Nº2

31 AGOSTO 2024

Boletín de Seguridad y Salud en el Trabajo del Sector Agrícola

Instituto Andaluz de Prevención de Riesgos Laborales
Consejería de Empleo, Empresa y Trabajo Autónomo

Laboratorio-Observatorio Andaluz de Condiciones de Trabajo en el Sector Agrícola (LASA)

https://www.juntadeandalucia.es/organismos/iaprl/areas/investigacion/lasa.html

FINALIDAD DE ESTE DOCUMENTO

Este boletín, realizado desde el Laboratorio-Observatorio Andaluz de Condiciones de Trabajo en el Sector Agrícola (LASA), engloba diferentes artículos científicos sobre Seguridad y Salud en el Trabajo (SST) en el sector de la agricultura. Recoge trabajos que han sido publicados en revistas del Journal Citation Reports en el segundo cuatrimestre del año 2024. Se expone el título y resumen en inglés de cada artículo junto con su información principal. Además, en todos se presenta un breve resumen en español de los aspectos más destacados. Este boletín pretende facilitar la revisión de los artículos publicados en este ámbito en el período de tiempo indicado y el acceso a las revistas correspondientes.

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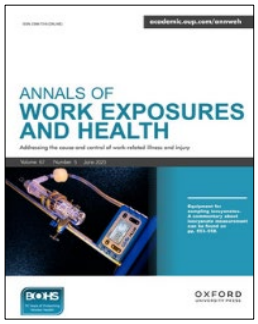
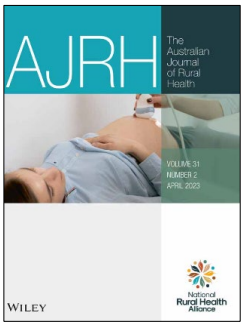
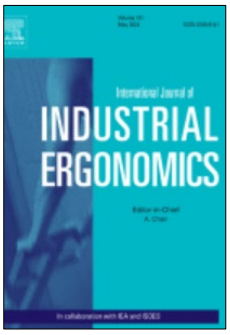


THE AUSTRALIAN JOURNAL OF RURAL HEALTH

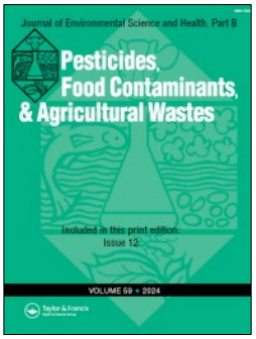


INTERNATIONAL JOURNAL OF INDUSTRIAL ERGONOMICS



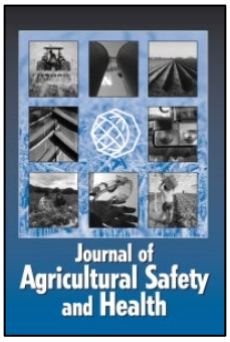
JOURNAL OF AGROMEDICINE

JOURNAL OF ENVIRONMENTAL SCIENCE AND HEALTH, PART B



ARCHIVES OF ENVIRONMENTAL & OCCUPATIONAL HEALTH

JOURNAL OF AGRICULTURAL SAFETY AND HEALTH



ANNALS OF WORK EXPOSURES AND HEALTH

ARTÍCULO 1: Impact of heat and a rest-shade-hydration intervention program on productivity of piece-paid industrial agricultural workers at risk of chronic kidney disease of nontraditional origin

Objectives: Assess the impact of environmental heat and a rest-shade-hydration (RSH) intervention against heat stress on productivity of piece-paid Mesoamerican sugarcane cutters. These workers are at a high risk of chronic kidney disease of non-traditional origin (CKDnt), from the severe heat stress they experience due to heavy work under hot conditions. RSH interventions in these populations improve kidney health outcomes, but their impact on productivity has yet to be examined.
Methods: We accessed routine productivity data from seed (SC, N = 749) and burned (BCC, N = 535) sugarcane cutters observed over five harvest seasons with increasing RSH intervention at a large Nicaraguan sugarcane mill. Hourly field-site wet-bulb globe temperature (WBGT) was recorded by mill staff and summarized as a daily mean. Mixed linear regression was used to model daily productivity, adjusting for age (18–29, 30–44, and >45 years), sex, WBGT (<28, 28–29, 29–30, 30–31, and >31 °C) on the same and preceding day, harvest season (2017–18 to 2021–22), month, and acclimatization status (<1, 1–2, and >2 weeks).
Results: There was an inverse dose–response relationship between SC productivity and WBGT on the same and preceding days, decreasing by approximately 3%/°C WBGT. Productivity increased during the study period, i.e. coinciding with RSH scale-up, by approximately 19% in SC and 9% in BCC.
Conclusion: Agricultural worker productivity was expected lower on hotter days, strengthening the interest in all stakeholders to mitigate increasing global temperatures and their impact. Despite decreasing the total time allocated for work each day, an RSH intervention appears to result in increased productivity and no apparent loss in productivity.

Impacto del calor y de un programa de intervención con descanso, sombra e hidratación en la productividad de los trabajadores agrícolas con riesgo de enfermedad renal crónica (con causas diferentes de las tradicionales)

Los cortadores de caña de azúcar se exponen a un riesgo elevado de sufrir una enfermedad renal crónica, debido al gran estrés térmico que sufren durante su labor. Un programa de intervención denominado descanso-sombra-hidratación mejora la salud renal, pero no se conoce si afecta a la productividad de los trabajadores. Por tanto, en esta investigación se evaluó su impacto. Se obtuvieron y analizaron datos de productividad de cortadores de caña de azúcar durante cinco temporadas de cosecha. Se registró la temperatura húmeda del bulbo, obteniendo una media diaria, y se aplicó regresión lineal mixta para la productividad diaria (considerando edad, sexo, temperatura de globo húmedo de ese día y del anterior, temporada de cosecha, etc.). Se concluyó que cuando aumentaba la temperatura, la productividad de los agricultores era menor. Sin embargo, cuando se aplicaba la intervención descanso-sombra-hidratación, la productividad aumentaba.

AUTORES	Erik Hansson, Kristina Jakobsson, Jason Glaser, Catharina Wesseling, Denis Chavarria, Rebekah A I Lucas, Heath Prince, David H Wegman
DOI	https://doi.org/10.1093/annweh/wxae007
PUBLICACIÓN	Annals of Work Exposures and Health, 2024, Volumen 68, Número 4, pp. 366-375
TEMÁTICA	Temperatura

ARTÍCULO 2: Working with cattle slurry on farms: emission and dispersion of hydrogen sulfide gas during stirring

Over the past 15 years, there have been numerous fatalities related to working with animal slurry. Working with cattle slurry releases toxic gases, in particular, hydrogen sulphide (H2S), which can cause acute central nervous system toxicity, breathing difficulties, and death if exposed to high concentrations. Real-time measurements of H2S gas were taken over distance and time, during the stirring of cattle slurry on farms. Gas was measured at eight slurry stores with differing typical configurations of indoor or outdoor stores and with or without slatted flooring. Highest H2S gas levels were measured from indoor stores under slatted floors, and generally at positions closest to the stirrer or the point of maximum stirring, with levels decreasing with distance from source. Most of the data indicate H2S gas levels increase very rapidly after stirring starts, and mostly decline to baseline levels within 30 min post start of stirring. There were, however, circumstances where gas levels remained high and only started to decline once the stirrer had stopped. H2S gas levels at all farms, at all positions measured were consistently below 10 ppm within 30 min of the stirrer being stopped. The current data highlight areas of the farm and ways of working that have the potential for workers and others to be at risk of exposure to toxic slurry gases. The area should be left to ventilate naturally for at least 30 min after the stirrer has been stopped before re-entering buildings. Influencing the design of stirring equipment and future slurry stores would likely reduce the risk of worker exposure to slurry gases.

Trabajar con purines de ganado en granjas: emisión y dispersión de gas sulfuro de hidrógeno durante la agitación

Trabajar con purines tiene graves consecuencias para la salud, ya que se liberan gases (concretamente sulfuro de hidrógeno) que pueden provocar un impacto tóxico en el sistema nervioso central, problemas respiratorios e incluso la muerte (con exposición a concentraciones muy elevadas). Se llevaron a cabo mediciones de sulfuro de hidrógeno durante la agitación de purines en granjas, teniendo en cuenta la distancia y el tiempo. Se realizaron en ocho almacenes de purines de diferente tipo: en interior, exterior, con suelos de rejilla y sin suelos de rejilla. Los resultados mostraron que las mayores concentraciones de este gas se obtuvieron en almacenes interiores y debajo de suelos de rejilla. La distancia influía, siendo la concentración mayor cuanto más cerca se realizaba la medición de la agitación. En todos los almacenes y mediciones, la concentración de sulfuro de hidrógeno fue inferior a 10 ppm después de 30 minutos de la parada del agitador. Se concluye el riesgo para los trabajadores y se establecen recomendaciones como ventilación durante 30 minutos tras finalizar la tarea, rediseño de equipos de agitación y de almacenes.

