors and new technological options that can be included:

- define the meaning and roadmap to 'Return-to-work rehabilitation' for people with neuromuscular disorders? What is the multidisciplinary team that can be involved in order to perform a 'reasonable job integration'?
- international reference regulatory framework for job accommodation;
- monitoring the residual motor skills and the efficacy of 'Return-to-work rehabilitation';
- movement Analysis Laboratories (Optoelectronic systems, IMUs and force plates), bipolar and High Density sEMG, alerting-feedback (Haptic-vibrotactyls, acoustic and visual stimuli);
- indexes for the motor/muscle performance monitoring;
- development of novel wearable sensing technologies and HRI paradigm to support re-integration of individuals who suffered from neuromuscular injuries, i.e. stroke, muscle-tendon tearing, musculoskeletal pain.

BREVE SINTESI

Editoriale della Article Collection di Frontiers in Neurology sul tema Inserimento/reinserimento lavorativo di persone con disturbi neuromuscolari nell'era dell'Industria 4.0.

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EXPLOITING IMMERSIVE VIRTUAL REALITY FOR INVESTIGATING THE EFFECTS OF INDUSTRIAL NOISE ON COGNITIVE PERFORMANCE AND PERCEIVED WORKLOAD

Evangelista A, Manghisi VM, De Giglio V, Martellotta F, Giliberti C, Mariconte R, Uva AE.

SUMMARY

Confined spaces are working environments where elements of distraction, such as noise, can cause accidents with major, even fatal, consequences. Studies on the effects of noise on cognitive abilities present mixed results, and those concerning confined spaces are limited as they require an expensive experimental setup replicating the working scenario. Immersive Virtual Reality (IVR) technology enables overcoming this gap by replicating the experimental conditions in a synthetic environment. We exploited IVR to study noise's impact on cognitive performance in confined spaces. We compared the impact of a stationary continuous noise source with an intermittent non-periodic one by administering the Stroop Color and Word Test. We also assessed the perceived cognitive effort by administering the modified noise-induced task load index questionnaire. We also compared the effects on the operator's physiological activity through Heart Rate Variability analysis. Results show that by keeping the equivalent noise level lower than 85 dB, noise has no statistically significant effects on cognitive performance and Heart Rate.

BREVE SINTESI

La realtà virtuale immersiva è stata utilizzata per studiare l'impatto del rumore sulle prestazioni cognitive di lavoratori che operano in spazi confinati. È stato confrontato l'impatto di una fonte di rumore continua e stazionaria con una fonte di rumore intermittente e non periodica. I risultati mostrano che mantenendo il rumore al di sotto di 85 dB, non si rilevano effetti statisticamente significativi sulle prestazioni cognitive e sulla frequenza cardiaca.

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EXPOSURE TO AIRBORNE MYCOTOXINS: THE RISKIEST WORKING ENVIRONMENTS AND TASKS

Marcelloni AM, Pigni D, Chiominto A, Giofrè A, Paba E.

SUMMARY

There is growing interest in the role of airborne mycotoxins in occupational environments, however, their impact on human health still remains poorly investigated. This review aims to provide a comprehensive analysis of the existing literature on the occurrence of inhalable mycotoxins in working environments to investigate which sectors and tasks are at greater risk of exposure.

We have performed a systematic search in the PubMed, Scopus and Web of Science databases from 2010 to date, without limitation of geographic location.

Database searches yielded 350 articles. After the removal of duplicates and applying our inclusion and exclusion criteria, 31 papers remained. Results show that the most exposed workers are those engaged in activities related to animal care and management and, in particular, in feeding tasks, while harvester cleaning seems to be the activity with the highest levels of exposure in agriculture. In healthcare settings mycotoxin concentrations are low but HVAC systems can be a source of contamination and this reinforces the relevance of further studies in this sector. The most common scenario is the exposure to multiple mycotoxins with variable concentrations depending on the working environment, the products handled or the tasks performed by workers. Some authors emphasize the importance of multi-approach sampling and analysis protocols to achieve an accurate and more realistic risk characterization.

Results brought forward by this review can be utilized by health and safety professionals to recognize activities in which workers may be potentially exposed to airborne mycotoxins and thus undertake suitable preventive and protective measures.

BREVE SINTESI

Questa revisione analizza la letteratura scientifica incentrata sull'esposizione a micotossine per via inalatoria al fine di individuare gli ambienti/mansioni lavorative maggiormente critiche e valutarne il reale impatto sulla salute occupazionale.

I dati ottenuti possono essere utili per il monitoraggio delle attività a rischio e l'attuazione di opportune strategie di prevenzione e controllo.

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JOB DEMANDS AND RESOURCES AND THEIR ASSOCIATION WITH EMPLOYEE WELL-BEING IN THE EUROPEAN HEALTHCARE SECTOR: A SYSTEMATIC REVIEW AND META-ANALYSIS OF PROSPECTIVE RESEARCH

Marzocchi I, Nielsen K, Di Tecco C, Vignoli M, Ghelli M, Ronchetti M, Iavicoli S.

SUMMARY

Despite the extant research on work and well-being in the healthcare sector, a comprehensive overview of the key work characteristics, and a meta-analytic investigation of their over-time relationships with well-being, are still lacking. This study provides (1) a summary of the most investigated job demands and resources at the group, leadership, and organisation levels (GLO) explored in the European healthcare sector; (2) a quantitative analysis of their prospective association with well-being; (3) a test of the moderator effect of work characteristics' source (GLO) and time lag. A systematic literature search was completed resulting in 47 independent samples (N = 39,467 healthcare employees). We identified a wide range of challenge (i.e. workload), hindrance (i.e. role stress), threat demands (i.e. violence from patients) and resources (i.e. control, support). Meta-analytic results showed that hindrance and threat demands were more detrimental than challenge demands, but unexpectedly challenge demands were not related to motivational outcomes. Baseline resources had an important role in protecting and promoting follow-up employee well-being, with group-level resources being more strongly negatively associated with strain. We found no significant differences in well-being between GLO levels of job demands. Time lag did not significantly moderate the prospective associations among work characteristics and employee well-being.

BREVE SINTESI

Nell'ambito della ricerca sistematica della letteratura, che ha esaminato 47 campioni indipendenti (39.467 lavoratori) del settore sanitario in Europa, è stata verificata la relazione tra le richieste lavorative, le risorse, a vari livelli (GLO), e il benessere. I risultati meta-analitici evidenziano quanto le risorse, specialmente di gruppo, rivestano un ruolo protettivo e di promozione del benessere dei lavoratori a lungo termine.

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LOCAL DYNAMIC STABILITY OF TRUNK DURING GAIT IS RESPONSIVE TO REHABILITATION IN SUBJECTS WITH PRIMARY DEGENERATIVE CEREBELLAR ATAXIA

Castiglia SF, Trabassi D, Conte C, Gioiosa V, Sebastianelli G, Abagnale C, Ranavolo A, Di Lorenzo C, Coppola G, Casali C, Serrao M.

