Newborn Screening Program for Mucopolysaccharidosis

Team

Ria Gambhir

HBSc Pharmacology and Biomedical Toxicology Specialist

John Li

HBSc Pharmacology and Biomedical Toxicology Specialist

Charmaine Chang

HBSc Pharmacology and Biomedical Toxicology Specialist

Ali Ezzeddine

HBSc Pharmacology Specialist

Community Partner

Canadian MPS Society
for Mucopolysaccharide & Related Diseases

Kim Angel

Executive Director
kimangel@mpssociety.ca

Jocelyn Chee

Programs Assistant
jocelyn@mpssociety.ca

Mucopolysaccharidosis (MPS)

- Inherited, lysosomal storage disorder affecting 1 in 25,000 births[1]
- Missing one of 11 lysosomal enzymes that typically break down glycosaminoglycans (GAGs); leads to accumulation of GAGs within blood, brain, spinal cord, and connective tissue[1]
- Symptoms include short stature, hydrocephalus, hearing loss, coarse facial features, hepatosplenomegaly
- Short life expectancy; early diagnoses is critical to improve overall health outcomes[1]

Newborn Screening Programs (NBS)

- Newborn blood samples are analyzed to detect serious congenital diseases[2]
- Newborn screening program for MPS I has been implemented in Ontario since July 2020[2]

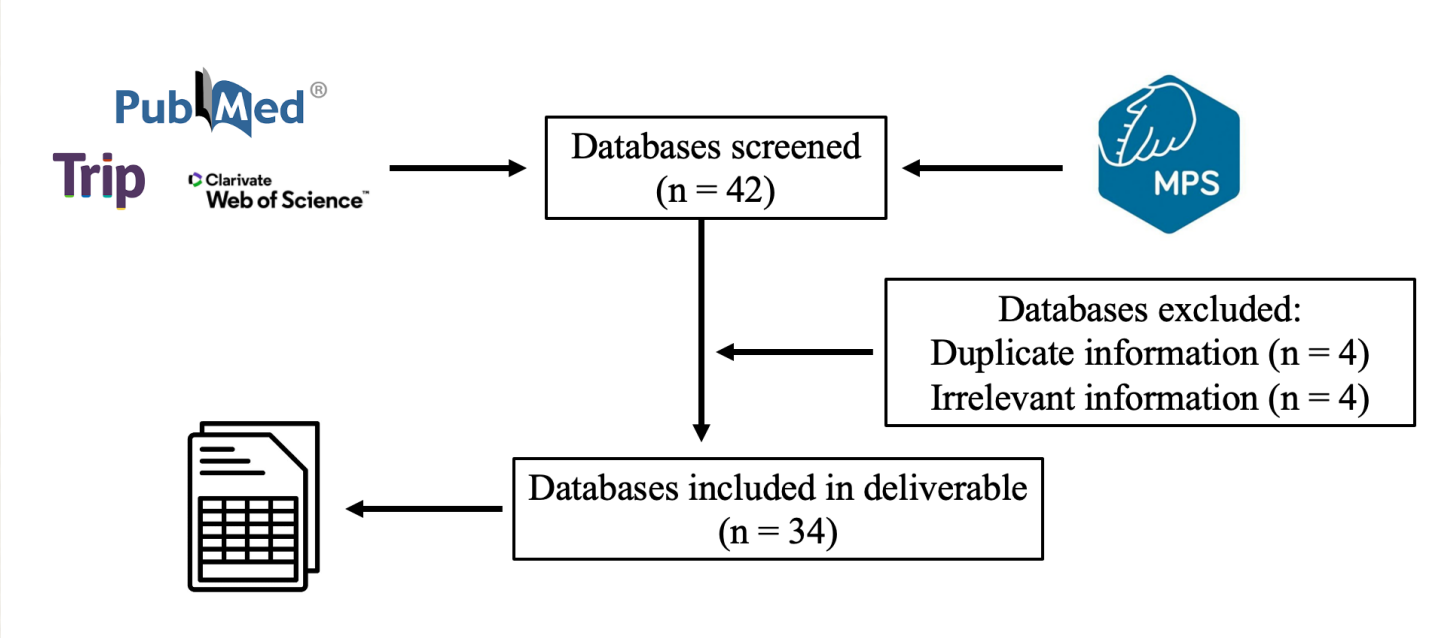
Challenge

Provide critical insights into the barriers to newborn screening (NBS) for MPS I and II in Canada by comparing practices and technologies with other countries.