AUTORES	Amy Gyte, Adrian Kelsey
DOI	https://doi.org/10.1093/annweh/wxae020
PUBLICACIÓN	Annals of Work Exposures and Health, 2024, Volumen 68, Número 4, pp. 387-396
TEMÁTICA	Exposición

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ARTÍCULO 3: Emergency presentations for farm-related injuries in older adults residing in south-western Victoria, Australia

Introduction: Farm workers are at high risk for injuries, and epidemiological data are needed to plan resource allocation.
Objective: This study identified regions with high farm-related injury rates in the Barwon South West region of Victoria, Australia, for residents aged ≥50 yr.
Design: Retrospective synthesis using electronic medical records of emergency presentations occurring during 2017–2019 inclusive for Local Government Areas (LGA) in the study region. For each LGA, age-standardised incidence rates (per 1000 population/year) were calculated.
Findings: For men and women combined, there were 31 218 emergency presentations for any injury, and 1150 (3.68%) of these were farm-related. The overall age-standardised rate for farm-related injury presentations was 2.6 (95% CI 2.4–2.7); men had a higher rate than women (4.1, 95% CI 3.9–4.4 versus 1.2, 95% CI 1.0–1.3, respectively). For individual LGAs, the highest rates of farm-related emergency presentations occurred in Moyne and Southern Grampians, both rural LGAs. Approximately two-thirds of farm-related injuries occurred during work activities (65.0%), and most individuals arrived at the hospital by transport classified as "other" (including private car, 83.3%). There were also several common injury causes identified: "other animal related injury" (20.2%), "cutting, piercing object" (19.5%), "fall ⟨1 m" (13.1%), and "struck by or collision with object" (12.5%). Few injuries were caused by machinery (1.7%) and these occurred mainly in the LGA of Moyne (65%).
Discussion and Conclusion: This study provides data to inform future research and resource allocation for the prevention of farm-related injuries.

Situaciones de emergencia por lesiones relacionadas con granjas en adultos mayores que residen en el suroeste de Victoria, Australia

Se identificaron las regiones en las que existía una elevada tasa de lesiones en personas de 50 años o mayores de *Barwon South West* de Victoria (Australia). Se recopilaron datos médicos electrónicos de urgencias ocurridas entre 2017 y 2019 en Áreas de Gobierno Local. Se obtuvieron 31218 urgencias asociadas con lesiones, ocurriendo el 3,68% de ellas en granjas. El número fue mayor para hombres que para mujeres. Las regiones que presentaron más urgencias fueron Moyne y Southern Grampians. El 65% de las lesiones se produjeron durante diferentes labores. Algunas causas frecuentes fueron: otras lesiones relacionadas con animales (20,2%), corte o perforación con objetos (19,5%), caídas a menos de 1 metro (13,1%) y golpes con objetos (12,5%). Pocas lesiones eran debidas al uso de maquinaria (1,7%).

AUTORES	Kara L. Holloway-Kew, Timothy R. Baker, Muhammad A. Sajjad, Tewodros Yosef, Mark A. Kotowicz, Jessie Adams, Susan Brumby, Richard S. Page, Alasdair G. Sutherland, Bianca E. Kavanagh, Sharon L. Brennan-Olsen, Lana J. Williams, Julie A. Pasco
DOI	https://doi.org/10.1111/ajr.13110
PUBLICACIÓN	The Australian Journal of Rural Health, 2024, Volumen 32, Número 3, pp. 498-509
TEMÁTICA	Accidentes y Enfermedades Laborales

INTERNATIONAL JOURNAL OF INDUSTRIAL ERGONOMICS

ARTÍCULO 4: Assessment of an arm-support exoskeleton on physical demands, task performance, and usability during simulated agricultural tasks

This laboratory-based study aimed to determine whether an arm-support exoskeleton (ASE) would be an effective intervention to reduce the physical strain associated with manual agricultural work. Twenty-four (gender-balanced) participants performed pruning and harvesting tasks (at four different heights: knee, elbow, shoulder, and overhead), lifting/lowering, and Timed Up & Go (TUG) tasks with and without an ASE. During these tasks, muscle activity (in the upper trapezius, anterior deltoid, biceps brachii, and erector spinae), task completion time, perceived exertion, and usability were assessed. The results indicated a significant reduction (31.7%–60.2%) in muscle activity, particularly in the upper trapezius and anterior deltoid, when using the ASE during tasks at shoulder work height or above. However, there was an observed increase in muscle strain in the erector spinae, suggesting potential risk to the lower back. Given these findings, a more rigorous evaluation of ASEs in agricultural tasks should be pursued before implementing exoskeletons in agricultural tasks to avoid unintended health hazards.

Evaluación de un exoesqueleto de soporte para el brazo en las demandas físicas, el rendimiento en tareas y la utilidad durante tareas agrícolas simuladas

Se analizó si un exoesqueleto de soporte para el brazo podría reducir el esfuerzo físico durante el trabajo manual en la agricultura. Este estudio se realizó en laboratorio y participaron 24 personas. Se evaluaron las labores de poda y cosecha (realizadas a cuatro alturas: rodilla, codo, hombro y por encima de la cabeza), tareas de levantamiento-bajada y la prueba “Timed Up & Go” (levántate y anda), sin el uso de exoesqueleto y con su uso. Se analizó la actividad muscular (en trapecio superior, deltoides anterior, bíceps braquial y erectores espinales), el tiempo de finalización de las labores, el esfuerzo percibido y la usabilidad. Los resultados mostraron que con el uso del exoesqueleto en las tareas con una altura al nivel de hombros o superior se producía una disminución importante de la actividad muscular. También se observó riesgo en la zona lumbar. Se recomendó la evaluación de estos equipos, antes de su utilización, para las tareas en las que se desee implantar.

AUTORES	Byungkyu Choi, Jaehyun Park, Jeong Ho Kim
DOI	https://doi.org/10.1016/j.ergon.2024.103569
PUBLICACIÓN	International Journal of Industrial Ergonomics, 2024, Volumen 101, 103569
TEMÁTICA	Riesgo Físico

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ARTÍCULO 5: Farmers' Mental Health: The Mediating Role of Chronic Fatigue

The agricultural environment is known to be particularly harmful to farmers' psychological health. To better understand how its impact is modulated, this study mainly focuses on the mediating role of chronic fatigue between A) loneliness at work, autonomy, workload, government regulations and policies and financial hardship, and B) life satisfaction, positive affect and psychological distress. The study is based on a sample of 453 Canadian dairy farmers. Structural equation modeling analyses confirmed the mediating role of chronic fatigue in the relationships between the factors studied, with the exception of financial hardship. Implications for research and the psychological burden affecting agricultural workers are discussed.

La salud mental de los agricultores: El papel mediador de la fatiga crónica

Este estudio analizó si la fatiga crónica influía en la relación entre las dificultades en el trabajo (soledad, autonomía, carga de trabajo, regulaciones, políticas y dificultades financieras) y los problemas de salud mental (satisfacción con la vida, afecto positivo y malestar psicológico). Participaron 453 productores de lácteos de Canadá. Los resultados mostraron la importancia de tratar la fatiga crónica para mejorar la salud mental de estos trabajadores.

AUTORES	Didier Dolbec, Philippe Dubreuil, Laetitia Larouche
DOI	https://doi.org/10.1080/1059924X.2023.2289967
PUBLICACIÓN	Journal of Agromedicine, 2024, Volumen 29, Número 3, pp. 307-320
TEMÁTICA	Riesgo Salud Mental

ARTÍCULO 6: Falls from Trees in Coastal Karnataka: A Neglected Cause of Polytrauma in Lower-Middle-Income Countries of Similar Agroforestry

Introduction: Falls are the second most common cause of injury associated with mortality worldwide and an important type of blunt trauma, which forms a significant percentage of traumatic accidents and emergency department admissions. Falling from a tree is an important problem because of its effect on one's health owing to infirmity caused by injuries, most commonly spinal injuries, and the economic burden that accompanies it.

Methods: A retrospective chart analysis was performed including all the patients with falls from heights who presented to a tertiary care hospital in South India during the summer months of 2018, 2019, and 2020. A structured case record form was used to capture information such as basic demographics, tree species, reason for climbing the tree, and mode of fall, along with the clinical profile, and outcomes from the cases selected from the emergency department registers and cross verified using ICD codes.

Results: Despite the existing lockdown due to COVID, an unusual increase in the number of patients getting admitted to the triage with a fall from tree was noted in the year 2020 compared to 2019 and 2018. The most common type of injuries sustained were spinal injuries. Burst fractures were leading types of fractures in the patients with spinal injury. The second most common type of injuries involved were of extremities, with lower extremities more than upper extremities. Two patients had inhospital mortality within 30 days.

Conclusions: Falls from a tree are a neglected and preventable mechanism of trauma with a significant socio-economic impact, as most of the patients are young or middle aged earning members of their families. The burden of this mode of injury is primarily on rural and agricultural communities. Pre-hospital services in areas with vast agroforestry cultivation require dedicated first response clinics. Lockdowns and geographic isolation during disasters or disease outbreaks must also factor in a supply of essential commodities and warrant treatment on an urgent basis to reduce the need and risk of injury from forestry and agricultural activities.

Caídas de árboles en la costa de Karnataka: una causa de politraumatismos en países de ingresos medios-bajos con sistemas agroforestales similares

Este estudio analizó los registros de los pacientes que habían asistido al hospital por una caída desde un árbol en el sur de India en los meses de verano de los años 2018, 2019 y 2020. Los resultados mostraron que 2020 fue el año con mayor número de caídas. Las lesiones más frecuentes fueron las de columna vertebral, seguidas por las de extremidades (principalmente las inferiores). Se concluyó que estas caídas tenían graves consecuencias y un gran impacto socioeconómico. Estas caídas se relacionaban con trabajos agrícolas y forestales.

