Exploring vaccine hesitancy towards COVID-19 vaccine among Métis Nation of Ontario citizens using latent class analysis

Dr. Ashok Chaurasia[1], Eliane Kim[2], Keith King[3], Shelley Gonneville[4], Dr. Sarah Edwards[5], Ornell Douglas[1], Dr. Jeff Kwong[5,2], Graham Mecredy[2], Dr. Jennifer Walker[6,2], Dr. Martin Cooke[1].

[1]University of Waterloo, [2]Institute for Clinical and Evaluative
[3]University of Alberta, [4]Métis Nation of Ontario, Sciences,
[5]University of Toronto, [6]McMaster University

INTRODUCTION

Understanding the barriers and attitudes to adoption of vaccination is important, particularly to support effective interventions. Despite Indigenous (First Nations, Métis and Inuit) Peoples being a priority population for COVID-19 vaccination in Canada, there has been a lack of research that can inform Métis-specific solutions, relative to other Indigenous Peoples.

The Métis Nation of Ontario (MNO) represents more than 30,000 Métis people in Ontario, Cnada's largest province. Using Latent Class Analysis (LCA), we developed vaccine hesitancy profiles and examined how these were related to observed vaccination. This approach can help understand how individual characteristics are related to vaccination among MNO citizens.

5C VACCINE HESITANCY MODEL

This model measures vaccine hesitancy via five aspects that have been shown to influence an individual's attitude and decision on vaccination[1].

The statement questions used to measure these 5Cs (in Likert scale: Strongly Agree, Agree, Neither Agree or Disagree, Disagree, Strongly Disagree) in MNO Citizens in the COVID-19 Survey are as follows:

Confidence: "I am completely confident that the COVID-19 vaccine(s) that will be available in Canada will be safe."

Complacency: "The COVID-19 disease is severe".

Constraints: "Everyday stress (such as competing priorities or many demands on my time) will prevent me from getting the COVID-19 vaccine".

Calculation: "When I think about getting the COVID-19 vaccine, I will weigh benefits and risks to make the best decision possible".

Collective responsibility: "COVID vaccination is a collective action to prevent the spread of disease".

DATA

A representative survey of MNO citizens 16 and older was conducted in February/March 2021 and linked to the COVID-19 vaccine database (COVAX; n=4,012), which includes all vaccines administered in Ontario.

REFERENCES

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[2] Adam J, Lippert AM. Under the Radar: Simplifying the Representation of Latent Class Characteristics. Socius. 2019 Aug:5:2378023119873498.

[3] Ashok Chaurasia. Visualizing Fitted Latent Classes with recommendations for practice to simplifying their understanding and knowledge translation. *(Currently under consideration for publication).*

METHODS

Latent Class Analysis (LCA)

Since LCA provides a framework for using *all* variable in 5Cs in multivariate fashion, it allows assessment of vaccine hesitancy profiles determined via distribution across all 5C variables.

Advantages of this approach

- Vaccination hesitancy is modelled as a result of multiple factors *jointly* (which is more akin to human decision-making behaviour); and
- Better helps researchers and policy-makers to address vaccine hesitancy using multiprong approach.

Logistic Regression with COVID-19 Vaccine Hesitancy Classes

In these models the observed COVID-19 vaccination status (*full or partial* vs. *not*) was regressed on COVID-19 Vaccine Hesitancy Classes. These model were stratified by sex and age-groups.

Advantages of this approach

- Allows assessment of vaccination rates association with types of vaccine hesitancy profiles; and
- Provides a better understanding of factors associated with vaccination rate and insights on multifaceted ways to improve vaccination rates.

RESULTS: Latent Classes for ages "<50 years"[2,3]