Project Development Process

- Search Concept
- Boolean

Project Development Process



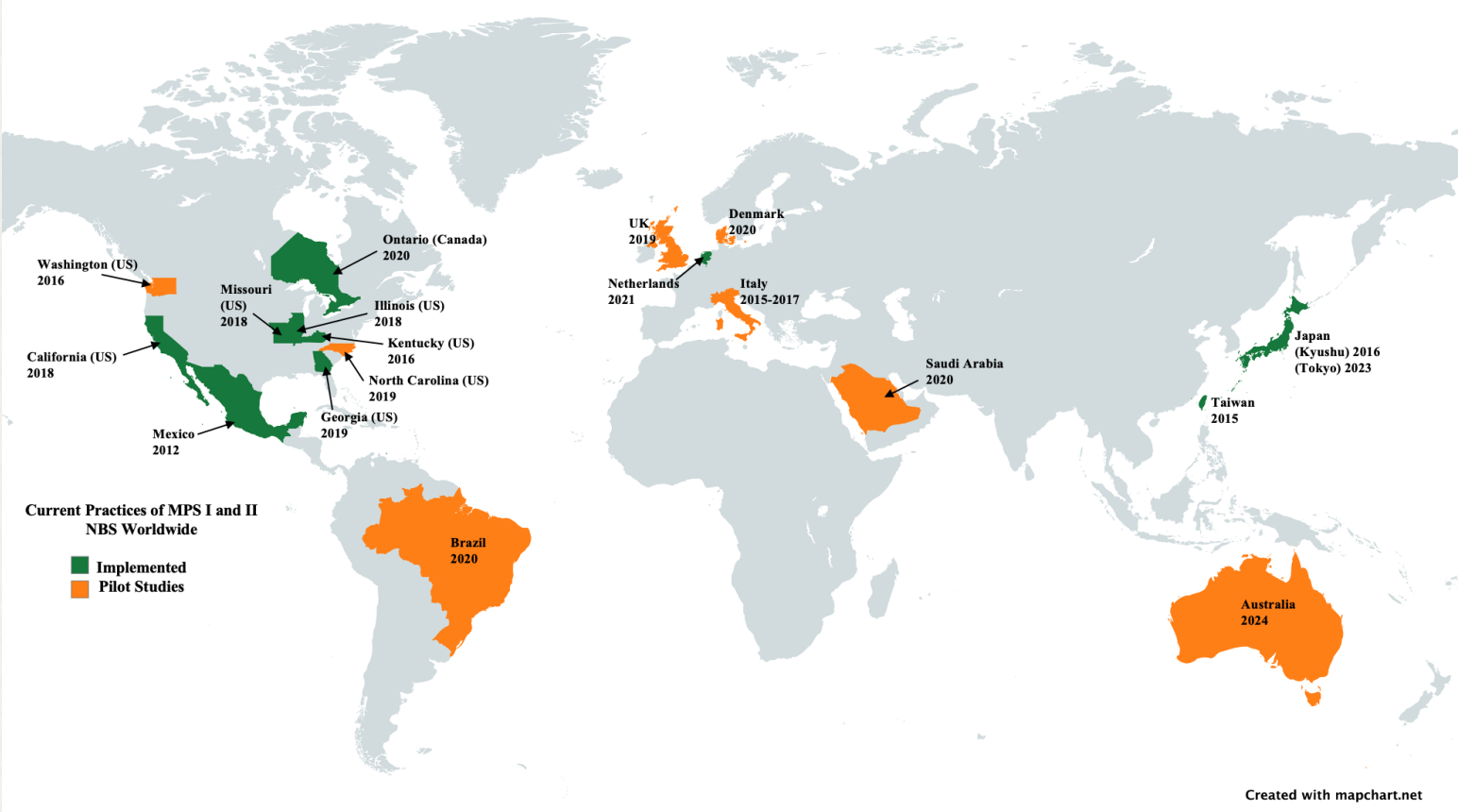
Deliverable

Country	Current Status Toward NBS Program	Type of MPS	Type of Test	Year Implemented/Pilot study conducted	Source	Summary	Relevance score (1-10, 10 most relevant) based on the status of NBS for MPS in each country or state
UK	Pilot Study	MPS I	blood spot/mass spec	2019	https://view-health-screening-recommendations.service.gov.uk/mps-i/	This report states that the last review on adding MPS I to the newborn screening panel occurred in April of 2020, at which point it was determined there was not sufficient evidence supporting a) the feasibility of implementing current techniques nationwide and b) the beneficial impact of early vs. late MPS diagnosis. Thus, newborn screening for MPS is not currently recommended in the UK	4
UK	Pilot Study	MPS I & II	sequencing and analysing newborns' genomes	October 2023 until April 2025	https://www.genomicsengland.co.uk/initiatives/newborns?utm_source=brevo&utm_campaign=Genomics%20England%20NBS%20list%20publication%20comms%20210923&utm_medium=email	The UK is conducting the "Generation Study" under the Newborn Genomes Programme, an NHS research initiative to sequence and analyze the genomes of 100,000 newborns, aiming to assess the benefits, challenges, and practicalities of genomic sequencing in newborns. Currently the study is testing for 200 + rare genetic conditions which includes, MPS I, MPS II.	7
US (Missouri)	Pilot study	MPS I	fluorometric enzymatic assay	2013	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7712507/	This pilot study reports on Missouri's newborn screening for MPS I in 2013, screening over 308,000 newborns using digital microfluidic technology. With a low false-positive rate of 0.040% and an incidence of 1 in 154,000, the findings highlight the efficacy of advanced screening technologies in early diagnosis and treatment of MPS I.	7
US (Missouri, Illinois)	Implemented	MPS II	blood spot/mass spec	2018	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9905270/	The study emphasizes that after the addition of MPS II in the RUSP on August 2022, two states, illinois and Missouri, implemented MPS II newborn screening. The study also emphasized that early treatment has clinical benefit for somatic non-CNS complications.	6