AUTORES	Freston Marc Sirur, Reem Hunain, Nagaraj Kamath, A S Chethana, Vrinda Lath, Karthik Naik, Prabhakar Sastri
DOI	https://doi.org/10.1080/1059924X.2023.2293833
PUBLICACIÓN	Journal of Agromedicine, 2024, Volumen 29, Número 3, pp. 321-332
TEMÁTICA	Accidentes y Enfermedades Laborales

ARTÍCULO 7: Agricultural Worker Perspectives on Climate Hazards and Risk Reduction Strategies

Objective: The purpose of this study was to understand the experiences of agricultural workers during periods of heat and wildfire smoke exposure and to support the development and implementation of protective workplace interventions.

Methods: Using community-engaged research and the Center for Disease Control (CDC) framework for policy evaluation, a qualitative descriptive study was conducted with current and former agricultural workers in Central Washington (WA). Twelve participants answered semi-structured questions via interviews or by attending a focus group. Interviews and focus groups were conducted in Spanish, recorded, transcribed, and translated into English; one interview was conducted in English.

Results: Using Braun and Clarke's Reflexive Thematic Analysis, five themes were identified among workers from various worksites: 1) Extreme weather and working conditions are becoming increasingly hazardous to worker health, 2) Employers and supervisors lack training and education on current labor laws, and health and safety rules, 3) Employers and supervisors use intimidation and retaliation to ensure productivity and to evoke feelings of replaceability among workers, 4) Workers do not trust regulatory agencies to enforce rules or hold employers accountable, 5) Solutions to climate-driven problems in the agricultural industry need to value worker health and safety, not just productivity. Participants reported experiencing adverse health symptoms related to heat and smoke exposure at work. Workers proposed solutions including improving education, training, and communication, and increased enforcement of existing and forthcoming occupational health and safety rules.

Conclusion: The agricultural workforce is essential for ensuring a robust food supply and is facing extreme weather events due to climate change. Western states impacted by wildfires and heat are working to develop and implement occupational health and safety rules. Developing effective policies and interventions inclusive of worker perspectives is critical to adapt to a changing climate, retain a stable workforce and promote optimal health.

Perspectivas de los trabajadores de la agricultura sobre los riesgos climáticos y las estrategias para reducirlos

Se analizó la exposición de trabajadores de la agricultura a altas temperaturas durante la realización de sus labores y al humo de incendios forestales. Participaron 12 trabajadores que respondieron a una serie de preguntas mediante entrevista o asistiendo a un grupo de discusión. Tras un análisis determinado se obtuvo que: cada vez son más peligrosas las condiciones laborales y climáticas, los supervisores no tienen formación sobre seguridad y salud, los supervisores mantienen la productividad utilizando represalias e intimidación, los trabajadores indican que no se obliga a los supervisores a cumplir normas, las soluciones en cuanto a condiciones climáticas deben considerar la seguridad y salud de los agricultores y no centrarse únicamente en la productividad. Los trabajadores que participaron en el estudio afirmaron sufrir consecuencias para su salud por la exposición a calor y humo. Indicaron que fomentar la formación y aplicar la normativa relativa a seguridad y salud podrían mejorar sus condiciones.

AUTORES	Molly Parker, Mary Jo Ybarra-Vega, Julie Postma
DOI	https://doi.org/10.1080/1059924X.2023.2299378
PUBLICACIÓN	Journal of Agromedicine, 2024, Volumen 29, Número 3, pp. 333-343
TEMÁTICA	Exposición

ARTÍCULO 8: Occupational Injuries and Health Status Among Rural Tribal Non-Traditional Fishing Communities in the Coastal Region of Tamil Nadu, India

Objectives: This study evaluated the occupational injuries and health hazards associated with fishing as an occupation among non-traditional rural tribal fishing communities in the coastal region of Tamil Nadu, India.

Methods: This cross-sectional study included a total of 170 individuals belonging to a fishing community, comprising both male (n=82) and female (n=88) participants. The demographic details including occupational history, lifestyle characteristics, socio-economic status, personal habits, and health status were assessed through the questionnaire survey.

Results: The fishing community has a low socioeconomic status and poor literacy, lifestyle, and personal habits. The mean age of the participants was 38.8yrs (male 34.8; female 39.9yrs). Only 10% reported usage of personal protective equipment (PPE), and the work duration varied from 8 to 24 hrs in a day. While male subjects reported smoking habits (12%) and alcohol consumption (23%), none of the females reported alcohol consumption and smoking habits. The major occupational injuries that occurred were due to catfish (72%) and oysters (48%). A large number of female subjects reported musculoskeletal pains. The body mass index of about 28% of fishermen was above the normal range. Abnormal blood sugar, blood pressure, and respiratory and neurological symptoms were the other major health complaints. The major environmental hazards reported were salinity, solar radiation, tides, and high wind.

Conclusion: Injuries from handling fish and oysters were observed to be the major occupational burden. Additonally, a high prevalence of musculoskeletal pain and chronic health illness was commonly observed among the fishers. Adequate training and awareness programs are required for effective management of occupational health hazards and health promotion.

Lesiones relacionadas con el trabajo y estado de salud entre comunidades tribales rurales sin tradición pesquera en la región costera de Tamil Nadu, India

Se evaluaron las lesiones y riesgos para la salud en la pesca, en concreto en comunidades rurales tribales que no tenían una tradición histórica pesquera en la región de Tamil Nadu (Indica). Participaron 170 trabajadores de este sector (82 hombres y 88 mujeres) y se obtuvo información mediante cuestionarios. Los resultados mostraron que solamente un 10% de los participantes empleaban equipos de protección personal. Las lesiones más relevantes relacionadas con el trabajo eran consecuencia de la manipulación de bagres (72%) y ostras (48%). Un alto porcentaje de mujeres sufría trastornos musculoesqueléticos. Los problemas de salud más comunes fueron azúcar en sangre, presión arterial y síntomas respiratorios y neurológicos. Los riesgos ambientales que se identificaron fueron salinidad, mareas, vientos y radicación solar. Se concluyó la importancia de la concienciación y formación de estos trabajadores.

AUTORES	Dhananjayan Venugopal, Ravichandran B, Panjakumar K, Mala A, Gopalakrishnan A, Jayaraman S, Rajeev KY, Arun S
DOI	https://doi.org/10.1080/1059924X.2024.2304197
PUBLICACIÓN	Journal of Agromedicine, 2024, Volumen 29, Número 3, pp. 344-354
TEMÁTICA	Seguridad y Salud General

ARTÍCULO 9: Mixed-Methods Assessment of Farmworkers' Perceptions of Workplace Compliance with Worker Protection Standards and Implications for Risk Perceptions and Protective Behaviors

Introduction: The Environmental Protection Agency (EPA)'s Worker Protection Standards is the primary set of legislation aimed at protecting farmworkers from occupational pesticide exposure in the United States. Previous studies suggest that worker adoption of Pesticide Protective Behaviors (PPBs) promoted by WPS is associated with lower urinary pesticide concentrations. However, adoption of PPBs is often outside of the control of individual farmworkers and dependent on workplace factors such as employer provisioning of Personal Protective Equipment (PPE) and access to trainings/resources.

Methods: We conducted a mixed-method study including urinary pesticide biomonitoring, surveys, and interviews with 62 Latinx farmworkers in southwestern Idaho from April to July 2022. We integrated findings across the various data sources to identify emergent themes relating to farmworkers' perceptions of workplace compliance with WPS and potential implications for their pesticide risk perceptions, protective behaviors, and urinary pesticide concentrations.

Results: Participants reported some indications of poor workplace compliance with WPS regulations, notably inconsistent access to clean handwashing stations and notification of pesticide applications. Some farmworkers, particularly pesticide applicators, viewed herbicides to be categorically safer than other classes of pesticides such as insecticides; these perceptions appeared to influence protective behaviors, such as the relatively low use of PPE while applying herbicides. These findings are underscored by the higher concentrations of biomarkers of herbicides, but not insecticides, among pesticide applicators compared with non-applicators (e.g. median 2,4-D concentrations = 1.40 µg/L among applicators and 0.69 µg/L among non-applicators). Participants further reported concerns regarding the inadequacy of pesticide safety training, pesticide drift, and the lack of communication regarding pesticide applications on and near fields where they are working.

Discussion: Participants' perceptions that herbicides are categorically safer than other pesticide classes is in direct conflict with WPS training, raising concerns about discrepancies between WPS instruction and other on-the-job training, as well as the inadequate provisioning of PPE during the application of certain pesticides. Our findings also suggest that current WPS regulations may not sufficiently address farmworkers' concerns, particularly in regard to pesticide drift.

Evaluación de métodos mixtos de las percepciones de los agricultores sobre el cumplimiento de las normas de protección laboral y sus implicaciones para las percepciones de riesgo y los comportamientos de protección

Las Normas de Protección de los Trabajadores de la "Environmental Protection Agency" (Estados Unidos) es la normativa centrada en proteger a los agricultores de la exposición durante los tratamientos fitosanitarios. Se realizó un estudio en Idaho (abril-julio de 2022) en el que participaron 62 trabajadores basado en biomonitoreo de fitosanitarios en orina y realización de entrevistas y encuestas. Los trabajadores indicaron que no se cumplían estas normas de protección, exponiendo un acceso limitado a zonas para lavado de manos y a notificaciones de aplicación de fitosanitarios. Los agricultores percibían que los herbicidas eran más seguros que otros productos, lo que tenía como consecuencia una baja utilización de equipos de protección personal durante su aplicación. Los agricultores también indicaron la falta de formación. Se concluyó que las Normas de Protección de los Trabajadores no coincidían con lo que se realizaba en los lugares de trabajo, además de que éstas no contemplaban algunas de las preocupaciones de los trabajadores.