SUMMARY

This study aimed to assess the responsiveness to the rehabilitation of three trunk acceleration-derived gait indexes, namely the harmonic ratio (HR), the short-term longest Lyapunov's exponent (sLLE), and the step-to-step coefficient of variation (CV), in a sample of subjects with primary degenerative cerebellar ataxia (swCA), and investigate the correlations between their improvements (Δ), clinical characteristics, and spatio-temporal and kinematic gait features. The trunk acceleration patterns in the antero-posterior (AP), medio-lateral (ML), and vertical (V) directions during gait of 21 swCA were recorded using a magneto-inertial measurement unit placed at the lower back before (T0) and after (T1) a period of inpatient rehabilitation. For comparison, a sample of 21 age- and gait speed-matched healthy subjects (HSmatched) was also included. At T1, sLLE in the AP (sLLEAP) and ML (sLLEML) directions significantly improved with moderate to large effect sizes, as well as SARA scores, stride length, and pelvic rotation. sLLEML and pelvic rotation also approached the HSmatched values at T1, suggesting a normalization of the parameter. HRs and CV did not significantly modify after rehabilitation. Δ sLLEML correlated with Δ of the gait subscore of the SARA scale (SARAGAIT) and Δ stride length and Δ sLLEAP correlated with Δ pelvic rotation and Δ SARAGAIT. The minimal clinically important differences for sLLEML and sLLEAP were $\geq 36.16\%$ and $\geq 28.19\%$, respectively, as the minimal score reflects a clinical improvement in SARA scores. When using inertial measurement units, sLLEAP and sLLEML can be considered responsive outcome measures for assessing the effectiveness of rehabilitation on trunk stability during walking in swCA.

BREVE SINTESI

Le accelerazioni del tronco (direzioni antero-posteriore, medio-laterale e verticale) durante il cammino di 21 soggetti con atassia cerebellare (CA) sono state registrate con un'unità di misura inerziale posizionata nella parte bassa della schiena prima e dopo un periodo di riabilitazione per valutare la reattività alla riabilitazione di tre indici del cammino. Gli indici investigati permettono di valutare l'efficacia della riabilitazione sulla stabilità del tronco durante la deambulazione di CA.

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LOW TRANSITION TEMPERATURE MIXTURE-BASED EXTRACTION OF 14 PESTICIDES FROM TOMATO SAMPLES AND THEIR HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY-TANDEM MASS SPECTROMETRY ANALYSIS

Della Posta S, Gallo V, Gentili A, Gherardi M, De Gara L, Fanali C.

SUMMARY

The extensive use of pesticides in agriculture has led to the development of analytical methods to determine pesticide residues in food matrices to prevent food exposure. However, most developed analytical methods do not consider impact on the environment in terms of the toxicity of the chemicals used and the amount of waste produced. An environmentally-friendly method, based on a miniaturized matrix solid-phase dispersion followed by high-performance liquid chromatography-tandem mass spectrometry, for the analysis of fourteen pesticides in tomatoes, was exploited. For the recovery of pesticides from tomato samples, a low transition temperature mixture (LTTM), containing choline chloride and sesamol 1:3 molar ratio, was employed. Extraction parameters like sample-to-dispersant ratio, extraction solvent volume and LTTM volume were optimized through a Box-Behnken design. The 1:4 sample-to-dispersant ratio, 900 μL of ethanol as extraction solvent and 50 μL of LTTM ensured the best result considering the pesticides' peak areas. The optimized analytical method was validated obtaining the following results: linearity range was between LOQ and 5 mg kg^{-1} with a minimum R^2 of 0.9944 for tebufenozide, values in the range of 0.001 - 0.023 and 0.004 - 0.076 mg kg^{-1} were obtained for LOD and LOQ respectively, while peak areas intra-day and inter-day repeatability were maximum of 10.19 and 9.15 %, respectively. The analytical method was applied to real samples. The analysis of whole and tomato pulp revealed the presence of seven and eight of the fourteen investigated pesticides, respectively, with concentration lower than the limit of quantification. In tomato peel, five pesticides, namely dimethomorph, methoxyfenozide, pyraclostrobin, pyriproxyfen, and spiromesifen were quantified with concentrations below maximum residue levels.

BREVE SINTESI

Nell'ambito dell'attività di ricerca sull'esposizione a pesticidi in agricoltura in ottica 'one health', un aspetto importante che si considera è quello di minimizzare anche l'impatto sulla salute dell'uomo e dell'ambiente dei metodi per l'analisi dei pesticidi. Nel contesto della chimica analitica verde, è stato sviluppato un metodo di analisi per i residui di 14 pesticidi su pomodoro, sostituendo i solventi di estrazione convenzionali con una miscela a base di cloruro di colina e sesamolo. Il metodo è stato efficacemente applicato a campioni reali.

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MATERNAL EXPOSURE TO ZINC OXIDE NANOPARTICLES CAUSES COCHLEAR DYSFUNCTION IN THE OFFSPRING

Campagnolo L, Lacconi V, Bernardini R, Viziano A, Pietroiusti A, Ippoliti L, Moleti A, Sisto R.

SUMMARY

Introduction: Zinc oxide nanoparticles (ZnO NPs) have been engineered and are largely used in material science and industry. This large and increasing use justifies a careful study about the toxicity of this material for human subjects. The concerns regard also the reproductive toxicity and the fetotoxicity. **Materials and methods:** The effect of the exposure to ZnO NPs on the cochlear function was studied in a group of pregnant CD1 mice and in their offspring. This study is part of a larger toxicological study about the toxicity of ZnO NPs during pregnancy. Four groups were analyzed and compared, exposed and nonexposed dams and their offspring. The cochlear function was quantitatively assessed by means of Distortion Product Otoacoustic Emissions (DPOAEs). **Results and discussion:** A large statistically significant difference was found between the non-exposed dams offspring and the exposed dams offspring ($p = 1.6 \cdot 10^{-3}$), whose DPOAE levels were significantly lower than those of non-exposed dams offspring and comparable to those of the adults. The DPOAE levels of the exposed and non-exposed dams were very low and not significantly different. This occurrence is related to the fact that these mice encounter a rapid aging process.

Conclusion: Our findings show that maternal exposure to ZnO NPs does not reflect in overt toxicity on fetal development nor impair offspring birth, however it may damage the nervous tissue of the inner ear in the offspring. Other studies should confirm this result and identify the mechanisms through which ZnO NPs may affect ear development.

BREVE SINTESI

In questo studio sperimentale su modello animale, femmine gravide di topo sono esposte a nanoparticelle di Ossido di Zinco, uno dei nanomateriali ingegnerizzati più diffusi. L'eventuale effetto neurotossico è stato studiato mediante otoemissioni.

Si mostrano differenze significative tra i cuccioli delle femmine esposte, che hanno segni di disfunzionalità cocleare, e i cuccioli di madri non esposte. L'esposizione durante la gravidanza sembra avere effetti oto/neurotossici sul feto.

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MITIGATING HEAT EFFECTS IN THE WORKPLACE WITH A VENTILATION JACKET: SIMULATIONS OF THE WHOLE-BODY AND LOCAL HUMAN THERMOPHYSIOLOGICAL RESPONSE WITH A SWEATING THERMAL MANIKIN IN A WARM-DRY ENVIRONMENT

Del Ferraro S, Falcone T, Morabito M, Bonafede M, Marinaccio A, Gao C, Molinaro V.

