

# Approaches to addressing occupational safety and health hazards in the future of work

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Disclaimer: The findings and conclusions in this report are those of the author and do not necessarily represent the views of the National Institute for Occupational Safety and Health.

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## Acknowledgements

### Co-investigators

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## Why explosion of interest in the future of work?

- Exponential growth of technology
- Technological impact on jobs-concern about job displacement
- Rapidly changing nature of work, workforce, and workplace due to technology, globalization, urbanization, climate, resource limitations, and demographics
- Need to shape future before it is too late

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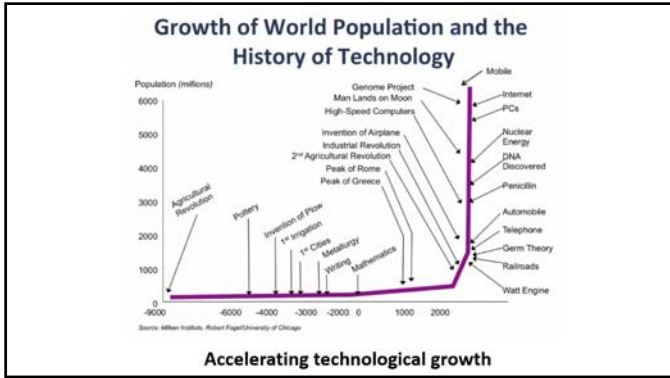
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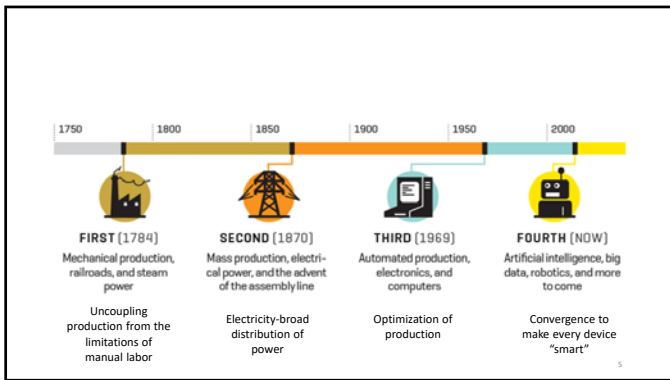
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### Fourth Industrial Revolution

- 4<sup>th</sup> major industrial era since the Industrial Revolution of the 18<sup>th</sup> century
- ...will fundamentally alter the way we live, work, and relate to one another (Schwab 2016)
- Unlike anything humankind has experienced before (Schwab 2016)
  - Potential new worker hazards

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## Why Study the Future of Work?

- Future is not predetermined and future outcomes *can* be influenced by our choices in the present (Hines & Bishop 2015).
- Engaging in strategic foresight can move us from being reactive to being proactive about the—
  - Design of job arrangements made possible by digitalization
  - Types of work that are performed using new technologies
  - Challenges to workforce health, safety and well-being

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“The future cannot be predicted but preferred futures can and should be envisioned, invented, implemented, continuously evaluated, revised, and re-envisioned”

(Dator 1995)

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## The workplace is a mosaic of hazards

- Changes in work, the workforce, and the workplace bring new hazards and risks
- While we still face older deadly hazards and risks
- Climate-related effects could be significant



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## The world of work is changing

- Work
  - Mosaic of old and new hazards
  - Physical  $\rightleftharpoons$  Mental
  - More Service Work
  - Work Intensification
  - Many jobs in a working lifetime
- Workforce
  - Older workers
  - More immigrants
  - More women
  - Less unionization
  - Chronic disease burden
- Workplace
  - More small business
  - More telecommuting
  - Contractors/Temporary
  - New work arrangements
  - Decrease in social protection

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## Changing Nature of Work



(Adam Levey in Thompson<sup>11</sup> 2015)

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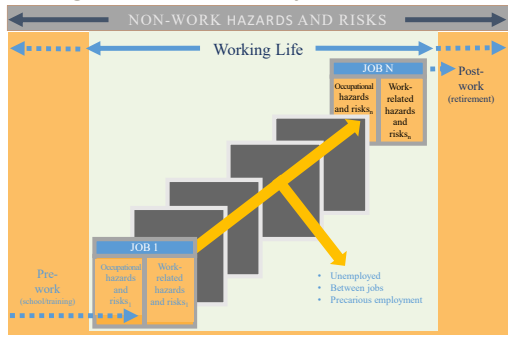
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## The working life continuum and dynamic nature of work



(Schulte et al 2017)