AUTORES	Carly Hyland, Lisa Meierotto, Rebecca L. Som Castellano, Cynthia L. Curl
DOI	https://doi.org/10.1080/1059924X.2024.2307483
PUBLICACIÓN	Journal of Agromedicine, 2024, Volumen 29, Número 3, pp. 355-371
TEMÁTICA	Tratamientos Fitosanitarios

ARTÍCULO 10: Retrospective Risk Assessment of Injuries and Fatalities in the Forestry and Logging Workforce in the United States, 2003-2019

Objectives: The objectives of this study on the forestry and logging workforce are to: 1) Analyze causes of injuries/fatalities to inform future intervention studies focused on risk mitigation, 2) determine whether there are any trends or associations between work-related risk factors and workplace injuries/fatalities over a 16-year period (2003–2019), and 3) identify knowledge gaps related to injuries and fatalities for future studies to address.
Methods: Data on fatalities, injuries, and illnesses of the forestry and logging workforce from the United States Bureau of Labor Statistics were analyzed. Correlation analysis ($p<.05$) was conducted to assess the relationship between causes of forestry and logging workforce fatalities by cause of fatality in the United States. Injury and fatality rates were calculated for each year (fatalities: 2003–2018; injuries: 2005–2019) and time span-specific incidence rates were calculated by cause.
Results: Contact with objects and equipment was the primary cause of injuries and fatalities in the forestry and logging workforce during the study period. Transportation-related incidents ranked second as the cause of fatalities, while the category of falls, slips, and trips was the second leading cause of injuries.
Conclusion: Gaps in occupational health and safety identified by this study should be collaboratively addressed by researchers and the forestry industry.

Evaluación retrospectiva del riesgo de lesiones y muertes en la fuerza laboral de la silvicultura y la tala de árboles en los Estados Unidos, 2003-2019

Se plantearon tres objetivos en el ámbito de la silvicultura y la tala de árboles: estudiar las causas de lesiones y muertes, identificar las relaciones entre los factores de riesgo y dichas lesiones entre los años 2003-2019 y detectar la falta de información sobre este tema. Mediante la Oficina de Estadísticas Laborales de los Estados Unidos se obtuvieron datos relacionados con estos aspectos para este sector, realizando estadísticas para obtener resultados. Estos mostraron que la primera causa de lesiones y muertes en el período de tiempo estudiado fue el contacto con equipos y objetos. La segunda causa más común de muerte fue el transporte utilizado. Para lesiones, la segunda causa se relacionó con caídas, tropiezos y resbalones.

AUTORES	Heidi Knecht,J o Anne G Balanay, Ricky Langley, Robin Tutor Marcom, Stephanie L. Richards
DOI	https://doi.org/10.1080/1059924X.2024.2325708
PUBLICACIÓN	Journal of Agromedicine, 2024, Volumen 29, Número 3, pp. 372-383
TEMÁTICA	Accidentes y Enfermedades Laborales

ARTÍCULO 11: Growing Resilience in Tough Times (GRITT): Development and Randomized Trial of a Farmer Mental Health Literacy Intervention

Objectives: Farmers in the United States (U.S.) are exposed to myriad stressors and experience their negative effects, including higher rates of suicide than individuals in some other occupations. However, interventions to address mental health amongst farmers have faced barriers, such as farmers' perceived stigma regarding mental health, time constraints, and geographical isolation. Using text-messaging for intervention delivery may help to address some barriers, as text messages are private, delivered directly to one's phone, and require no travel. Our objective was to develop and assess the feasibility, acceptability, and initial efficacy of a text-messaging mental health literacy intervention tailored to U.S. farmers: Growing Resiliency in Tough Times (GRITT).
Methods: U.S. farmers (N=134) were randomly assigned to an intervention group, who received 12 weeks of text messages regarding mental health literacy, or a control group, who received no treatment. Online pre-test and post-test surveys assessed mental health knowledge, familiarity with relevant mental health resources, self-efficacy to manage stress, and perceived stress. Feasibility was assessed via recruitment and retention data, and intervention group participants completed post-test measures to assess acceptability.
Results: Results indicate that intervention group participants were highly satisfied with the intervention and had higher post-test scores on multiple facets of mental health literacy and self-efficacy to manage farm stress than control group participants. The intervention group experienced a significant drop in perceived stress from pre-test to post-test. Participant retention was relatively high (84%). However, recruitment difficulties call into question intervention feasibility.
Conclusion: Though the intervention was efficacious in enhancing mental health literacy, improving stress management self-efficacy, and reducing stress, difficulties with participant recruitment indicate the need for continued intervention research in this context.

Fortaleciendo la resiliencia en tiempos difíciles: desarrollo y ensayo aleatorio de una intervención de alfabetización en salud mental para agricultores

Este estudio desarrolló y evaluó una intervención sobre salud mental, basada en el envío de mensajes de texto a agricultores en Estados Unidos. Se crearon dos grupos de participantes: el grupo de control y el grupo de intervención. En este último, los trabajadores recibían mensajes de texto al móvil durante 12 semanas sobre alfabetización en salud mental. Además, se realizaron encuestas antes y después del proceso. Los resultados mostraron que los trabajadores del grupo de intervención obtuvieron mejores puntuaciones en la encuesta final sobre salud mental, redujeron su estrés percibido y se mostraron satisfechos con el estudio realizado.

AUTORES	Amanda J. Holmstrom, Gwyn Shelle
DOI	https://doi.org/10.1080/1059924X.2024.2334016
PUBLICACIÓN	Journal of Agromedicine, 2024, Volumen 29, Número 3, pp. 392-403
TEMÁTICA	Riesgo Salud Mental

ARTÍCULO 12: Organophosphate Pesticide Exposure: Effect on Farmers' Sperm Quality in the Mekong Delta, Vietnam

Objectives: Using pesticides in the An Giang province is widespread. However, studies on the health effect of organophosphate pesticide have not been updated within the past 12 years. This study aimed to assess exposure to organophosphate pesticides and their effects on sperm quality among farmers in the An Giang Province, Mekong Delta, Vietnam.

Methods: During the winter – spring crop season of December 2021 to February 2022, a cross-sectional study was conducted on farmers aged 18 to 60 years-old based on seven communes' health checkup programs. The pesticide spray group included farmers who had sprayed pesticides in the previous week and had a history of working in agriculture for more than 2 years. The control group was defined as those who lived in the same community, had not worked in agriculture, and had never sprayed pesticides. Demographic characteristics and blood, urine, and semen samples were collected and analyzed.

Results: Data for 184 eligible participants were analyzed, including 116 farmers in the pesticide spray group and 68 non-farmers in the control group. Pesticide spray contributed to a decrease in the sperm quality index of 6.253 units (95% CI, 4.472–8.749). Increasing each pseudocholinesterase (PChE) unit (kIU/L) was associated with an increase of 1.181 units in the sperm quality index (95% CI, 0.757–0.947).

Conclusions: Preventive methods for organophosphate pesticide exposure, such as administrative controls, engineering controls, substitution, and personal protective equipment should be applied to control health risks. In the An Giang setting, personal protective equipment is feasible, but most types of equipment are not used. The immediate priority is to determine the cause of personal protective equipment not being used and to find solutions to encourage people to use them.

Exposición a tratamientos fitosanitarios organofosforados: efecto sobre la salud reproductiva de los agricultores en el delta del Mekong, Vietnam

Se investigó la exposición de los agricultores a tratamientos fitosanitarios organofosforados y sus consecuencias en la salud reproductiva masculina. Este estudio se llevó a cabo en An Giang, en el delta del río Mekong, en Vietnam, entre diciembre de 2021 y febrero de 2022. Participaron 184 trabajadores de 18 a 60 años. Se dividieron en un grupo de agricultores (expuestos a tratamientos fitosanitarios en la semana anterior y con más de dos años de experiencia en el sector) y un grupo de control (nunca expuesto y sin experiencia). Se demostró que la pulverización de tratamientos fitosanitarios tuvo como consecuencia una reducción de indicadores clave de salud reproductiva. Se concluyó la necesidad de medidas preventivas para la realización de dicha labor.

AUTORES	Hong Lap Nguyen, Quoc Dat Ngo, Van Chinh Nguyen, Kien Duc Ngo, Vinh Nien Lam, Tran Ngoc Dang, Quang Hien Tran, Tri Dung Phung, Kim Trung Nguyen, Truong Vien Nguyen, Bui Thi Hong Loan, Thien Thuan Tran
DOI	https://doi.org/10.1080/1059924X.2024.2337675
PUBLICACIÓN	Journal of Agromedicine, 2024, Volumen 29, Número 3, pp. 404-414
TEMÁTICA	Tratamientos Fitosanitarios

ARTÍCULO 13: Effects of Short-Term Hand Tractor Operation on Upper Limb Responses of Users

Objectives: Continuous exposure to hand-arm vibration integrated with poor posture and forceful movements are known causes of musculoskeletal disorders (MSD). In most related studies, force and vibration levels in experimental research is controlled. This study aims to determine how actual hand tractor field operation can affect the upper limb of users. It intends to characterize upper limb muscle activation applied during actual hand tractor usage. Lastly, it determines the immediate impacts on hand strength and perceived upper limb discomfort after the operation.

Methods: We recruited 15 farm operators with a mean working experience of 20.1±12.2 years. They were asked to operate a hand tractor on paddy fields for at most 8 minutes. Handle vibration was measured using a tri-axial accelerometer. The total unweighted vibration acceleration was computed and used to represent the handle vibration magnitude. Muscle activation was measured using surface electromyography (sEMG). Six sEMG sensors were attached to the dominant and non-dominant side of the extensor carpi radialis (ECR), bicep, and deltoid. Pre- and post-task hand strength and subjective discomfort rating were also taken.