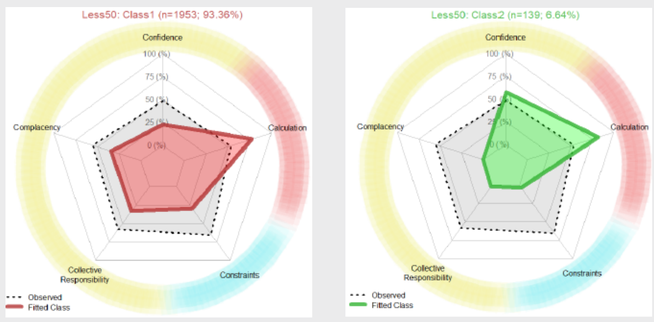

Table 1: Logistic Regression results for Two-Class LCA model for < 50 years

Effect	Beta	SE	Odds Ratio	Confidence Interval	p-value
LCA 2 class (Class 1 vs Class 2)	1.9687	0.2036	7.161	4.8052 - 10.672	<.0001
Chronic conditions (yes vs no)	0.0191	0.2605	1.0193	0.6117 - 1.6985	0.9414
Covid testing status (tested vs not tested)	1.1017	0.1834	3.0091	2.1007 - 4.3104	<.0001
Sex (Male vs Female)	-0.2519	0.1618	0.7773	0.5660 - 1.0674	0.1195
Education (secondary/high school or less vs college/university/ certificate/higher)	-0.2365	0.1792	0.7894	0.5556 - 1.1216	0.1869

In this age group
- Odds of Vaccination in Class1 are 7.161 times the Odds of Vaccination in Class2
- Likelihood of vaccination in Class1 is greater than Likelihood of vaccination in Class2 Subjects from LC1 are more likely to get vaccinated compared to subjects from LC2

RESULTS: Latent Classes for ages "≥50 years" [2,3]

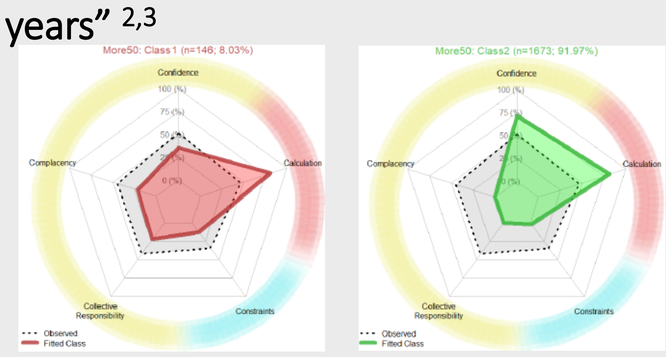

Table 2: Logistic Regression results for Two-Class LCA model for ≥ 50 years

Effect	Beta	SE	Odds Ratio	Confidence Interval	p-value
LCA 2 class (Class 1 vs Class 2)	-1.586	0.2591	0.2047	0.1232 - 0.3401	<.0001
Chronic conditions (yes vs no)	0.199	0.2333	1.2202	0.7725 - 1.9275	0.3935
Covid testing status (tested vs not tested)	0.5255	0.2503	1.6914	1.0355 - 2.7625	0.0358
Sex (Male vs Female)	0.4151	0.2237	1.5145	0.9769 - 2.3479	0.0635
Education (secondary/high school or less vs college/ university/certificate/higher)	0.2742	0.2289	1.3155	0.8400 - 2.0603	0.2309

In this age group
- Odds of Vaccination in Class1 are 0.2047 times the Odds of Vaccination in Class2
- Likelihood of vaccination in Class1 is lower than Likelihood in Class2
- Subjects from LC1 are less likely to get vaccinated compared to subjects from LC2

FINDINGS FROM AGE-STRATIFIED ANALYSIS

The two fitted classes/profiles (with respect to observed average profile) are:

- Class 1 – Higher calculation and Lower confidence, complacency, collective responsibility, constraints;
- Class 2 – Higher calculation and confidence, and Lower complacency, collective responsibility, and constraints.

Among those younger than 50 years, those in Class 1 were significantly more likely to have been vaccinated, after controlling for sex, chronic conditions, COVID testing and education (OR = 7.16). For MNO citizens 50 years and older, those in Class 1 were significantly less likely to be vaccinated (OR = 0.20).

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RESULTS: Latent Classes for Females [2,3]

