Pandemic Risk in Canadian Vulnerable Populations

Seyed M. Moghadas

Centre for Disease Modelling
York University
Toronto, Canada

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Demographics: Area and Population

Area: 649,950 km$^2$
Land: 548,360 km$^2$
Population: 1,208,268

Area: 551,500 km$^2$
Land: 545,630.00 km$^2$
Population: 65,350,000
Pandemic Experience in Canada

- Highest hospitalization rates in both pandemic waves in children <5 years of age
- Highest ICU admission rates in children <2 years of age
- Underlying medical conditions:
  - 56.1% among hospitalized cases
  - 70.8% among ICU admitted cases
- Pregnant women and Aboriginal peoples at greater risk of severe disease than the general population
- Cumulative crude rates (per 100,000):

<table>
<thead>
<tr>
<th></th>
<th>Hospitalization</th>
<th>ICU admission</th>
<th>Death</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aboriginals</td>
<td>69.3</td>
<td>12.7</td>
<td>3.3</td>
</tr>
<tr>
<td>Non-Aboriginals</td>
<td>24.5</td>
<td>4.1</td>
<td>1.2</td>
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</tbody>
</table>
Pandemic Experience in Manitoba

Incidence rates of pandemic in two waves by age and gender in Manitoba
Pandemic Experience in Manitoba

Hospitalization rates of Pandemic in two waves by age and gender in Manitoba
ICU admission rates of Pandemic in two waves by age and gender in Manitoba
Pandemic Experience in Manitoba

Distribution of hospitalization for pandemic H1N1 cases by comorbidities and other risk factors.
Pandemic Experience in Manitoba

Distribution of ICU admission for pandemic H1N1 cases by comorbidities and other risk factors
Pandemic Experience in Manitoba

Cases of H1N1 infection in two waves by health region in Manitoba
Objectives

• Comparative analyses of age distribution of infection and hospitalization
  – First Nation vs non-First Nation populations
  – First wave vs second wave
  – On-reserve vs off-reserve First Nation populations

• Impact of remoteness on hospitalization and ICU admission
Relative Risks

$$\text{RIR}_i = \left( \frac{\text{no. of confirmed cases in age group } i}{\text{total no. of confirmed cases in all age groups}} \right) \left( \frac{\text{population of age group } i}{\text{sum of the total populations in all age groups}} \right)$$

$$\text{RHR}_i = \left( \frac{\text{no. of hospitalized cases in age group } i}{\text{total no. of hospitalized cases in all age groups}} \right) \left( \frac{\text{population of age group } i}{\text{sum of the total populations in all age groups}} \right)$$
Relative Risk of Infection

FN populations

Non-FN populations

First wave

Second wave
Relative Risk of Hospitalization

FN populations

Non-FN populations

First wave

Second wave
Aggregated Risk of Infection for First Nation Populations

On-reserve

Off-reserve

First wave

Second wave
Aggregated Risk of Hospitalization for First Nation Populations

On-reserve

Off-reserve

Relative Hospitalization Ratio

Age group

First wave

Second wave
Summary of Findings

• Higher risk of infection and hospitalization for FN populations throughout pandemic
• First wave: Pre-school age at significantly higher risk of infection and hospitalization in FN compared to non-FN
• Second wave: risk of school-age infection increased in non-FN
• Risk of pre-school infection in on-reserve FN was significantly higher that in off-reserve FN
• No significant differences in risk of hospitalization between on-reserve and off-reserve FN
• Risk of ICU admission for off-reserve FN was significantly higher than for on-reserve FN
Classification of Urban and Rural Areas

Metropolitan Influence Zones (MIZ): 7-point score based on population density and proximity to nearest urban centre
Risk of Hospitalization and ICU

• Logistic regression to predict:
  – Odds of hospitalization given infection
  – Odds of ICU admission given hospitalization

• Model covariates:
  – MIZ, age, infection wave

• MIZ as a continuous measure of rurality:
  \[ \text{odds hospitalization} = e^{\beta_0 + \beta_1 \text{(age)} + \beta_2 \text{(MIZ)} + \beta_3 \text{(wave)}} \]

• MIZ with scoring:
  \[ \text{odds hospitalization} = e^{\beta_0 + \beta_1 \text{(age)} + \beta_{[1,2,...,7]} \text{([MIZ])} + \beta_3 \text{(wave)}} \]

• Ongoing Work ...
Public Health Implications

• Do demographics and proximity of communities to urban centres matter in disease outcomes?
• How do disease-associated risks change in vulnerable populations?
• Does “one size fits all” work? How specific should intervention measures be with respect to the population and health system capacity?
• How can we address risks, benefits, and trade-offs of competing interventions strategies?

Optimal resource allocation and utilization!
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• Data Sources
  – Manitoba Health; Statistics Canada (Census); Aboriginal Canada Portal

• Reference