Results: The total unweighted handle vibration acceleration is 17.45±7.53 m/s2. This exceeds the allowable safe value. Meanwhile, the percentage of maximum voluntary contraction (% MVC) of the muscles ranged from 6% to 14% with the ECR having a significantly higher activation ($p<.05$) than the bicep and deltoid. The post-task grip strength of the dominant hand was lower than its pre-task value ($p<.01$) while that of the non-dominant side did not vary significantly. There is a modest trend of higher hand discomfort of the non-dominant side on post-task than pre-task rating ($p<.10$). Although, overall, the perceived discomfort ranged from none to mild discomfort.

Conclusion: In conclusion, the study showed an indication that the effects of vibration on humans are evident even at mild muscle exertion, with the exertion predominantly concentrated on the distal arm area clearly affecting grip strength and hand discomfort. In such cases, future recommendations can revolve around the improvement of the hand tractor handle grip to impose grip comfort and ease.

Efectos del uso a corto plazo de tractores manuales en las extremidades superiores de los usuarios

Se investigaron las consecuencias del uso de un tractor manual para las extremidades superiores de los trabajadores. Participaron 15 agricultores con una experiencia laboral determinada, que debían conducir un tractor de este tipo durante 8 minutos por un campo de arroz. Se empleó un acelerómetro triaxial para medir la vibración del volante, electromiografía de superficie para medir la activación muscular, se registró la fuerza de la mano y la calificación subjetiva del malestar. Se demostró que la vibración del volante superaba el límite seguro y que sus efectos eran evidentes incluso con baja exigencia muscular, afectando a la fuerza de agarre y al malestar en las manos. Se recomendó mejorar el diseño del volante para disminuir estos impactos.

AUTORES	Josefa Angelie D. Revilla, John Kenneth P. Punongbayan, Clarissa M. Pesigan, Stephanie Caridad DR. Landicho
DOI	https://doi.org/10.1080/1059924X.2024.2338844
PUBLICACIÓN	Journal of Agromedicine, 2024, Volumen 29, Número 3, pp. 415-425
TEMÁTICA	Riesgo Físico

ARTÍCULO 14: Formaldehyde Exposure of Aquaculture Workers in Korea

Objectives: Korea's aquaculture sector primarily cultivates aquatic life, with fish seed production as a focus. Formalin, a parasiticide, consists of 37% formaldehyde mixed with yellow No. 4 dye. Formaldehyde vaporization poses cancer risks, classified as a carcinogen. Korea regulates formaldehyde as a hazardous substance, requiring workplace environment measurements. Few aquaculture farms have conducted these checks in recent years. In this study, we investigated actual formaldehyde exposure levels among Korean aquaculture workers, highlighting a critical safety concern.

Methods: A field survey was conducted to measure formaldehyde exposure at 10 aquaculture farms in areas where Korean aquaculture is concentrated. Short-term and long-term personal samples, local samples, and direct-reading measurements were conducted. Formaldehyde exposure levels were detected in short-term personal samples from six farms and in long-term personal samples from two farms, and formaldehyde was detected in all local samples. In direct-reading measurements, a high concentration of formaldehyde was sustained for short periods.

Results: Long-term (8-hour) personal samples were mostly non-detectable, except for farms A and D, which had levels of 0.0009 ppm and 0.0017 ppm, respectively. Short-term (15-minute) samples were non-detectable in four farms, with an average of 0.0158 (±0.0130) ppm in the remaining six farms. Local samples from all farms had an average of 0.0384 (±0.0957) ppm of formaldehyde. For farms A and D, where long-term sampling detected formaldehyde, real-time measurements showed a sustained high concentration in farm A for about 48 minutes before decreasing. Farm D had no detectable formaldehyde throughout the monitoring period.

Conclusion: According to the formaldehyde exposure level assessment, short term exposure to formaldehyde during and immediately after application of formalin nearly exceeded the ACGIH TLV STEL in one farm. However, concentration of long term samples appeared at 10% of ACGIH TLV TWA. Additional study is recommended to determine whether exposure to formaldehyde poses a health risk for aquaculture workers during application of formalin.

Exposición al formaldehído de los trabajadores de la acuicultura en Corea

Se analizó la exposición al formaldehído de trabajadores de acuicultura en Corea. Se realizó una encuesta y se tomaron muestras personales (a corto y largo plazo), locales y se realizaron mediciones directas en diez granjas. Entre otros resultados, en las muestras personales a largo plazo (8 horas), los niveles de formaldehído fueron bajos o no se detectaron, exceptuando en dos granjas. En las muestras a corto plazo (15 minutos) no se detectó formaldehído en cuatro granjas, pero en las otras seis tuvieron un valor promedio. Además, en una de las granjas casi alcanzó el límite permitido.

AUTORES	Woo Je Lee, Ki Youn Kim
DOI	https://doi.org/10.1080/1059924X.2024.2339513
PUBLICACIÓN	Journal of Agromedicine, 2024, Volumen 29, Número 3, pp. 426-431
TEMÁTICA	Exposición

ARTÍCULO 15: Qualitative Analysis Following the Delivery of a Farmer Lifestyle Program

Background: Irish farmers are adversely affected by noncommunicable diseases. Although there has been an increase in farmer health promotion activities in Ireland, farmers views on lifestyle programs are currently unknown.
Objectives: To qualitatively analyze the impact of the previously mentioned 6-week physical activity and health education intervention on farmer health and to investigate how best to support this cohort moving forward.
Methods: A qualitative study was conducted online (two interviews, three focus groups) with fourteen Irish farmers (53.5±6.5years) who completed the 6-week program in December 2019. Interviews and focus groups were recorded, transcribed, and analyzed for themes.
Results: The main themes that emerged from this study were barriers, facilitators, and recommendations for lifestyle programs aimed to improve farmer health. Additional views on health and lifestyle behaviors were mentioned. Time of year was reported as the main barrier for farmers to engage in lifestyle programs. The key facilitators reported by farmers were the social health benefits obtained from the program and the farmer-specific nature of the program. Farmers suggested that physical activity and health education programs that are farmer-specific, delivered locally and catering for all fitness abilities should be more widely available to them. Although some farmers reported that they maintained the lifestyle behaviors they established during the initial 6-week program, follow-up supports are needed to encourage sustainable behavior change.
Conclusions: Interventions that are farmer-specific, community-based, and feasible within the context of available resources may be effective in improving farmer health. Working in partnership with organizations that support farmers has the potential to improve farmer health.

Análisis cualitativo tras la implementación de un programa de estilo de vida para agricultores

El objetivo de este estudio fue analizar el impacto de una intervención basada en educación en salud y actividad física en trabajadores de la agricultura, con una duración de seis semanas. Para ello, se realizaron dos entrevistas y se crearon tres grupos focales. En total, participaron 14 agricultores irlandeses. Se concluyó que este tipo de intervenciones podían mejorar la salud de los trabajadores del sector de la agricultura.

AUTORES	Ruth Kavanagh, Pauline Douglas, Laura Keaver
DOI	https://doi.org/10.1080/1059924X.2024.2343400
PUBLICACIÓN	Journal of Agromedicine, 2024, Volumen 29, Número 3, pp. 451-460
TEMÁTICA	Seguridad y Salud General

ARTÍCULO 16: Work-Related Hazards and Perceived Confined-Space Health Risk: Understanding the Correlation with Mental Workload Among Farmers in Northern Thailand's Shallow Wells

Objectives: This study examined factors related to perceived health risks in confined spaces (PCSHR) and their correlation with the mental workload among farmers managing agricultural wells in northern Thailand.

Methods: A cross-sectional, multi-stage sample of 356 farmers was selected from four rural districts' agricultural areas. Data were collected through interviews conducted from August to December 2022, using a self-administered structured questionnaire. The five-part questionnaire gathered demographic data, information on experiences and operations in agricultural wells, knowledge of confined spaces, PCSHR, and the six-dimension NASA Task Load Index (TLX) mental workload. Linear regression and multi-variable analyses were used to investigate factors associated with PCSHR, while Pearson correlations tested the association between PCSHR and mental workload variables.

Results: Most farmers were male (92.4%), worked in wells to install pumping systems (81.7%) and maintain equipment (73.3%), averaging 3.80 times per year, with an average duration of 25.81minutes. Physical symptoms reported included difficulty breathing (72.8%), feeling swelteringly hot (55.9%), and sweating excessively (27.8%), as well as accidents such as being struck by falling soil or objects (20.2%), and falling into the well while climbing down (14.9%). Farmers' perceived risk scores were high when working while physically exhausted or unprepared and when assisting an unconscious worker without knowing the gas concentration. In addition, the maximal mental workload scores were mental demand and effort subscale. Factors significantly associated with PCSHR (adj.R2=60.6%, $p<.05$) encompassed education higher than lower secondary level, current alcohol consumption, smaller well width, assisted operations, number of physical symptoms experienced, absence of environmental accidents, and confined space knowledge, while increased PCSHR was positively associated with mental workload (Overall $r=0.711$, $p<.01$).

Conclusion: Comprehensive education about potential hazards can improve farmers' risk perception, potentially reducing mental workload and preventing fatal accidents. Field studies are recommended to develop community-specific work protocols and accurate measuring instruments suitable for rural settings are needed.