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### Growing concern

<p>Emerging technologies such as:</p> <ul style="list-style-type: none"> <li>• automation</li> <li>• artificial intelligence (AI)</li> <li>• robotics</li> </ul>	<p>Other determinants:</p> <ul style="list-style-type: none"> <li>• Globalization</li> <li>• Migration</li> <li>• Demographics</li> <li>• Climate</li> </ul>
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Displace human jobs  
 Diminish human labor as driver of economic growth; increase emphasis on capital  
 Create new types of hazards

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### Various estimates of job displacement

- 47% of US jobs at risk of automation  
(Frey and Osborne 2013)
- 30-40% of jobs in European Countries  
(Baert & Lendert 2015; Bowles 2014, Roland Berger 2014, Deloitte 2014)
- 9% of OECD jobs are automatable  
(Arntz et al 2017)
- Timeframe for technological change
- Literature divided
  - Those who predict short-term
  - Those who say it will occur gradually  
(Eurofound 2017)

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### Brief history of concern for technology and unemployment

1811 Ned Ludd  
 1930 Keynes  
 1952 Leontif  
 1996 Rifkin  
 2011 Clifton  
 2011 Brynjolfsson and McAfee "Race against the machines"  
 2013 Frey and Osborne "About 47% of total US jobs at risk of being automated"

- Relatively soon
- Perhaps next decade

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Current technological trends may:

- Erode middle-class jobs
- Lead to deepening job polarization (Balliesler and Elsheikh; 2018)
- Displace 400 million jobs globally (MGI 2017)
- Create a mismatch between technology and skills (capabilities)
  - Skill gap controversy
  - Proactive worker training and retraining urgently needed
  - Life long learning

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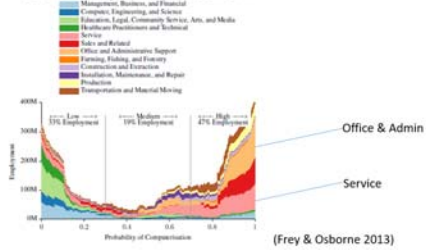
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### Assessment of 702 Occupations for Susceptibility to Computerization



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Technology

Enabling

Disruptive

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Past concerns about “end of work” have proved wrong

- New technology always had the feature that it reduces demand for some types of labor and increases demand for others
- However, there is no guarantee that the current impact of new technology will be as it was in the past (International Panel on Social Progress, 2016)
- Human imagination and ingenuity is a powerful factor

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NIOSH Approach to Future of Work

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From: <https://www.cdc.gov/niosh/topics/future-of-work/default.html>

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## NIOSH Literature Review Study

- Mapping future of work scenarios to identify potential occupational hazards
- Search literature 1999-2019
- Use search terms such as:
  - Future of work, Industry 4.0, 4<sup>th</sup> industrial revolution, advanced manufacturing, new employment arrangements, future of jobs, changing world of work, emerging occupational risks, emerging occupational hazards, innovation and work, technological change and work, and digitalization and work.
- Identify scenarios of future work
- Identify potential hazards in these scenarios
- Recommend interventions for hazards

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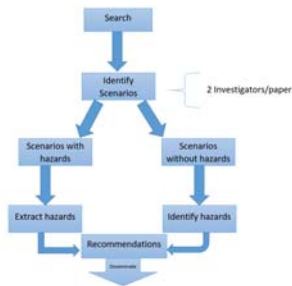
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## Approach for mapping future-of-work surveillance



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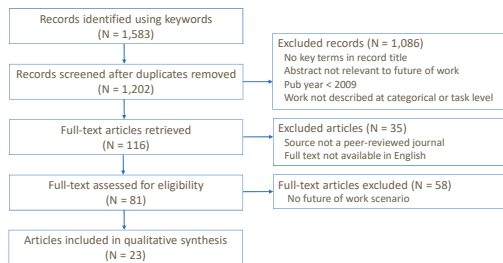
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## Flow chart for inclusion of peer-reviewed *future of work* scenarios



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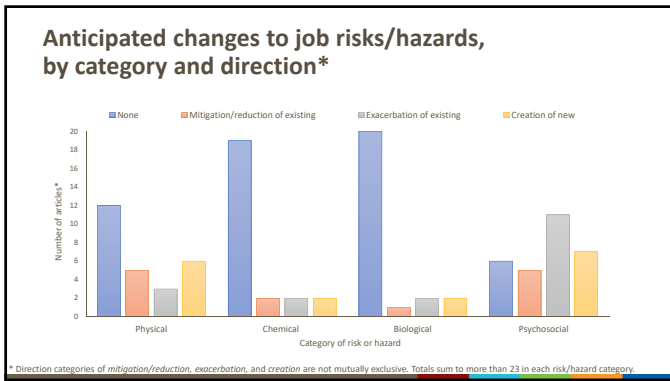
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- ### Next steps
- In-depth content analysis of scenarios
  - Thematic groupings of scenario elements
  - Recommendations for OSH