SUMMARY

Climate change is increasingly affecting human well-being and will inevitably impact on occupational sectors in terms of costs, productivity, workers' health and injuries. Among the cooling garment developed to reduce heat strain, the ventilation jacket could be considered for possible use in workplaces, as it is wearable without limiting the user's mobility and autonomy. In this study, simulations with a sweating manikin are carried out to investigate the effects of a short-sleeved ventilation jacket on human thermophysiological responses in a warm-dry scenario. Simulations were performed in a climatic chamber (air temperature = 30.1 °C; air velocity = 0.29 m/s; relative humidity = 30.0 %), considering two constant levels of metabolic rate M ($M_1 = 2.4$ MET; $M_2 = 3.2$ MET), a sequence of these two (Work), and three levels of fan velocities ($l_f = 0$; $l_f = 2$; $l_f = 4$). The results revealed a more evident impact on the mean skin temperature (T_{sk}) compared to the rectal temperature (T_{re}), with significant decreases (compared to fan-off) at all M levels, for T_{sk} from the beginning and for T_{re} from the 61st minute. Skin temperatures of the torso zones decreased significantly (compared to fan-off) at all M levels, and a greater drop was registered for the Back. The fans at the highest level ($l_f = 4$) were significantly effective in improving whole-body and local thermal sensations when compared to fan-off, at all M levels. At the intermediate level ($l_f = 2$), the statistical significance varied with thermal zone, M and time interval considered. The results of the simulations also showed that the Lower Torso needs to be monitored at M_2 level, as the drop in skin temperature could lead to local overcooling and thermal discomfort. Simulations showed the potential effectiveness of the ventilation jacket, but human trials are needed to verify its cooling power in real working conditions.

BREVE SINTESI

I cambiamenti climatici stanno producendo conseguenze sulla salute dei lavoratori e sono allo studio soluzioni indossabili (abbigliamento refrigeranti) per mitigare gli effetti del caldo, che non compromettano l'autonomia del lavoratore durante lo svolgimento della propria attività lavorativa. Lo studio presenta i risultati di simulazioni effettuate in camera climatica con un manichino termico per valutare gli effetti sulla risposta termofisiologica di una giacca ventilata, in un ambiente caldo - secco ($t_a = 30.1^\circ\text{C}$) e per due condizioni di metabolismo energetico costante ed uno variabile.

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NMR UNTARGETED AND HPLC-MS/MS TARGETED METABOLOMIC APPROACHES FOR EVALUATING STYRENE EXPOSURE IN THE URINE OF SHIPYARD WORKERS

Giampaoli O, Sciubba F, Tranfo G, Sisto R, Pigni D, De Rosa M, Patriarca A, Miccheli A, Fetoni AR, Tricarico L et al.

SUMMARY

Due to its chemical properties, styrene is largely employed in the manufacturing of several products including rubber, polymers and resins, and it is particularly suitable for shipbuilding industry purposes. In this context, the main exposure to styrene occurs in occupational settings. Despite its widespread use, its long-term effects on human health at the occupational level are still unclear. The aim of this pilot study was to evaluate changes in styrene exposure biomarkers related to the metabolic and oxidative stress profiles in the urine of seventeen shipyard workers and seventeen non-exposed subjects. Urinary metabolites were assessed by means of NMR spectroscopy, including mandelic and phenylglyoxylic acids; four oxidative stress biomarkers, namely 8-oxo-7,8-dihydroguanine, 8-oxo-7,8-dihydroguanosine, and 8-oxo-7,8-dihydro-2'-deoxyguanosine and 3-nitrotyrosine, were evaluated via HPLC-MS/MS. The metabolic profiles of exposed workers showed both long- and short-term metabolic responses to styrene exposure compared to non-exposed subjects. From the comparison between non-exposed and before-shift workers, only 8-oxo-7,8-dihydroguanine and 8-oxo-7,8-dihydro-2'-deoxyguanosine levels were significantly different (long term exposure response). At the same time, comparing the non-exposed group with after-shift workers, we observed lower levels of pseudouridine and 1-methylnicotinamide and higher glutamine levels in after-shift workers. The comparison between before-shift and after-shift workers showed that 8-oxo-7,8-dihydroguanine significantly increased after the shift, suggesting its involvement in the exposure to styrene (short-term exposure response). The obtained results, although preliminary, allow us to lay the basis for further human studies aimed at establishing a global understanding of styrene metabolism.

BREVE SINTESI

Allo scopo di valutare i cambiamenti nei biomarcatori di esposizione allo stirene e nei profili di stress metabolico e ossidativo nelle urine di lavoratori di un cantiere navale e altrettanti soggetti non esposti, sono stati valutati i metaboliti urinari mediante spettroscopia NMR, e i biomarcatori le guanine ossidate urinarie tramite HPLC -MS/MS, osservando un aumento dello stress ossidativo urinario sia a lungo che a breve termine.

CITAZIONE BIBLIOGRAFICA

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NON-MALIGNANT OCCUPATIONAL RESPIRATORY DISEASES AND CLIMATE CHANGE

D'Ovidio MC, Lancia A, Melis P, Vonesch N, Tomao P, Grandi C, Annesi-Maesano I.

SUMMARY

BACKGROUND: Respiratory diseases of infectious, allergic, neoplastic or degenerative origin are due to the interaction of environmental and occupational risk factors, individual susceptibility and other co-factors and comorbidities. Asthma and other respiratory pathologies can be worsened by climate change and exposure to other agents in occupational environments.

METHODS: PubMed and Scopus, and several websites on public and occupational health were queried to find publications and documents on work-related respiratory diseases, asthma, rhinitis, chronic obstructive pulmonary disease (COPD), pneumoconiosis and allergic alveolitis in association with climate change.

RESULTS: Most of the retrieved articles concerned asthma (75 in Scopus), while the other topics were less frequently covered in the scientific literature, with a maximum of 29 papers for rhinitis and 23 for COPD.

The most important terms highlighted by the word clouds were 'health', 'air', 'pollution', and, only for asthma and rhinitis, 'pollen' and 'allergic/allergy'. Website data on public and occupational health, and climate change were reported.

CONCLUSIONS: Assessment and management of respiratory diseases that recognise occupational exposures should be improved, and more research into integrated approaches should be favoured. Health surveillance practices for workers exposed to agents that cause respiratory diseases should be implemented. The development of biomarkers of exposure, effect and susceptibility needs further study.

BREVE SINTESI

Le patologie respiratorie di diversa origine tra cui infettiva e allergica sono dovute alle interazioni tra fattori di esposizione ambientali, occupazionali, comorbilità, suscettibilità individuali.

Il cambiamento climatico e l'esposizione a diversi agenti concorrono alla patogenesi e all'eziologia di asma e altre patologie respiratorie.

Lo studio condotto con PubMed, Scopus ha evidenziato la necessità di favorire approcci integrati anche per individuare biomarcatori di esposizione ed effetto.

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OXIDATIVE STRESS AND INFLAMMATION CAUSE AUDITORY SYSTEM DAMAGE VIA GLIAL CELL ACTIVATION AND DYSREGULATED EXPRESSION OF GAP JUNCTION PROTEINS IN AN EXPERIMENTAL MODEL OF STYRENE-INDUCED OTO/NEUROTOXICITY

Paciello F, Pisani A, Rolesi R, Montuoro R, Mohamed-Hizam V, Boni G, Ripoli C, Galli J, Sisto R, Fetoni AR, Grassi C.