Riesgos laborales y percepción de riesgo para la salud en espacios confinados: comprensión de la correlación con la carga de trabajo mental entre los agricultores de los pozos poco profundos del norte de Tailandia

Se investigaron los factores asociados con la percepción de riesgos para la salud en espacios confinados y su relación con la carga mental en trabajadores encargados de pozos agrícolas en la zona norte de Tailandia. Participaron 356 agricultores pertenecientes a cuatro zonas diferentes. Se empleó un cuestionario y se aplicó estadística para obtener resultados. Los trabajadores percibieron un elevado nivel de riesgo al trabajar físicamente cansados, sin preparación y sin tener conocimiento previo sobre concentración de gases. Respecto a la carga mental, las puntuaciones más altas correspondían a la demanda mental y al esfuerzo. Además, una mayor percepción del riesgo tenía como consecuencia un aumento de la carga mental de los agricultores. Se concluyó la necesidad de formación acerca de los peligros del trabajo que realizaban para mejorar la percepción del riesgo, disminuir la carga mental y prevenir accidentes graves.

AUTORES	Prakasit Tonchoy, Pannawadee Singkaew, Punyisa Pudpong, Nisarat Auttama
DOI	https://doi.org/10.1080/1059924X.2024.2343405
PUBLICACIÓN	Journal of Agromedicine, 2024, Volumen 29, Número 3, pp. 461-476
TEMÁTICA	Riesgo Salud Mental

ARTÍCULO 17: Farmworker Acceptability of Backpack Hydration Systems

Objective: To improve water access while working and contribute to fewer heat-related illnesses (HRI), backpack hydration systems were provided to over 200 farmworkers to use during the 2022 growing season. Acceptability of the water intake intervention was assessed among farmworkers in eastern North Carolina, USA.
Methods: With a pre-established community–university partnership, the acceptability of the intervention was assessed using a cross-sectional survey. The backpack brand selected included a 3-liter water bladder and attached drinking hose. Data analysis included descriptive and correlation statistics.
Results: Among 47 male, migrant farmworkers, most (90%) reported the hydration backpack to be acceptable or completely acceptable to workplace fluid intake. Most (53%) reported using the backpack some of the time, compared to 28% who used it often. The participants reported an average of 4.8 (SD 2.2) liters of water intake from the backpack on a typical workday. Most reported the backpack improved the quantity and frequency of their water consumption.
Conclusion: This study was an important first step in implementation of hydration backpack systems as an HRI-preventative intervention among farmworkers. Future interventional studies could assess the efficacy of the backpacks on health outcomes, including incidence of dehydration and symptoms of HRI.

Aceptación de los sistemas de hidratación con mochila por parte de los trabajadores agrícolas

Con el fin de disminuir enfermedades provocadas por el trabajo con altas temperaturas, se suministraron equipos de hidratación portátiles a más de 200 agricultores durante la campaña agrícola de 2022 en Carolina del Norte. Se trataba de mochilas formadas por un depósito de agua con 3 litros de capacidad y una manguera para beber. Para analizar la aceptación de esta intervención se utilizó una encuesta y los resultados se obtuvieron mediante estadísticas. Participaron 47 agricultores, de los que el 90% indicaron que la mochila era aceptable para consumir líquidos en el puesto de trabajo. Entre otros resultados, la mayoría de los trabajadores expusieron que el uso de la mochila incrementó la frecuencia y cantidad de agua que consumían.

AUTORES	Elizabeth Mizelle, Lori A. Modly, Daniel J. Smith
DOI	https://doi.org/10.1080/1059924X.2024.2349022
PUBLICACIÓN	Journal of Agromedicine, 2024, Volumen 29, Número 3, pp. 477-485
TEMÁTICA	Temperatura

JOURNAL OF ENVIRONMENTAL SCIENCE AND HEALTH, PART B

ARTÍCULO 18: Herbicide contamination of Batak plain agricultural soils and risk assessment

Herbicide residue levels were analyzed in agricultural soils of Batak plain and health risk assessments were made for relevant pesticides. Herbicide contamination levels were analyzed with the use of Quick-Easy-Cheap-Efficient-Rugged-Safe (QuEChERS)-liquid chromatography/tandem mass spectrometry (LC–MS/MS) procedure. Herbicide-free soil samples were spiked at two different levels. Overall recovery of the method was 87.32%. Present findings were parallel to SANTE recovery limits. About 50% of collected samples from the study sites contained herbicides at different concentrations. Totally, eight herbicides were detected, and herbicide concentrations ranged between 1.085 and 1724.23 µg kg−1. Metolachlor had the highest concentration (1724.23 µg kg−1) in a sample taken close to the pesticide waste disposal area. Six herbicides were detected at different concentrations in the same sample. Persistent herbicides (terbuthylazine and pendimethalin) were detected in 35 samples. Risk assessments revealed that hazard index (HI) and hazard quotient (HQ) were less than 1. The greatest HQ values were identified for terbuthylazine as 2772.48×10−7 and 20793.61×10−7 for adults and children, respectively. The HI for all herbicides were 3916.05×10−7 for adult and 29370.39×10−7 for children.

Contaminación por tratamientos fitosanitarios de los suelos agrícolas de la llanura de Batak y evaluación de riesgos

Se analizaron los residuos de tratamientos fitosanitarios en suelos agrícolas de la llanura de Batak y su riesgo para la salud. Se recogieron y estudiaron muestras del suelo. El 50% de las muestras tomadas contenían diferentes concentraciones de fitosanitarios. A pesar de los niveles encontrados, los riesgos para la salud eran bajos según los índices analizados.

AUTORES	Burak Polat, Osman Tiryaki
DOI	https://doi.org/10.1080/03601234.2024.2322900
PUBLICACIÓN	Journal of Environmental Science and Health, Part B, 2024, Volumen 59, Número 5, pp. 203-208
TEMÁTICA	Tratamientos Fitosanitarios

ARCHIVES OF ENVIRONMENTAL & OCCUPATIONAL HEALTH

ARTÍCULO 19: Impact of chlorpyrifos exposure on lung function in Egyptian adolescent agriculture workers

Chlorpyrifos (CPF) is a widely used organophosphate insecticide that has been linked to detrimental health effects that range from neurological impacts to respiratory disease. The objective of this study was to assess respiratory symptoms associated with CPF exposure throughout the application season. Urine samples were collected from Egyptian adolescent applicators (n = 206) and non-applicators (n = 72) to assess 3,5,6-trichloro-2-pyridinol (TCPy), a biomarker for CPF exposure, along with spirometry measures to determine lung ventilatory function. Samples were collected over 7 months in 2016. Logistic regression was used to model the odds of reporting wheeze symptoms based on urinary TCPy concentrations while controlling for age and smoking in the household. Ordinal multinomial logistic regression was used to model the percent reference for forced expiratory volume in one second (rFEV1) based on urinary TCPy concentration (μg/g creatinine). Wheezing increased with increasing pesticide exposure (OR = 1.74 (1.32 – 2.31)). There was no statistically significant relationship between rFEV1 and TCPy concentration. Efforts to reduce pesticide exposure should be implemented to prevent the potential onset or exacerbation of any linked respiratory complications in adolescents.

Impacto de la exposición al clorpirifós en la función pulmonar de los trabajadores agrícolas adolescentes egipcios

Se investigó si la exposición al clorpirifós durante su aplicación afectaba a la salud respiratoria de adolescentes en Egipto. Se recogieron muestras de orina de 206 jóvenes que aplicaban este producto y 72 que no lo aplicaban, además de medir la función pulmonar mediante espirómetro. Los resultados mostraron que las sibilancias aumentaban con niveles de exposición mayores al clorpirifós. Sin embargo, no se demostró una relación evidente entre esta exposición y el volumen espiratorio forzado.

AUTORES	Ernesto E. Mendez, Jonathan Davis, Matthew R. Bonner, Gaafar M. Abdel Rasoul, Ahmed A. Ismail, Olfat M. Hendy, James R. Olson, Diane S. Rohlman
DOI	https://doi.org/10.1080/19338244.2024.2374582
PUBLICACIÓN	Archives of Environmental & Occupational Health, 2024, Volumen 79, Número 3-4, pp. 121-129
TEMÁTICA	Tratamientos Fitosanitarios

JOURNAL OF AGRICULTURAL SAFETY AND HEALTH

ARTÍCULO 20: Safety risk assessment of an autonomous agricultural machine

The goal of this study was to analyze the safety implications of an autonomous agricultural machine (TerraPreta) using the standards ISO 18497 (ISO, 2018) and ISO 12100:2012 (ISO, 2012), as well as to investigate the ergonomics associated with the use of the autonomous agricultural machine. First, three engineers involved in the robot's manufacturing process were asked to evaluate the robot's functionalities compliance with the applicable safety standards and protective measures outlined in standard ISO 18497 (ISO, 2018). Second, while the robot was planting cover crop seeds, an attempt was made to identify and evaluate every risk connected to the robot using the risk assessment techniques outlined in ISO 12100:2012 (ISO, 2012). (1) Half (50%) of the functionalities of the autonomous agricultural machine complied with the safety requirements and protective measures described within the standard ISO 18497 (ISO, 2018). (2) The heavy reliance on past incident data of the risk assessment procedure described within the standard ISO 12100:2012 (ISO, 2012) makes it ineffective for new and revolutionary technologies such as autonomous agricultural machines where such data are not available. (3) Lifting a bag to fill the robot hopper with seeds was found to be a moderately hazardous activity associated with human-robot interaction. Multiple tentative solutions were provided to avoid this moderately hazardous activity.