US	Discussed on the RUSP	MPS I		2016	https://ncbi.nlm.nih.gov/pmc/articles/PMC7712368/	This study highlights that MPS I was added to the RUSP mainly because early initiation of specific therapies significantly improves patient outcomes and due to the historically significant delays in diagnosing MPS I from symptom onset. Additionally, it emphasizes the need of a second-tier biomarker, to reduce false	8

Why Is It Important?

- Comparative overview of how **different countries have approached MPS in Newborn screening.**
- Highlights **what worked well and what challenges were faced.**
- Helps **identify successful strategies** that can be adapted for Canada.

Map


Washington (US)
2016
Ontario (Canada)
2020
Missouri
(US)
2018
Illinois (US)
2018
Kentucky (US)
2016
California (US)
2018
North Carolina (US)
2019
Georgia (US)
2019
Mexico
2012
Brazil
2020
UK
2019
Denmark
2020
Netherlands
2021
Italy
2015-2017
Saudi Arabia
2020
Japan
(Kyushu) 2016
(Tokyo) 2023
Taiwan
2015
Australia
2024
Current Practices of MPS I and II
NBS Worldwide
Implemented
Pilot Studies
Created with mapchart.net

Alignment

SUPPORT AND ADVOCACY

Improving diagnosis and health outcomes

POLITICAL CHANGE

Comprehensive information for Key Opinion Leaders in Canada

Challenges and Future Directions

COST OF REDUCING FALSE POSITIVES

Using second-tier tests[3]

CONFIRMING DIAGNOSIS

Managing delays[4]

PROVINCIAL JURISDICTION

Implementing federal legislation[5]

ECONOMIC BURDEN

Future study to support this work

References

1. Mucopolysaccharidoses | National Institute of Neurological Disorders and Stroke. Accessed November 25, 2024. https://www.ninds.nih.gov/health-information/disorders/mucopolysaccharidoses

2. Hurler Disease ("Mucopolysaccharidosis type 1H" or "MPS1H"). Newborn Screening Ontario. Accessed November 25, 2024. https://www.newbornscreening.on.ca/en/results/screen-positive-results/disease-information/hurler-disease-mucopolysaccharidosis-type-1h-or-mps1h/

3. Clarke LA, Dickson P, Ellinwood NM, Klein TL. Newborn Screening for Mucopolysaccharidosis I: Moving Forward Learning from Experience. Int J Neonatal Screen. 2020;6(4):91. Published 2020 Nov 19. doi:10.3390/ijns6040091

4. Wood TC, Harvey K, Beck M, et al. Diagnosing mucopolysaccharidosis IVA. J Inherit Metab Dis. 2013;36(2):293-307. doi:10.1007/s10545-013-9587-1

5. Newborn screening. mpssociety. January 13, 2023. Accessed November 25, 2024. https://www.mpssociety.ca/newborn-screening/.

Thank You!