SUMMARY

Background: Redox imbalance and inflammation have been proposed as the principal mechanisms of damage in the auditory system, resulting in functional alterations and hearing loss. Microglia and astrocytes play a crucial role in mediating oxidative/inflammatory injury in the central nervous system; however, the role of glial cells in the auditory damage is still elusive.

Objectives: Here we investigated glial-mediated responses to toxic injury in peripheral and central structures of the auditory pathway, i.e., the cochlea and the auditory cortex (ACx), in rats exposed to styrene, a volatile compound with well-known oto/neurotoxic properties.

Methods: Male adult Wistar rats were treated with styrene (400 mg/kg daily for 3 weeks, 5/days a week). Electrophysiological, morphological, immunofluorescence and molecular analyses were performed in both the cochlea and the ACx to evaluate the mechanisms underlying styrene-induced oto/neurotoxicity in the auditory system.

Results: We showed that the oto/neurotoxic insult induced by styrene increases oxidative stress in both cochlea and ACx. This was associated with macrophages and glial cell activation, increased expression of inflammatory markers (i.e., pro-inflammatory cytokines and chemokine receptors) and alterations in connexin (Cx) and pannexin (Panx) expression, likely responsible for dysregulation of the microglia/astrocyte network. Specifically, we found downregulation of Cx26 and Cx30 in the cochlea, and high level of Cx43 and Panx1 in the ACx.

Conclusions: Collectively, our results provide novel evidence on the role of immune and glial cell activation in the oxidative/inflammatory damage induced by styrene in the auditory system at both peripheral and central levels, also involving alterations of gap junction networks. Our data suggest that targeting glial cells and connexin/pannexin expression might be useful to attenuate oxidative/inflammatory damage in the auditory system.

BREVE SINTESI

Vengono studiati in questo lavoro i meccanismi di oto/neurotossicità indotti dall'esposizione a stirene. Il modello sperimentale è un ratto Wistar esposto a stirene. Lo studio conferma che lo stirene induce processi ossidativi e infiammatori sia a livello di sistema uditivo periferico che a livello centrale.

CITAZIONE BIBLIOGRAFICA

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DOI: <https://doi.org/10.1186/s12974-023-02996-3>

OXIDATIVE STRESS IN OCCUPATIONAL EXPOSURE TO STYRENE VAPOURS AND DANGEROUS CHEMICALS IN SHIPBUILDING INDUSTRY

Pigini D, Paci E, Guglielmetti R, Tranfo G, Spagnoli M, Fetoni AR, Tricarico L, Sisto R.

SUMMARY

Introduction: In shipbuilding industry, workers are exposed to various dangerous chemicals among which styrene must be listed. The International Agency for Research on Cancer classifies styrene as belonging to Group 2A, probably carcinogenic to humans. This study is aimed at evaluating the oxidative stress effects due to occupational exposure to styrene and the other chemicals.

Materials and Methods: Styrene urinary metabolites Mandelic and Phenylglyoxylic acid, (MA, PGA respectively) and urinary biomarkers of oxidative stress, i.e. the protein oxidation products of DNA and RNA, were measured in a group of 17 workers and compared to the concentrations found in a group of 17 healthy volunteers.

Results and discussion: A statistically significant difference was found for 8-oxoGua and 8-oxo-7,8-diidroguanine (8-oxoGua) and 8-oxo-7,8-diidro-2'-deoxiguanosine (8-oxodGuo) values that are higher in workers than in the control group. The workers performing painting are most exposed to styrene and show higher concentrations of 8-oxo-7,8-diidroguanosine (8-oxoGuo). Workers performing the tasks of wood refining and welding are less exposed to styrene but have higher concentrations of 8-oxoGua and 8-oxodGuo.

Conclusions: The exposure scenario in shipbuilding is a complex one in which different xenobiotics are simultaneously present. The oxidative stress effect biomarkers, coming from the oxidation product of RNA and DNA, are promising, sensitive, but not specific.

BREVE SINTESI

Questo lavoro ha l'obiettivo di valutare lo stress ossidativo dovuto all'esposizione professionale a stirene e altre sostanze chimiche nel contesto espositivo di un cantiere navale. Sono state trovate differenze significative rispetto a un gruppo di controllo nella concentrazione di biomarker che derivano dall'ossidazione del DNA ed RNA. I lavoratori esposti a stirene hanno concentrazioni più elevate di 8-oxoGuo, mentre i lavoratori esposti a polvere di legno e fumi metallici di 8-oxodGuo e 8-oxoGua.

CITAZIONE BIBLIOGRAFICA

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PREVENTION-THROUGH-DESIGN APPROACH TO MITIGATE WORKERS' EXPOSURE IN THE GRAPHENE PRODUCTION PROCESSES

Boccuni F, Tombolini F, Natale C, Bellagamba I, Sebastiani F, Ferrante R.

SUMMARY

The growing development of new and advanced nanomaterials call for a responsible approach to evaluate and prevent health and safety risks for workers, who could be exposed in their whole life cycle. Since many uncertainties still remain about health effects and as long as occupational exposure limits will not be enforced, Prevention-through-Design (PtD) approach has been proposed as a framework aimed at preventing risks, taking into account health and safety aspects starting from the design stages of innovation production processes. PtD principles could be applied to NMs, including the design of strategies to mitigate emissions and minimize risks related to the manufacturing processes. In the present study, this approach has been successfully applied to different case studies of graphene based NMs production in Research and Development laboratories, with promising applications in the industrial scale. The methodology includes the integration of ISO control banding tool and OECD multi-metric and tiered approach to assess exposure by inhalation, improving the reliability of risk analysis framework. The findings support the complementary use of qualitative and quantitative data to identify tailored control measures and prevent risks in parallel with the development of NMs production processes, by giving also the opportunity to evaluate their effectiveness.

BREVE SINTESI

Dal momento che gli effetti sulla salute riguardante l'esposizione a nanomateriali e materiali avanzati sono ancora incerti e in attesa di limiti di esposizione professionale normati, è stato applicato l'approccio Prevention-through-Design (PtD) a tre differenti scenari espositivi inerenti la produzione di materiali a base di grafene. I risultati supportano l'uso complementare di dati qualitativi quantitativi per prevenire i rischi in relazione anche allo sviluppo dei processi di produzione.

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PROMOTING SAFETY, SECURITY, AWARENESS AND PRODUCTIVITY IN PORT PLANTS

Bruzzone AG, Massei M, Sinelshchikov K, De Paoli A, Giovannetti A, Longo F, Fancello G, Vairo T, Giliberti C, Mariconte R.

SUMMARY

This paper focuses on the combined use of eXtended Reality and Simulation to improve awareness and confidence in Container Terminal Operations by tailoring a Simulation Systems. The complexity of Port Operations creates a quite dangerous environment where the highly competitive business sector push to increase speed of operations and flows, requiring to operate with high performance in a safe framework. In additions Port Terminals involve many actors that have to work and interoperate within a multi domain environment, outdoor all around the clock along the year in an all- weather condition. Training and Education are crucial to face these challenges and make it possible to introduce new technologies in the very strategic field of Port Activities. The authors propose an experimentation carried out to demonstrate the potential to move training and education on virtual interactive solutions based on MS2G paradigm (Modeling, interoperable Simulation and Serious Games) by tailoring a Simulation System.