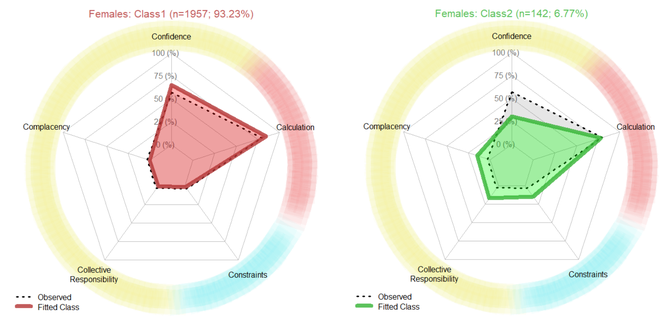

Table 3: Logistic Regression results for Two-Class LCA model for Females

Effect	Beta	SE	Odds Ratio	Confidence Interval	p-value
LCA 2 class (Class 1 vs Class 2)	1.563	0.2311	4.7731	3.0347 - 7.5073	<.0001
Chronic conditions (yes vs no)	-0.1638	0.2344	0.8489	0.5362 - 1.3439	0.4845
Covid testing status (tested vs not tested)	0.9143	0.2003	2.495	1.6850 - 3.6944	<.0001
Age group (16-29 vs 30-49)	0.1946	0.2601	1.2148	0.7296 - 2.0227	0.4544
Age group (50-64 vs 30-49)	0.2689	0.2195	1.3086	0.8511 - 2.0120	0.2205
Age group (65+ vs 30-49)	0.9306	0.3579	2.5361	1.2575 - 5.1145	0.0093
Education (secondary/high school or less vs college/university/ certificate/higher)	0.0975	0.2151	1.1024	0.7232 - 1.6804	0.6503

Odds of Vaccination in Class1 are 4.77 times the Odds of Vaccination in Class2
Likelihood of vaccination in Class1 is greater than Likelihood of vaccination in Class2

RESULTS: Latent Classes for Males [2,3]

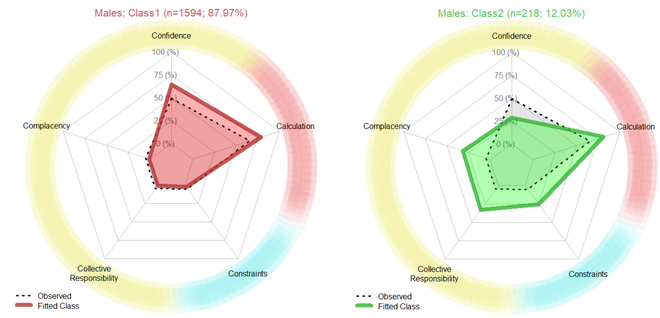

Table 4: Logistic Regression results for Two-Class LCA model for Males

Effect	Beta	SE	Odds Ratio	Confidence Interval	p-value
LCA 2 class (Class 1 vs Class 2)	1.545	0.1987	4.6882	3.1760 - 6.9205	<.0001
Chronic conditions (yes vs no)	0.3314	0.2622	1.3929	0.8331 - 2.3289	0.2063
Covid testing status (tested vs not tested)	0.9382	0.2213	2.5554	1.6560 - 3.9433	<.0001
Age group (16-29 vs 30-49)	0.6057	0.2624	1.8326	1.0958 - 3.0648	0.021
Age group (50-64 vs 30-49)	1.0593	0.2421	2.8845	1.7946 - 4.6362	<.0001
Age group (65+ vs 30-49)	1.4116	0.3512	4.1027	2.0613 - 8.1656	<.0001
Education (secondary/high school or less vs college/ university/certificate/higher)	-0.2699	0.1915	0.7634	0.5245 - 1.1112	0.1587

Odds of Vaccination in Class1 are 4.69 times the Odds of Vaccination in Class 2
Likelihood of vaccination in Class1 is greater than Likelihood of vaccination in Class

FINDINGS FROM SEX-STRATIFIED ANALYSIS

The fitted two classes/profiles (with respect to observed average profile) are:

- Class1 – Higher confidence and calculation
- Class2 – Lower confidence and Higher calculation, complacency, collective responsibility, constraints.

Among both men and women, those belonging to Class1 were significantly more likely to be vaccinated than those in Class2, after controlling for age, chronic conditions, COVID testing and education (Females: OR = 4.77, Males: OR= 4.69.)

CONCLUSIONS

This study demonstrates that the "5C" psychological antecedents of vaccination are useful in predicting vaccination among MNO citizens. Moreover, the dimensions of the model are not independent. Using LCA, we can identify how combinations of these antecedents are predictive of vaccination. Stratifying the models by age and by sex shows that the definition of the relevant clusters of antecedents differs by demographic group.

The clusters suggested by the models depend on how the analyses are stratified, whether by age or sex. Stratified by sex, "high confidence, high calculators" describes those most likely to be vaccinated, compared to "low confidence, high complacency" citizens. Stratified by age, "low confidence, high calculators" are most likely to be vaccinated among those 50 and older, but the pattern changes for those under 50. The size of our dataset does not permit us to test which is definitively better. Further research is necessary to more conclusively identify the most useful cluster definitions.

ACKNOWLEDGEMENTS

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