Evaluación de riesgos de seguridad en una máquina agrícola autónoma

Se realizó una evaluación de la seguridad y ergonomía de un robot destinado a la agricultura denominado TerraPreta. Inicialmente, tres ingenieros que habían participado en su fabricación analizaron si se cumplían los criterios de seguridad y medidas de protección establecidos en la norma ISO 18497, concluyendo que solamente el 50% de las funcionalidades de la máquina los cumplían. Posteriormente, se intentó realizar una evaluación de riesgos relacionados con el robot cuando éste sembraba semillas mediante la ISO 12100:2012, determinando que dicha norma no era útil para tecnologías nuevas como la de este caso. Por último, se identificó que la tarea de levantar bolsas para llenar el depósito de semillas del robot presentaba riesgo para los trabajadores. Se recomendaron diferentes estrategias para evitar los riesgos durante dicha actividad.

AUTORES	Guy Roger Aby, Salah F. Issa, Girish Chowdhary
DOI	https://doi.org/10.13031/jash.15756
PUBLICACIÓN	Journal of Agricultural Safety and Health, 2024, Volumen 30, Número 1, pp. 1-15
TEMÁTICA	Vehículos y Maquinaria Agrícola

ARTÍCULO 21: Prevalence of e.coli O157:H7, Salmonella, and Cryptosporidium Among Arizona Dairy Workers Using Post-Work Swabbing

The dairy industry in Arizona, like many other agricultural industries in the United States, is dependent on the labor that migrant farm workers provide. Infections caused by zoonotic pathogens are commonly underreported or misdiagnosed, and possibly more so in migratory workers that face cultural, structural, legal, financial, and geographic barriers to health services. The objectives of this project were to: assess the demographics of Arizona dairy workers, determine the exposure potential of Arizona dairy workers to zoonotic organisms, and inform best management practices. A questionnaire including demographics, work tasks, and household characteristics was administered. Swab samples were collected from the shoulders, knees, and foreheads of employees at two dairy operations at the end of the work shift. The swabs were cultured for E.coli O157:H7 and Salmonella. Molecular DNA isolated from Salmonella and Cryptosporidium was quantified using droplet-digital Polymerase Chain Reaction (ddPCR). Twenty dairy workers were recruited, and 60 samples were collected. The majority of workers were male, preferred to speak Spanish, and identified as Latino/Hispanic (68.8%, 93.8%, and 93.8%, respectively). E. coli O157:H7 was detected in 13% of cultured knee and forehead samples. Salmonella spp. gene copies were detected on 60.0% of samples collected from forehead skin samples; 40.0% of shoulder clothing samples; and 15% of knee clothing samples, as measured via ddPCR. The positive cultural and molecular samples indicate the need for improved post-workday sanitation practices at farms. This study provides surveillance of a largely invisible population, including insights that can be used to create site-specific health and safety protocols for the dairy industry, inform risk assessment models, and foster preventive practices in the dairy industry.

Prevalencia de E. coli O157:H7, Salmonella y Cryptosporidium entre trabajadores de lecherías en Arizona mediante hisopados post-trabajo

Se evaluó la exposición de trabajadores de lecherías de Arizona a organismos zoonóticos, se analizaron sus características demográficas y se recomendaron mejoras en sus tareas. Mediante un cuestionario se recogió la información demográfica, sobre las labores que realizaban y aspectos del hogar. Se recogieron 60 muestras de 20 trabajadores mediante hisopos en los hombros, rodillas y frente durante dos tareas que realizaron al final del día de trabajo. Tras un análisis, los resultados mostraron E.coli en el 13% de las muestran tomadas en rodillas y frente. También se identificaron genes de Salmonella spp. en el 60% de las muestras de la frente, 40% de hombros y 15% de rodillas. Se concluye la necesidad de implantar prácticas de higiene tras el trabajo.

AUTORES	Rietta Wagoner, Kaitlyn A. Benally, Daniela Cabrera, Gerardo Lopez, Nicolas I. Lopez-Galvez, Duarte Diaz
DOI	https://doi.org/10.13031/jash.15680
PUBLICACIÓN	Journal of Agricultural Safety and Health, 2024, Volumen 30, Número 1, pp. 17-34
TEMÁTICA	Exposición

ARTÍCULO 22: Identification of Advantages and Limitations of Current Risk Assessment and Hazard Analysis Methods when Applied on Autonomous Agricultural Machineries

In the last ten years, the development of automated agricultural machinery has seen noteworthy advancements. Nevertheless, the successful commercialization of these technologies depends critically on their ability to operate safely. This study evaluated the advantages and limitations of current risk assessment and hazard analysis methods currently used to ensure the safety of autonomous agricultural machines. An online survey containing 18 questions was distributed to 711 participants identified as potential individuals who are currently working or have worked on autonomous agricultural machines to determine the type and frequency of risk assessment and hazard analysis methods applied on autonomous agricultural machines, examine the advantages and limitations of each method, and investigate the perceived effectiveness of each method. Frequency analysis was used to determine the most and least utilized risk assessment and hazard analysis methods. The advantages and limitations of each risk assessment and hazard analysis approach were compared. Descriptive statistics (counts, means, medians, percent) and frequency analysis of the variables were used. The three main types of risk assessment and hazard analysis techniques applied to autonomous agricultural machines. The methods are (a) Informal Group Analysis (e.g., Brainstorming), (b) Hazard Analysis and Risk Assessment (HARA), and (c) Failure Mode and Effects Analysis (FMEA). Replicability is perceived as the main advantage of FMEA and HARA, while cost-effectiveness is the main advantage of Informal Group Analysis. The need to have pre-existing data of the autonomous agricultural machine at hand to be able to perform risk assessment and subjectivity are the main limitations of FMEA, HARA, and Informal Group Analysis dealing with novel and revolutionary autonomous agricultural machines. Industry experts do not believe that the risk assessment and hazard analysis procedures now used are reliable and efficient enough to guarantee the safety of autonomous agricultural tractors. This study reveals important information about the current state of risk assessment and hazard analysis methods in the context of autonomous agricultural machinery. This knowledge can inform future research, policy development, and industry practices to ensure the safety of autonomous agricultural machines.

Identificación de las ventajas y limitaciones de los métodos actuales de evaluación de riesgos y análisis de peligros cuando se aplican a maquinarias agrícolas autónomas

Se estudiaron las ventajas y limitaciones de métodos existentes de evaluación de riesgos al utilizados para comprobar la seguridad de máquinas autónomas para agricultura. Se realizó una encuesta online de 18 preguntas a 711 trabajadores. Se identificaron los tres métodos más comunes, siendo la replicabilidad la ventaja de dos de ellos y la rentabilidad del tercero. La subjetividad y la necesidad de poseer datos previos de la máquina eran algunos inconvenientes. Se concluyó que estos métodos no eran confiables ni eficientes para garantizar la seguridad de estas máquinas.

AUTORES	Guy R. Aby, Salah F. Issa, John F. Reid, Cheryl Beseler, John M. Shutske
DOI	https://doi.org/10.13031/jash.15873
PUBLICACIÓN	Journal of Agricultural Safety and Health, 2024, Volumen 30, Número 2, pp. 35-52
TEMÁTICA	Vehículos y Maquinaria Agrícola

ARTÍCULO 23: AgroGuardian: An All-Terrain Vehicle Crash Detection and Notification System

All-Terrain Vehicle (ATV) incidents are a common cause of injury and death in the agricultural industry in the United States. Many ATV off-road crashes on farms and ranches may result in trauma requiring immediate care, but the injured rider is unable to seek help due to their injuries. Moreover, many of these crashes occur in isolated areas that may be difficult to access and have unreliable cellular phone service, making contact with emergency medical services (EMS) challenging. This study aimed at developing and testing a low-cost ATV crash detection device (AgroGuardian) that immediately alerts EMS and emergency contacts, even when the rider is unable to take action and/or there is no cellular phone service available. AgroGuardian includes an embedded data logging system, a smartphone application, and a remote database. The embedded system includes an Inertial Measurement Unit (IMU) for attitude estimation, a Global Positioning System (GPS) for location estimation, and a Rock7 modem for off-board communication. A smartphone application was developed for the users to input information about their vehicle (e.g., make and model) and emergency contacts. Also, it allows them to interact with their ATV data. An emergency signal along with the ATV's coordinates is transmitted through the Rock7 modem and received in the remote database when a rollover is detected by the system. This emergency signal is then processed and sent to EMS and emergency contacts. Our results indicated that the device: (1) is unlikely to miss an ATV rollover; (2) has a fast EMS notification time (40.7 s); and (3) the ATV localization system presented an average error of 2.34 m.

AgroGuardian: un sistema de detección y notificación de accidentes de vehículos todoterreno

Se desarrolló AgroGuardian, un nuevo dispositivo de detección de accidentes de vehículos todoterreno, capaz de contactar de forma inmediata con los servicios de emergencia. Se compone de una unidad de medición inercial, GPS y un módem Rock7 para comunicación. Se determinó que era muy eficaz para detectar un vuelco del vehículo. Además, el tiempo de alerta a los servicios de emergencia era muy breve, en concreto de 40,7 s. Por último, el sistema de localización tenía un error de 2,34 m.