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International Commission on Occupational Health  
(ICOH)  
Approach to the Future of Work

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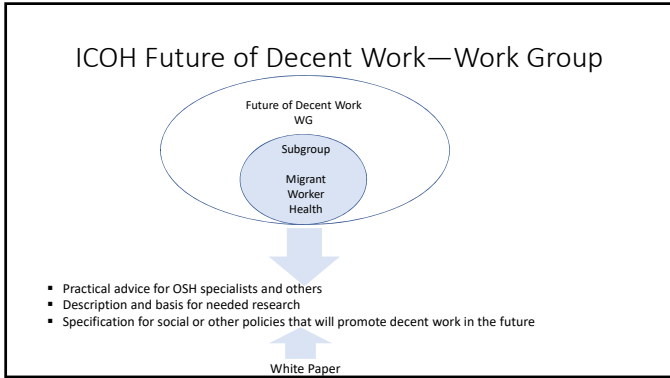
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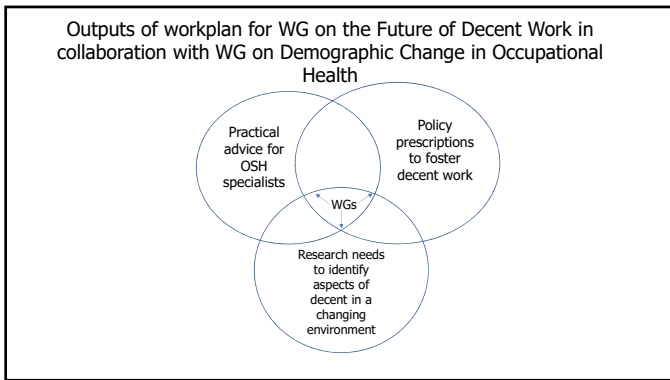
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**A paradigm shift is needed to an expanded focus for occupational safety and health.**

**Broader view of burden vertically and horizontally**

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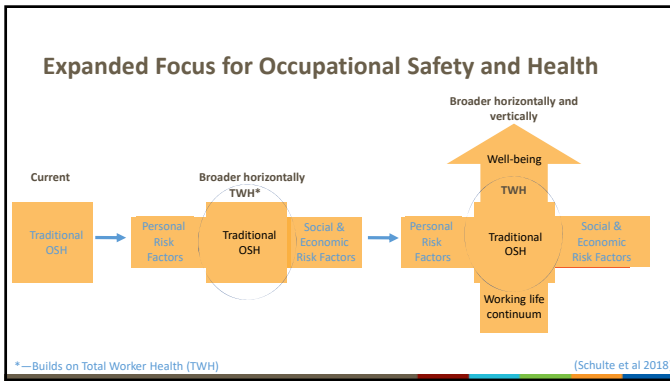
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### Future of jobs and hazards

Types of Jobs	Hazards	
	Old	New
Traditional Jobs	Utilize the body of knowledge from safety, industrial hygiene and occupational medicine  Identify where old hazards are not being addressed adequately  How do we apply what we already know to re-employed/re-deployed workforce?	Develop research agenda and planning  Conduct ongoing assessment of guidance and regulations  How do we (quickly) support research, disseminate results and transfer it into practice?
Future Jobs	Determine the extent to which old hazards will be manifest in future jobs  Determine how to adapt old guidance to new jobs  How do we identify and apply "old" knowledge to these jobs?	Be alert for sentinel events  Consider leading indicators  Identify scenarios  Use forecasting

(Adapted from Schulte 2009)

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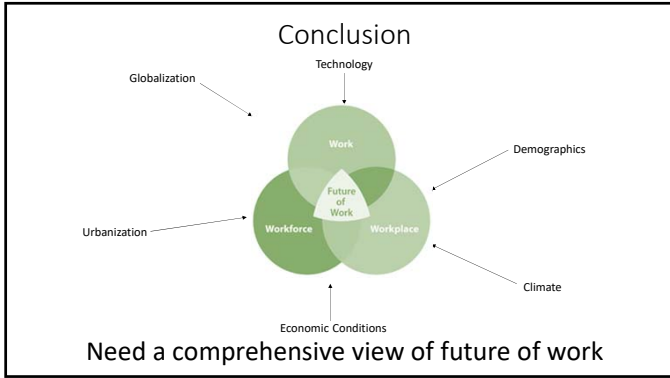
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Thank You  
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