CROSS-CUTTING FINDINGS

A series of expert interviews, 10 rapid evidence “profiles” of occupational illnesses and diseases and rapid review on AI-enabled surveillance for zoonses was undertaken.

Key emerging and re-emerging illnesses, diseases, and issues included contact dermatitis, occupational asthma, welding fumes exposure, zoonotic diseases, and mental health issues.

Climate change is going to shape a number of occupational illnesses and diseases in complex ways.

Big data and machine learning are creating several new opportunities for surveillance.

Long-term planning, engagement, and support is required.

Sensing and monitoring technology are getting a lot better, but still need further improvement and validation in many cases.

Collaboration across sectors and disciplines is key.

Greater awareness of occupational illnesses and diseases among workers and healthcare providers would help identify problems while they are still modest in size.

PRACTICE INTERVIEWS

Eight interviews were undertaken with experts with backgrounds in medicine, public health/epidemiology, occupational hygiene, economics, and a range of construction trades.

Emerging and re-emerging occupational illnesses and diseases

The following categories of illnesses and diseases were highlighted by participants:

- **Communicable/Infectious diseases**
  - The focus on respiratory illnesses should not be lost while addressing emerging zoonotic infections.
- **Respiratory illnesses and diseases**
  - Silicosis, pneumoconiosis, occupational asthma, and lung cancer were mentioned
- **Illnesses and diseases related to chemical/nanoparticle exposures**
  - Hairdressers and similar high-turnover professions with high levels of chemical exposure were mentioned as a key cohort for surveillance.
- **Dermatological issues**
  - Contact dermatitis was mentioned by several participants.
  - Dermatological conditions may often not be linked to working conditions by GPs.
- **Mental health conditions**
  - Mental health conditions were mentioned by nearly all participants.
  - Changes in work arrangements and norms following the COVID-19 pandemic are likely contributing to this.

Surveillance and monitoring

The surveillance and monitoring approaches highlighted by participants were as follows:

- **Data linkage** and better utilisation of existing data sets.
- Well-supported **cohort studies** and **registries** are valuable.
- Health assessments in key exposure settings/industries.
- **Networks** of knowledgeable health practitioners and workers.
- **Artificial intelligence** techniques.
- **New monitoring devices**, like wearables.

Changes to workplaces and the workforce

A few changes to workplaces and workforce dynamics were mentioned by participants:

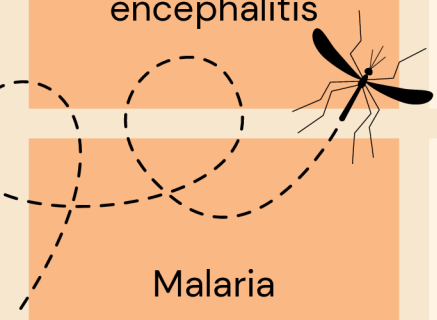
- **Working from home** has reshaped people's risks for musculoskeletal diseases, mental health conditions, cohesiveness of the workforce, and work-home conflict.
- **AI and automation** raise a number of **workplace-specific risks.**
- Older workers may need additional safety and health measures due to cognitive, psychological, or physical factors.

Key risk mitigation strategies

- Product life cycle assessment and understanding.
- Considering how a return to work can be included in holistic health considerations.
- Training workers in occupational hygiene.