BREVE SINTESI

La complessità delle operazioni portuali crea un ambiente piuttosto pericoloso in cui è necessario svolgere operazioni velocemente ma in un contesto sicuro. I terminal portuali coinvolgono molti attori che devono lavorare e interagire in un ambiente all'aperto 24 ore su 24, durante tutto l'anno, in qualunque condizione atmosferica. Gli autori propongono una sperimentazione condotta per dimostrare le potenzialità di spostare la formazione e l'istruzione su soluzioni interattive virtuali basate sul paradigma MS2G (Modeling, interoperable Simulation e Serious Games) personalizzando il sistema di simulazione.

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PROPOSAL AND PRACTICALITY OF ALTERNATIVE BLUE-LIGHT HAZARD RISK ASSESSMENT METHOD FOR HIGH INTENSITY WHITE-LIGHT SOURCES AT WORKPLACES

Bauer S, Berget M, Borra M, Brissinger D, Brose M, Görlich S, Halbritter W, Heepenstrick T, Janßen M, Kitz E, Kubica JM, Łowcewicz M, Marro M, Militello A, Pelko M, Rybczyński A, Weber M, Wolska A.

SUMMARY

It is prescribed to determine BLH weighted radiances, L_B , for an assessment of spotlights with an angular subtense $\alpha \geq 11$ mrad. The BLH weighted irradiance, E_B , can be used alternatively for smaller sources. Appropriate instruments are not common among persons commissioned with risk assessment (RA), and especially L_B measurements may be challenging. Therefore, a practical BLH RA approach is proposed that is based on illuminance, E_v , pre-calculated blackbody BLH efficacies of luminous radiation, $K_{B,v}^{\text{Planck}}$, and solid angle considerations. *Methods.* The practicality of this method was examined and compared against other RA approaches. *Results.* To ensure comparability of the applied instruments, measurements were performed close to a radiance standard, showing deviations within the lamp's expanded uncertainties ($< 4\%$), whereas the deviations were $\pm 15\%$ for longer distances. Focusing on a complex LED spotlight, all detected values could be converted to L_B by means of the RA methods within $\pm 20\%$. Two field tests with several spotlights yielded maximum permissible exposure durations obtained from the different RA approaches that agreed among each other within uncertainties largely below $\pm 30\%$. *Conclusion.* The general practicality of the proposed E_v method can be concluded for a workplace BLH RA of white-light sources.

BREVE SINTESI

La valutazione del rischio retinico per esposizione a luce visibile ('rischio da luce blu') avviene confrontando i valori limite di esposizione, espressi per 'sorgenti estese' con la grandezza 'Radianza Efficace' L_B e per 'sorgenti puntiformi' con la grandezza 'Irradianza Efficace' E_B , con le corrispondenti grandezze determinate misurando l'emissione della sorgente. E_B ed in particolare L_B , risultano essere parametri piuttosto complessi da misurare e richiedono apparecchiature sofisticate e costose. Si propone un metodo alternativo che consente di fare la valutazione del rischio effettuando più semplici misure di illuminamento E_v con un comune luxmetro, pur garantendo un errore modesto nella stima delle grandezze, più che accettabile nella maggior parte delle situazioni. Tale metodo è stato validato per confronto con i risultati ottenuti con le più sofisticate tecniche convenzionali con diverse tipologie di strumenti, caratterizzando l'emissione di 'standard' di radianza ed altre sorgenti molto intense di luce bianca. Gli scostamenti dei valori stimati nei casi peggiori risultano largamente inferiori a $\pm 30\%$, errori comuni per questa tipologia di misure.

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QUALITY MANAGEMENT PRACTICES. IMPACT OF ISO 9001:2015 CERTIFICATION ON DIRECTIVE 2014/68/UE (PED)

Giacobbe F, Bemporad E, Carro A, Pera F.

SUMMARY

This work aims to highlight the factors that characterize quality systems in the case of pressure equipment manufacturing. For the CE marking, according to the Pressure Equipment Directive (PED), the manufacturer may adopt conformity assessment modules based on the Quality System for production process, directly for the product, for its final inspection and testing or for full fabrication process, design included. At international level, the ISO 9001 standard is now consolidated and wide spread and was revised in 2015 with the introduction of new concepts. This article highlights the individual requirements of ISO 9001 which are directly and indirectly correlated with the Quality System factors required by PED. This allows to comply with the essential safety requirements of the directive following a Plan-Do-Check-Act approach and conforming to the formalization of the management systems provided by the High Level Structure.

BREVE SINTESI

L'articolo mette in evidenza i fattori che caratterizzano i sistemi di qualità nel caso della fabbricazione di attrezzature a pressione. Il sistema qualità può applicarsi al processo produttivo o al prodotto, o alla sua ispezione e test finale o all'intero processo di fabbricazione, inclusa la progettazione. A livello internazionale, la norma ISO 9001: 2015 è ormai consolidata e diffusa. L'articolo evidenzia i requisiti individuali della ISO 9001 direttamente e indirettamente correlati ai fattori del Sistema di Qualità richiesti dalla PED. Ciò consente di conformarsi ai requisiti essenziali di sicurezza della direttiva seguendo un approccio Plan-Do-Check-Act e conformandosi alla formalizzazione dei sistemi di gestione previsti dalla Struttura ad Alto Livello della ISO 9001:2015.

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REVIEW OF NORM OCCURRENCE AND APPLICATION OF A TAILORED GRADED APPROACH FOR THE RADIATION PROTECTION IN GEOTHERMAL PLANTS

Leonardi F, Venoso G, Bogi A, Bucci S, Caldognetto E, De Stena A, La Verde G, Luzzi L, Nuccetelli C, Picciolo F, Pratesi G, Trotti F, Ugolini R, Pugliese M, Trevisi R, Peroni I.

SUMMARY

In the present paper, the general methodological approach developed to manage legislative requirements for NORM involving industries was fitted to the geothermal industrial sector, which is in the indicative list of the European Directive 2013/59/Euratom (EU-BSS). A review of the state of the art about the radiological characterization of NORM in geothermal plants have been performed with the aim to identify matrices and exposure scenarios of radiological concern. From the analysis of collected data, it results that radiological content of NORM residues generally depends on the characteristics of the geothermal fluid as well as on the type of the plants. In several plants, residues (both scales and filtering materials) show generally high activity concentrations, especially for Ra-226 and Ra-228 decay segments, exceeding Exemption Levels of the EU-BSS. Several tables have been presented as tools to support the stakeholders in the application of the legislative requirements regarding radiation protection in the geothermal sector.

BREVE SINTESI

In questa pubblicazione è stato adattato al settore industriale della geotermia, l'approccio metodologico generale sviluppato per supportare gli stakeholder nell'applicazione dei requisiti legislativi in materia di radioprotezione nel settore geotermico. È stata effettuata una revisione dello stato dell'arte sulla caratterizzazione radiologica dei NORM negli impianti geotermici con l'obiettivo di identificare matrici e scenari di esposizione di interesse radiologico. Dall'analisi dei dati raccolti risulta che il contenuto radiologico dei residui NORM dipende generalmente dalle caratteristiche del fluido geotermico nonché dalla tipologia degli impianti. In diversi impianti, i residui (sia incrostazioni che materiali filtranti) mostrano generalmente concentrazioni di attività superiori ai livelli di esenzione, in particolare per i segmenti di catena di Ra-226 e Ra-228.

