Multiple Chemical Sensitivity: Literature Review and State of the Science

Overview

Multiple Chemical Sensitivity (MCS) is a complex, chronic health condition associated with numerous symptoms, linked to low-level exposure to one or more chemicals. Significant gaps exist in the scientific understanding of MCS. Variability in observed symptoms and subsequent clinical diagnoses limit the certainty of population prevalence estimates.

Alberta Health commissioned a literature review from a consultancy in the fields of toxicology and environmental assessment to understand the current state of science related to MCS.

Report Objectives

- The key objectives of this report were to:
  - Identify the lines of research into MCS and the key theories that are used to define it, and describe the State of the Science.
  - To synthesize research across major relevant fields of research, and attempt to describe the answers to the following research questions:
    - What factors, both human and environmental, contribute to the development of MCS in individuals?
    - What are the markers or symptoms of MCS?
    - What are the health outcomes of MCS?
    - What clinical responses to MCS have been tested and how effective were those responses?1
    - What public health responses to MCS have been tested, and what is the evidence for their effectiveness?
- The Report was not intended to:
  - Represent a comprehensive historical review of the research and reporting on MCS, but focus on the more recent research from 2000-2017;
  - Serve as an investigation or inquiry related to the specific symptoms, health issues or exposures reported by individuals within the Peace River, Alberta area nor is it intended for diagnostic purposes for the specific treatment or management of individuals in the area of Peace River, Alberta;
  - Provide an evaluation of potential causative or triggering exposures of individuals within the Peace River, Alberta area or elsewhere;
  - Serve as a complete meta-analysis of all available data or include an evaluation of statistical relationships between multiple studies.

Context

In 2013, an Alberta Energy Regulator (AER) panel of Hearing Commissioners initiated an inquiry into concerns from area residents about odours and emissions from heavy oil operations in the Peace River, Alberta area. The six-month inquiry process included an eight-day public hearing in January 2014, and resulted in the AER Panel and Commissioners making 20 recommendations, two of which were addressed to the Ministry of Health.

The MCS report focusses on Recommendation 1: Encouragement of studies to better understand the health effect of odours and emissions. The report is intended to provide information on the current state of science surrounding MCS: an objective identified in partnership with local area residents.

Report Summary

The information included in this report was summarized within sub-sections to provide the reader with a sense of the complexity of the topic, the wide range of symptoms, triggers and overlapping conditions, and the variety in diagnostic frameworks that are used in the literature.

The report included a comprehensive, systematic literature search and review of peer-reviewed scientific literature and available grey literature. Over 4,000 documents (peer-reviewed and grey combined) were uncovered in the initial search, and through careful application of pre-defined

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1 This research question was removed from consideration in the report, due to the subjective nature of the results. All clinical information identified in the literature search is available within the annotated bibliography in Appendix A.
inclusion and exclusion criteria, and ratings for quality and relevance, a focused list of over 140 peer-reviewed literature papers and over 20 grey literature documents was compiled. These papers included recently published epidemiological, clinical and experimental studies involving human subjects. The information presented here is reflective of the time frame between 2000-2017, and acknowledges that this is not a fully comprehensive coverage of the vast realm of MCS reporting available.

The state of knowledge regarding MCS continues to evolve over time. In the literature, MCS is represented by several different terms. To date, several diagnostic frameworks and related terms have been published, but there is no clear consensus on nomenclature evident amongst practitioners or researchers, and none of the diagnostic frameworks appear to be universally agreed upon or used by researchers. A wide range of symptoms have been associated with MCS, encompassing sensory, neurological, physical, gastrointestinal and behavioural effects. These effects have been associated with a variety of triggers or stimuli, but there is no clear pattern with respect to chemicals or substances.

Literature identified during the comprehensive search and screening process was sorted and organized topically by lines of research identified previously in comprehensive reviews of MCS by other leading researchers. This was done with the intent of providing a current view of the state of the science on MCS.

The Report and its appendices have been peer-reviewed by relevant experts in the government and other agencies, and external to the government including but not limited to medical professionals, and health and environmental organizations.

Key Findings

- MCS is a complex topic of which the state of knowledge has been evolving over time. Consensus over consistent nomenclature and diagnostic frameworks has not been established, contributing further to the challenges surrounding diagnosis, and further management from both public health and occupational health perspectives.
- A wide range of symptoms have been associated with MCS, encompassing sensory, neurological, physical, gastrointestinal and behavioural effects. These effects have been associated with a variety of triggers or stimuli, but there is no clear pattern with respect to chemicals or substances.
- Two areas were found to overlap with some of the most commonly reported symptoms in the literature in patients with diagnosed MCS. It is possible that the biological processes involved in MCS may involve (1) olfactory processing, and (2) neurogenic sensitization and neurogenic inflammation, as these involve the nervous system and the reaction of the brain to stimuli (irritant and olfactory) and irritation effects on mucosal membranes of the eye and respiratory tract.
- This review has revealed that there is a fundamental need for the diagnostic criteria for MCS to be reviewed, updated and harmonized to help ensure appropriate and consistent diagnosis of the condition. This need was evident throughout the entire review and impacts everything from the development of a concise clinical profile, the consistent diagnosis of patients within and between centres, the design of research studies, to effective clinical management and health care provision.
- Further, there is a need for well-designed studies that examine what factors may pre-dispose individuals to MCS. This may include research considering more than one potential endpoint, and for longitudinal studies – tracking individuals over time– to understand the potential interaction between those potential factors that may pre-dispose individuals to MCS.

Disclaimer

- While this report stemmed out of the Peace River inquiry, the Report is not intended to serve as an investigation or inquiry related to the specific symptoms, health issues or exposures reported by individuals within the Peace River, Alberta area.
- This report is not intended for clinical use.
- The report is not intended to provide an evaluation of potential causative or triggering exposures of individuals within the Peace River area or elsewhere.

Additional Resources

- Multiple Chemical Sensitivity: Literature Review and State of the Science (2021)
- Odours and Human Health (2017)
- Odours and Human Health (2017)

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