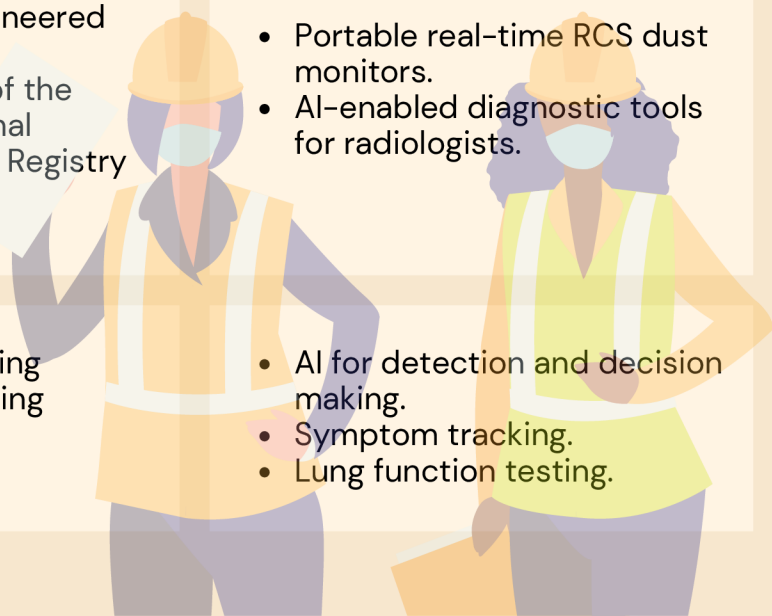
PROFILE FINDINGS 1/2

	Risk Control Strategies	Monitoring Strategies
Chemical exposure and miscarriages in healthcare workers	• Following safety protocols. • Ensuring adequate ventilation. • Using PPE. • Engineering controls like compounding aseptic containment isolators, robotic systems, and closed system drug transfer devices.	• Frequent risk assessments. • Proper training. • Workload management. • Biomarker monitoring.
Mosquito-borne encephalitis	• Using PPE. • Mosquito control programs.	• Geospatial analysis. • Geographic information system (GIS). • Remote sensing. • Machine learning.
Malaria	• Traveller surveillance. • Proactive and passive case detections along the border. • Intensive vector surveillance. • Evidence-based vector control.	• Web-based platforms. • Mobile applications. • Drone technology to monitor mosquito breeding sites via aerial imaging.
Occupational asthma	• Eliminating or reducing exposure to sensitising agents. • Partial segregation of work areas. • Improved ventilation. • Engineering control. • Using PPE.	• Specific inhalation challenge. • Pre-placement assessments. • Screening tools (e.g., Occupational Asthma Screening Questionnaire).
Occupational heat stress	• Hydration. • Recognising heat illness symptoms. • Hybrid cooling vests. • Rotating jobs. • Maintaining work-rest cycles. • Addressing critical thermal risk areas.	• Sensor-based safety helmet. • Wet-bulb globe temperature. • Discomfort index. • Predicted heat strain. • Universal thermal climate index.



PROFILE FINDINGS 2/2

	Risk Control Strategies	Monitoring Strategies
Poor air quality resulting from bushfires and risk controls for the workplace	• Using PPE. • Reducing outdoor work time. • Regular medical assessments to detect early signs of respiratory and cardiovascular issues.	• Satellite-based smoke tracking. • Chemical transport models. • Using web-based platform or applications to monitor PM2.5 levels.
Ross River virus	• Using PPE. • Mosquito control programs.	• Early warning systems based on climate and weather factors. • Forecast modelling system using climatic and environmental variables.
Secondary mental injury as a result of primary physical injuries	• Improving fairness in the injury claim process. • Implementing a flexible work system. • Better communication between claimants, supervisors, colleague, case managers, and health providers.	• Psychological reporting scales.
Silicosis outside of construction, manufacturing and mining	• Ban on the use, supply, and manufacture of engineered stone. • The establishment of the National Occupational Respiratory Disease Registry in Australia.	• Portable real-time RCS dust monitors. • AI-enabled diagnostic tools for radiologists.
Work-related COPD	• Eliminating or reducing exposure to sensitising agents. • Using PPE.	• AI for detection and decision making. • Symptom tracking. • Lung function testing.



RAPID REVIEW - AI & BIG DATA FOR ZOONOTIC DISEASE SURVEILLANCE

A rapid review responding to the question: **How are big data and artificial intelligence being used to better undertake surveillance and monitoring for zoonotic diseases in occupational settings?**

Machine learning (ML) is being used to better predict zoonotic disease dynamics that may be relevant to the workplace

- ML is useful for working with a wide range of types of data and predict risk factors for specific types of workers.
- ML can be used to predict the emergence of poultry diseases (e.g. avian influenza or Newcastle disease).

ML and big data are being used to support better prevention of zoonotic disease spread in settings relevant to many workers

- Risk factors identified with ML techniques can be used to design prevention efforts in occupational settings.
- Analysing large datasets using ML can result in a range of valuable prevention insights like the emergence of zoonotic diseases and key exposure pathways.

ML and big data can be used to personalise insights for individuals

- Processing data related to social characteristics, lifestyle factors, lifetime events, and interaction between determinants can be used to predict susceptibility to mental health problems.
- These data can be used in conjunction with data about exposures to agents or environments to quantify individuals' risks of developing occupational illnesses.

Participatory approaches can enhance the quality of surveillance

- Studies underlined the critical role of human experts and practitioners in collecting, managing, and analysing data and insights resulting from big data and AI.
- A global surveillance program was strengthened by involving a network of experts to validate and analyse outputs from the database as well as provided critical, jurisdiction-specific insights.

Key risks, limitations, and challenges

- Insights are only as good as the data on which they are based, and issues can be magnified when compiling large datasets.
- Linking datasets comes with legal and privacy concerns.
- Making linkages between zoonotic surveillance and occupational settings may require changing how some data are collected and structured to link data effectively.
- Building the infrastructure for using these tools well may require significant up-front investments.