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DOI: <https://doi.org/10.1140/epjp/s13360-024-04917-6>

RISK ASSESSMENT FOR WORKERS WITH WEARABLE MEDICAL DEVICES EXPOSED TO ELECTROMAGNETIC FIELDS

Vivarelli C, Censi F, Calcagnini G, Falsaperla R, Mattei E.

SUMMARY

The exponential diffusion of wearable medical devices (WMD) in recent years has involved people of all ages, including workers. Workers who use WMDs should be considered at a particular risk from electromagnetic fields, and in accordance with EU Directive 2013/35/EU, they require an individual risk assessment. Currently, there is no international standard that provides specific guidance on how to perform such a risk assessment. This paper focuses on the effects of electromagnetic fields on WMDs and does not consider the direct effects on human body tissues. It aims to offer practical recommendations to employers and/or health physicists for the risk assessment of workers with WMDs. Focusing on EU countries, we first describe the requirements outlined by the technical standard for the electromagnetic compatibility (EMC) of medical electrical equipment IEC EN 60601-1-2. Then, some general guidelines on how to perform the risk assessment are provided. The assessment can be conducted by comparing the field values measured in the workplace with the immunity test levels specified in the technical standards of medical electrical equipment. If the measured values are lower than the immunity test levels indicated in the standard and the distance from the electromagnetic source is greater than the distance used by the manufacturer during the EMC (electromagnetic compatibility) tests (typically 30 cm), the risk for the worker may be considered acceptable. However, if the measured values exceed the immunity test levels or the distance criteria, a specific evaluation based on a case-by-case analysis is required.

BREVE SINTESI

I lavoratori portatori di dispositivi medici indossabili sono considerati particolarmente a rischio per i campi elettromagnetici e, in conformità alla Direttiva UE 2013/35/UE, necessitano di una valutazione del rischio specifica. Attualmente non esiste uno standard internazionale che fornisca indicazioni su come eseguire tale valutazione. L'obiettivo di questo lavoro è quindi offrire indicazioni pratiche ai datori di lavoro e/o ai fisici sanitari per effettuare la valutazione del rischio dei lavoratori con dispositivi medici indossabili. Allo scopo vengono descritti i requisiti delineati dalla norma tecnica per la compatibilità elettromagnetica delle apparecchiature elettromedicali, la IEC EN 60601-1-2 e vengono fornite alcune linee guida generali su come eseguire una efficace valutazione del rischio.

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STUDIES OF POTENTIAL MIGRATION OF HAZARDOUS CHEMICALS FROM SUSTAINABLE FOOD CONTACT MATERIALS

Simonetti G, Riccardi C, Pomata D, Acquaviva L, Fricano A, Buiarelli F, Senofonte M, Di Filippo P.

SUMMARY

In recent years, due to modern techniques for the distribution, transport, and retail sale of food, the production of large amounts of non-biodegradable and bioaccumulative packaging waste has become a major environmental issue. To address this issue, new food packaging materials based on renewable biomass have been studied as eco-friendly, biodegradable, and biocompatible alternatives to synthetic materials. However, although these materials are not petrochemical derivatives, the presence of contaminants cannot be excluded. This work aims to extend the knowledge on bio-based packaging materials, researching the presence of contaminants potentially able to migrate to food at concentrations of concern. In this study, we focus on two classes of contaminants, organophosphate esters (OPEs) and perfluoroalkyl substances (PFASs), carrying out migration tests toward different simulants, according to the current European regulation. PFAS analysis was performed using high-resolution liquid chromatography coupled to ion trap-tandem mass spectrometry (QTrap). OPE analyses were performed both by gas chromatography-mass spectrometry (GC-MS) and high-resolution liquid chromatography coupled to triple quadrupole mass spectrometry (TQMS). Preliminary findings demonstrate the release of toxic OPEs and PFASs from bio-based food packaging, highlighting the need to investigate the presence of potentially harmful chemicals in these materials. © 2024 by the authors.

BREVE SINTESI

Negli ultimi anni, a causa delle moderne tecniche di distribuzione, trasporto e vendita al dettaglio degli alimenti, la produzione di grandi quantità di rifiuti di imballaggio non biodegradabili e bioaccumulabili è diventata un grave problema ambientale. Per affrontare questo problema, sono stati studiati nuovi materiali per l'imballaggio alimentare, basati su biomassa rinnovabile, come alternative ecologiche, biodegradabili e biocompatibili, ai materiali sintetici. Sebbene questi materiali non siano derivati petrolchimici, non si può escludere la presenza di contaminanti che, nei processi di raccolta, trasporto, trattamento e smaltimento come rifiuti, potrebbero causare inquinamento. Questo lavoro mira ad estendere la conoscenza sui materiali di imballaggio a base biologica, ricercando la presenza di contaminanti potenzialmente in grado di migrare negli alimenti a concentrazioni preoccupanti. In questo studio, ci concentriamo su due classi di contaminanti, esteri organofosfati (OPE) e sostanze perfluoroalchiliche (PFAS), eseguendo test di migrazione verso diversi simulanti, secondo l'attuale normativa europea. L'analisi PFAS è stata eseguita utilizzando la cromatografia liquida ad alta risoluzione accoppiata alla spettrometria di massa tandem con trappola ionica (QTrap). Le analisi OPE sono state eseguite sia mediante gascromatografia-spettrometria di massa (GC-MS) che cromatografia liquida ad alta risoluzione accoppiata alla spettrometria di massa a triplo quadrupolo (TQMS). I risultati preliminari dimostrano il rilascio di OPE e PFAS tossici dagli imballaggi alimentari di origine biologica, evidenziando la necessità di indagare sulla presenza di sostanze chimiche potenzialmente dannose in questi materiali.

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TARGETING GLUCOSYLCERAMIDE SYNTHASE INDUCES ANTIPROLIFERATIVE AND PROAPOPTOTIC EFFECTS IN OSIMERTINIB-RESISTANT NSCLC CELL MODELS

La Monica S, Vacondio F, Eltayeb K, Lodola A, Volta F, Viglioli M, Ferlenghi F, Galvani F, Galetti M, Bonelli M, Fumarola C, Cavazzoni A, Flammini L, Verzè M, Minari R, Petronini PG, Tiseo M, Mor M, Alfieri R.

SUMMARY

The EGFR tyrosine kinase inhibitor osimertinib has been approved for the first-line treatment of EGFR-mutated Non-Small Cell Lung Cancer (NSCLC) patients. Despite its efficacy, patients develop resistance. Mechanisms of resistance are heterogeneous and not fully understood, and their characterization is essential to find new strategies to overcome resistance. Ceramides are well-known regulators of apoptosis and are converted into glucosylceramides (GlcCer) by glucosylceramide synthase (GCS). A higher content of GlcCers was observed in lung pleural effusions from NSCLC patients and their role in osimertinib-resistance has not been documented. The aim of this study was to determine the therapeutic potential of inhibiting GCS in NSCLC EGFR-mutant models resistant to osimertinib in vitro and in vivo. Lipidomic analysis showed a significant increase in the intracellular levels of glycosylceramides, including GlcCers in osimertinib resistant clones compared to sensitive cells. In resistant cells, the GCS inhibitor PDMP caused cell cycle arrest, inhibition of 2D and 3D cell proliferation, colony formation and migration capability, and apoptosis induction. The intratumoral injection of PDMP completely suppressed the growth of OR xenograft models. This study demonstrated that dysregulation of ceramide metabolism is involved in osimertinib-resistance and targeting GCS may be a promising therapeutic strategy for patients progressed to osimertinib.