AUTORES	Farzaneh Khorsandi, Guilherme De Moura Araujo, Fernando Ferreira Lima dos Santos
DOI	https://doi.org/10.13031/jash.15801
PUBLICACIÓN	Journal of Agricultural Safety and Health, 2024, Volumen 30, Número 2, pp. 53-74
TEMÁTICA	Vehículos y Maquinaria Agrícola

ARTÍCULO 24: Geospatial Agricultural Incident Analysis for the State of Indiana

A total of 29 recent agricultural-related injuries and fatalities throughout the state of Indiana were identified and analyzed for their proximity to cellular towers and emergency medical services (EMS). The objective of this research was to identify relationships between selected agricultural incidents and the ability of the victim to successfully contact emergency services. The geographic information system (GIS) software ArcGIS Pro and ArcGIS Online were utilized for trend identification and analysis. Findings from this analysis showed that only one EMS provider was most likely to be found within five miles of a given incident location. This frequency increased to seven EMS providers when the proximity range was increased to ten miles of a given incident location. The analysis also showed that only one cellular tower was most likely to be within a 10-mile radius of a given incident. There were frequently no accessible towers within five miles of a given incident. In addition, identified incidents were overlaid on a digital elevation map (DEM) of Indiana for analysis on the relationship between elevation and the number of accessible cell towers in the area. Studies have confirmed that victims of serious agricultural-related injuries, especially while working alone, face significant barriers in alerting EMS of their need for assistance. Geospatial analysis techniques performed in this study can be utilized by other states to assess access to EMS and for larger-scale, agricultural incident analysis. These tools have the potential to improve detail in agricultural incident reporting.

Análisis geoespacial de incidentes agrícolas para el estado de Indiana

Se estudiaron 29 incidentes de lesiones y muertes en el sector de la agricultura del estado de Indiana y se analizó su cercanía a torres celulares y a servicios de emergencia. El objetivo fue investigar la relación entre los accidentes en agricultura y la dificultad de la persona para contactar con emergencias. Los resultados indicaron que, para distancias de cinco millas, había disponible un único servicio de emergencias y para diez millas, se aumentaba a siete. Solamente había disponible una torre celular dentro de 10 millas, pero en muchas situaciones no existían a cinco millas del accidente.

AUTORES	Aaron James Etienne, , Noah Joel Haslett, William E. Field,
DOI	https://doi.org/10.13031/jash.15919
PUBLICACIÓN	Journal of Agricultural Safety and Health, 2024, Volumen 30, Número 2, pp. 75-88
TEMÁTICA	Accidentes y Enfermedades Laborales

ARTÍCULO 25: An Automated On-The-Go Unloading System Reduces Harvest Operator Stress Relative to Manual Operation
On-the-go unloading improves harvest operational efficiency, but it requires skilled labor because it is challenging and stressful to balance numerous concurrent tasks. Harvest automation reduces workload, stress, and fatigue. The objective of this study was to determine if using a commercially available, automated on-the-go unloading system (Raven Cart AutomationTM, RCA, Raven Industries) would reduce operator stress compared to manual operation. Nine grain cart tractor operators and six combine operators participated in this study. Operators performed their typical harvest operation, except to alternate on-the-go unloading using RCA or operating manually. Skin conductance (electrodermal activity) was measured with an Empatica E4 wristband, and stressful events were quantified. Machine data was collected from the tractor and combine via CAN logs. Over 200 total unload events were analyzed. Grain cart and combine operators using RCA had an 18% ($p = 0.022$) and 12% ($p = 0.18$) reduction in stress rate, respectively, compared to operating the grain cart tractor manually. RCA reduced the tractor cross-track error standard deviation by 2.5 cm on straight passes ($p < 0.0001$). The use of an automated on-the-go unloading system reduces operator stress during harvest and could positively affect the health of operators, especially during the long harvest workdays.

Un sistema automatizado de descarga sobre la marcha reduce el estrés del operador de cosecha en comparación con la operación manual	
Se investigó si emplear un sistema automatizado para descargar sobre la marcha durante la cosecha podría disminuir el estrés de los trabajadores en comparación con la realización de dicha labor de forma manual. Participaron 15 agricultores, que realizaron la tarea utilizando este sistema y realizándolo manualmente. Se midió la actividad electrodérmica con el fin de cuantificar el estrés y se recopilaron datos de las máquinas. Los resultados mostraron una reducción del estrés al usar este sistema automatizado.	
AUTORES	Travis A. Burgers, Kusha Kamarei, Mukund Vora, Matthew Horne
DOI	https://doi.org/10.13031/jash.15992
PUBLICACIÓN	Journal of Agricultural Safety and Health, 2024, Volumen 30, Número 3, pp. 89-106
TEMÁTICA	Vehículos y Maquinaria Agrícola

ARTÍCULO 26: Assessing Relationship Between Goat and Sheep Farmers' Stress and Their Demographics: A Pilot Study

This pilot study aims to investigate goat and sheep farmers' stress amidst the COVID-19 pandemic. The authors developed a questionnaire based on existing literature to measure farmers‘ stress. The online questionnaire was sent to the 3000 goat and sheep farmers registered in the Penn State Extension Listserv. We used the technique described by Dillman et al. (2014) to collect online data. After cleaning the data, the response rate was 6.8% (n = 204). The mean and SD for farmer‘s stress were 3.0±.63 out of 5, occupational stress 3.11±.65, and personal stress 2.80 ± .82, respectively. During the COVID-19 pandemic, work hours during the busy season and farm size exhibited a positive low association with farmers' stress (rs = .245 and rs = .238, respectively). They predicted 10% of the total variation in farmers' stress. We propose that extension professionals and public health practitioners learn lessons from the COVID-19 pandemic in case other public health concerns arise. We suggest that future educational programs addressing stress among farmers prioritize specific strategies to reduce occupational stress and cope with uncertainty during health-related outbreaks or other crises. An interesting avenue for further investigation can involve examining other issues related to farmers' financial planning, time management (especially during the busy season), and their relationships with family members.

Evaluación de la relación entre el estrés de los ganaderos de cabras y ovejas y su demografía: un estudio piloto

Se desarrolló un cuestionario a partir de bibliografía ya disponible, con el objetivo de analizar el estrés de los ganaderos de cabras y ovejas en la pandemia del COVID-19. Participaron 3000 trabajadores, que realizaron dicho cuestionario en modalidad online. Solamente respondieron 204 personas, siendo la tasa de respuesta del 6,8%. Los resultados mostraron niveles moderados de estrés general, relacionado con el trabajo y personal.

AUTORES	Suzanna R. Windon, Carolyn Henzi
DOI	https://doi.org/10.13031/jash.15820
PUBLICACIÓN	Journal of Agricultural Safety and Health, 2024, Volumen 30, Número 3, pp. 107-122
TEMÁTICA	Estrés Laboral

ARTÍCULO 27: Documenting Baseline Efficacy of Grain Rescue Training for Emergency First Responders Through Pre- and Post-Testing, and Follow-Up Survey

Purdue University's Agricultural Safety and Health Program has provided leadership for nearly 40 years in the documentation of fatalities and injuries associated with agricultural confined spaces, especially those relating to grain storage, handling, and transport. Findings have been used to develop evidence-based resources to assist in the prevention and mitigation of these incidents, including the design of in-service training resources for emergency rescue and medical personnel responding to entrapments or engulfment in agricultural confined spaces. To enhance the efficacy and consistency of these training resources, a list of core competencies was developed with companion test questions by a panel of experts to validate the baseline understanding and knowledge gain of training participants. The test questions were pilot tested as pre- and post-tests and incorporated into a curriculum developed under a U.S. Department of Labor Susan Harwood Training Grant. The twenty-question pre- and post-tests were administered to 2,141 registered emergency first responder participants in training conducted primarily in Indiana. Participation was voluntary, providing 671 usable matched pre- and post-tests. On average, test scores improved from 67% to 75%. A question-by-question review highlighted areas of common knowledge as well as at least one topic in which the potential for confusion was increased by the instructional content. In addition, participants were interviewed within 3 years to assess the impact of the training received. Interviewees indicated a high level of satisfaction with the training, and over 25% indicated that their fire/rescue service adopted at least one of the seven key strategies discussed in the training. One key concern observed in training was the lack of understanding related to certain hazards, such as the nature of free-flowing grain, that may put first responders at risk of becoming secondary victims during rescue and extrication efforts. A need was identified for continued improvement of emergency first responder training through the incorporation of recent research findings on confined space rescue, greater attention to the prevention of secondary injuries, and more consistent instructor preparation in order to increase the probability of successful outcomes from incidents involving grain storage, handling, and transport.

Documentar la eficacia de la formación sobre rescate en espacios confinados (para grano) de los trabajadores de emergencias mediante pruebas (previas y posteriores) y una encuesta de seguimiento

Con la información proporcionada por el Programa de Seguridad y Salud Agrícola de la Universidad de Purdue, que ha estudiado durante numerosos años las muertes y lesiones derivadas de trabajos en espacios confinados en agricultura (principalmente asociados con almacenamiento, manejo y trasporte de granos) se han desarrollado recursos preventivos y formaciones para trabajadores de emergencias que responden a las alertas en este tipo de espacios. Se realizó una lista de preguntas para comprobar la comprensión y conocimiento de los participantes de estas formaciones. Estas preguntas fueron entregadas a 2141 trabajadores de emergencias en Indiana, antes y después de la formación. También se realizaron entrevistas. Entre otros resultados, se demostró un nivel elevado de satisfacción con la formación y la adopción de estrategias clave. Sin embargo, se identificó que algunos peligros no se entendían completamente. Se concluyó la necesidad de seguir mejorando la formación de los trabajadores de emergencias, incluyendo hechos actualizados sobre rescate en espacios confinados.

AUTORES	Yuan-Hsin Cheng, William E. Field, Salah F. Issa, Brian F. French, Shawn G. Ehlers, Edward J. Sheldon
DOI	https://doi.org/10.13031/jash.16012
PUBLICACIÓN	Journal of Agricultural Safety and Health, 2024, Volumen 30, Número 3, pp. 123-138
TEMÁTICA	Formación