BREVE SINTESI

Nei versamenti pleurici polmonari di pazienti affetti da NSCLC sono stati osservati elevati livelli di glucosilceramidi, derivati delle ceramidi che hanno un ruolo nella regolazione dell'apoptosi. Lo scopo di questo studio è stato quello di determinare il potenziale terapeutico dell'inibizione della loro sintesi in modelli di carcinoma polmonare resistenti a osimertinib. L'analisi lipidomica ha confermato un aumento significativo dei livelli intracellulari di glicosilceramidi nei cloni resistenti a osimertinib. Inoltre, l'inibizione della loro sintesi sia in vitro sia in vivo ha soppresso completamente la crescita tumorale. Questo studio ha dimostrato che le glucosilceramidi possono rappresentare un bersaglio terapeutico promettente per i pazienti affetti da carcinoma polmonare.

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DOI: <https://doi.org/10.1038/s41598-024-57028-8>

TARGETING METABOLIC ADAPTIVE RESPONSES INDUCED BY GLUCOSE STARVATION INHIBITS CELL PROLIFERATION AND ENHANCES CELL DEATH IN OSIMERTINIB-RESISTANT NON-SMALL CELL LUNG CANCER (NSCLC) CELL LINES

Eltayeb K, Alfieri R, Fumarola C, Bonelli M, Galetti M, Cavazzoni A, Digiacomo G, Galvani F, Vacondio F, Lodola A, Mor M, Minari R, Tiseo M, La Monica S, Petronini PG.

SUMMARY

Osimertinib, a tyrosine kinase inhibitor targeting mutant EGFR, has received approval for initial treatment in patients with Non-Small Cell Lung Cancer (NSCLC). While effective in both first- and second-line treatments, patients eventually develop acquired resistance. Metabolic reprogramming represents a strategy through which cancer cells may resist and adapt to the selective pressure exerted by the drug. In the current study, we investigated the metabolic adaptations associated with osimertinib-resistance in NSCLC cells under low glucose culture conditions. We demonstrated that, unlike osimertinib-sensitive cells, osimertinib-resistant cells were able to survive under low glucose conditions by increasing the rate of glucose and glutamine uptake and by shifting towards mitochondrial metabolism. Inhibiting glucose/pyruvate contribution to mitochondrial respiration, glutamine deamination to glutamate, and oxidative phosphorylation decreased the proliferation and survival abilities of osimertinib-resistant cells to glucose starvation. Our findings underscore the remarkable adaptability of osimertinib-resistant NSCLC cells in a low glucose environment and highlight the pivotal role of mitochondrial metabolism in mediating this adaptation. Targeting the metabolic adaptive responses triggered by glucose shortage emerges as a promising strategy, effectively inhibiting cell proliferation and promoting cell death in osimertinib-resistant cells.

BREVE SINTESI

La riprogrammazione metabolica rappresenta una strategia attraverso la quale le cellule tumorali possono resistere e adattarsi alla pressione selettiva esercitata da alcuni farmaci antitumorali. Abbiamo quindi analizzato gli adattamenti metabolici associati alla resistenza all'osimertinib in cellule polmonari di NSCLC in condizioni di coltura a basso contenuto di glucosio. Le cellule resistenti si sono dimostrate in grado di sopravvivere in tali condizioni, aumentando il tasso di assorbimento di glucosio e glutammina e spostandosi verso il metabolismo mitocondriale. Puntare sulle risposte metaboliche di adattamento innescate dalla carenza di glucosio emerge come una strategia promettente, in grado di inibire la proliferazione cellulare e promuovere la morte cellulare nelle cellule resistenti a osimertinib.

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THE IMPACT OF TOXIC METAL BIOACCUMULATION ON COLORECTAL CANCER: UNRAVELLING THE UNEXPLORED CONNECTION

Bonfiglio R, Sisto R, Casciardi S, Palumbo V, Scioli MA, Palumbo A, Trivigno D, Giacobbi E, Servadei F, Melino G, Mauriello A, Scimeca M.

SUMMARY

Colorectal cancer is a major public health concern, with increasing incidence and mortality rates worldwide. Environmental factors, including exposure to toxic metals, such as lead, chromium, cadmium, aluminium, copper, arsenic and mercury, have been suggested to play a significant role in the development and progression of this neoplasia. In particular, the bioaccumulation of toxic metals can play a significant role in colorectal cancer by regulating biological phenomenon associated to both cancer occurrence and progression, such as cell death and proliferation. Also, frequently these metals can induce DNA mutations in well-known oncogenes. This review provides a critical analysis of the current evidence, highlighting the need for further research to fully grasp the complex interplay between toxic metal bioaccumulation and colorectal cancer. Understanding the contribution of toxic metals to colorectal cancer occurrence and progression is essential for the development of targeted preventive strategies and social interventions, with the ultimate goal of reducing the burden of this disease.

BREVE SINTESI

L'articolo consiste in una rassegna critica dei lavori presenti in letteratura sul bioaccumulo e sugli effetti biologici, con particolare riferimento al tumore del colon retto, dei metalli pesanti. Per il piombo, il cromo esavalente, l'alluminio, il rame, il mercurio e l'arsenico vengono riportati: diffusione, modalità di esposizione, effetti sulla salute, organi bersaglio, con particolare riferimento al colon retto. Risulta acclarato il rischio derivante da un accumulo cronico di tali metalli.

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THE LOWER LIMB MUSCLE CO-ACTIVATION MAP DURING HUMAN LOCOMOTION: FROM SLOW WALKING TO RUNNING

Fiori L, Castiglia SF, Chini G, Draicchio F, Sacco F, Serrao M, Tatarelli A, Varrecchia T, Ranavolo A.

SUMMARY

The central nervous system (CNS) controls movements and regulates joint stiffness with muscle co-activation, but until now, few studies have examined muscle pairs during running. This study aims to investigate differences in lower limb muscle coactivation during gait at different speeds, from walking to running. Nineteen healthy runners walked and ran at speeds ranging from 0.8 km/h to 9.3 km/h. Twelve lower limb muscles' co-activation was calculated using the time-varying multimuscle co-activation function (TMCf) with global, flexor-extension, and rostral-caudal approaches. Spatiotemporal and kinematic parameters were also measured. We found that TMCf, spatiotemporal, and kinematic parameters were significantly affected by gait speed for all approaches. Significant differences were observed in the main parameters of each co-activation approach and in the spatiotemporal and kinematic parameters at the transition between walking and running. In particular, significant differences were observed in the global co-activation (C_{glob}, main effect $F(1,17) = 641.04$, $p < 0.001$; at the transition $p < 0.001$), the stride length (main effect $F(1,17) = 253.03$, $p < 0.001$; at the transition $p < 0.001$), the stride frequency (main effect $F(1,17) = 714.22$, $p < 0.001$; at the transition $p < 0.001$) and the Center of Mass displacement in the vertical (Co_{My}, main effect $F(1,17) = 426.2$, $p < 0.001$; at the transition $p < 0.001$) and medial-lateral (Co_{Mz}, main effect $F(1,17) = 120.29$, $p < 0.001$; at the transition $p < 0.001$) directions. Regarding the correlation analysis, the Co_{My} was positively correlated with a higher C_{glob} ($r = 0.88$, $p < 0.001$) and negatively correlated with FullWidth at Half Maximum (FWHM_{glob}, $r = -0.83$, $p < 0.001$), whereas the Co_{Mz} was positively correlated with the global Center of Activity (Co_{Aglob}, $r = 0.97$, $p < 0.001$). Positive and negative strong correlations were found between global co-activation parameters and center of mass displacements, as well as some spatiotemporal parameters, regardless of gait speed.

BREVE SINTESI

Il sistema nervoso centrale (SNC) controlla i movimenti e regola la rigidità articolare con co-attivazione muscolare, ma fino ad ora, pochi studi hanno esaminato le coppie muscolari durante la corsa. Questo studio ha lo scopo di indagare le differenze nella coattivazione muscolare degli arti inferiori durante la deambulazione a diverse velocità, dalla camminata alla corsa.

CITAZIONE BIBLIOGRAFICA

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USO DI BIG DATA PER LA VALUTAZIONE DEGLI EFFETTI SANITARI ACUTI E CRONICI DELL'INQUINAMENTO ATMOSFERICO NELLA POPOLAZIONE ITALIANA

Maio S, Stafoggia M, Gariazzo C, Viegi G.

SUMMARY

Questo supplemento presenta i più recenti risultati del progetto BIGEPI quali: i dati ambientali e dati sanitari utilizzati nel progetto; l'impatto delle temperature calde e fredde sulla mortalità per causa; gli effetti a breve termine del PM10 sulla mortalità causa-specifica e ruolo delle pressioni ambientali di lungo periodo nelle aree industriali di Brindisi e Civitavecchia; l'esposizione di lungo periodo all'inquinamento atmosferico e incidenza di malattia coronarica acuta e ictus negli studi longitudinali italiani; l'esposizione di lungo periodo all'inquinamento atmosferico e incidenza di malattia coronarica acuta e ictus negli studi longitudinali italiani; lo studio sulle variazioni dei rischi di mortalità naturale in relazione all'utilizzo di diversi indicatori di esposizione di lungo periodo all'inquinamento atmosferico; Il ruolo dell'esposizione a inquinanti aerodispersi nel luogo di lavoro sulla prevalenza e gravità della malattia respiratoria cronica in Italia; uno studio sulla associazione tra settore occupazionale e mortalità respiratoria negli studi longitudinali di Roma e Torino.

I risultati degli studi BEEP e BIGEPI hanno confermato le grandi potenzialità dell'uso dei big data e della collaborazione interdisciplinare e hanno fornito nuove e più aggiornate evidenze in ambito epidemiologico ambientale e occupazionale, stimolando nuovi indirizzi di ricerca scientifica e confermando la necessità di azioni di prevenzione in materia di qualità dell'aria e cambiamenti climatici per la salute della popolazione generale e dei lavoratori.

Inoltre, BIGEPI ha permesso di confrontare stime di mortalità ottenute utilizzando modelli di esposizione nazionali e locali.

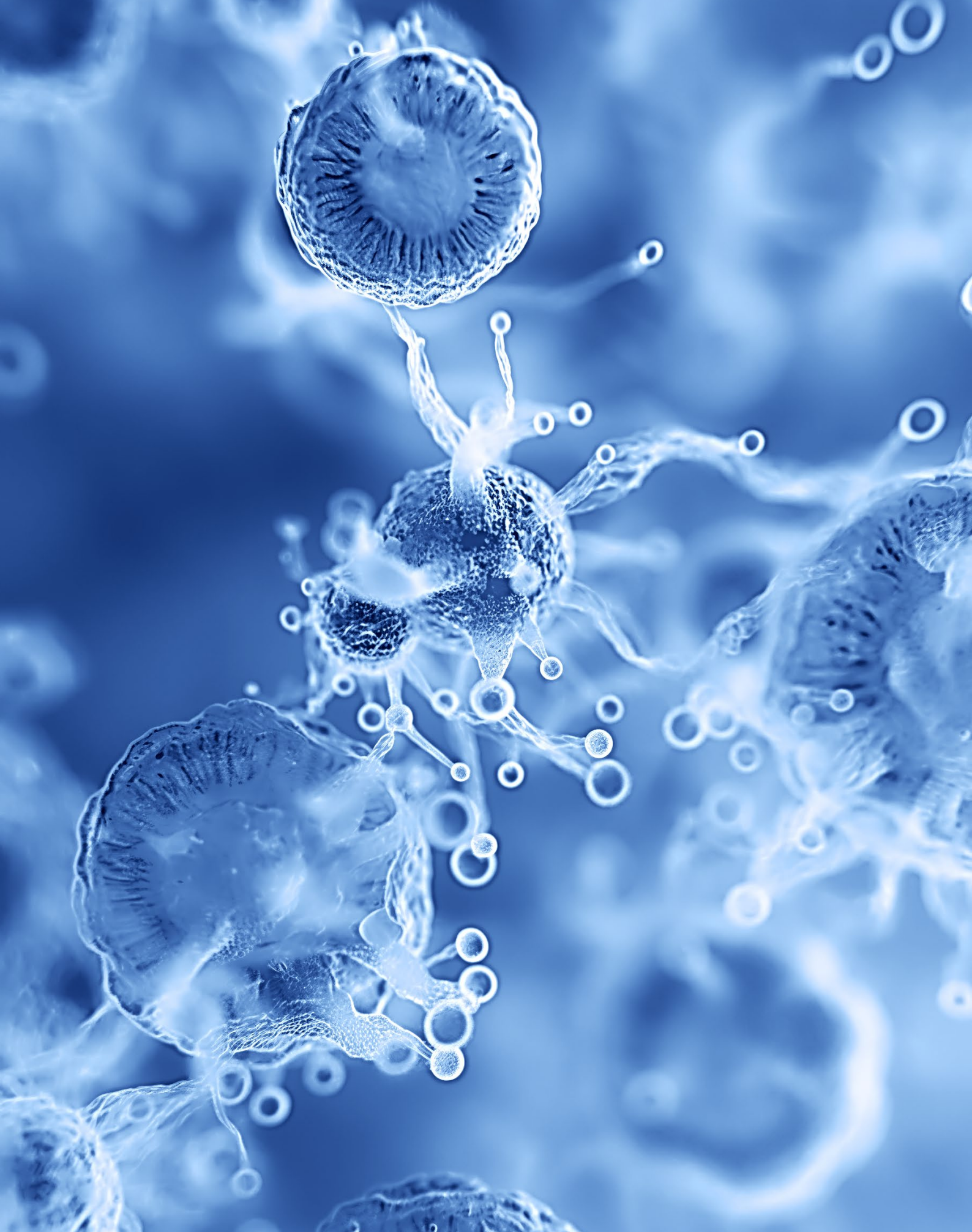
BREVE SINTESI

Il presente volume riporta i risultati di uno studio sui rischi collegati all'esposizione di breve e lungo periodo all'inquinamento atmosferico, alle temperature estreme e all'esposizione occupazionale, in termini di mortalità, ricoveri ospedalieri, morbosità e parametri fisiologici. I risultati degli studi BEEP e BIGEPI hanno confermato le grandi potenzialità dell'uso dei big data in ambito epidemiologico ambientale e occupazionale.

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