

Ministry of Health / Long-Term Care

# LTC Analysis

February, 2021

Capacity Planning and Analytics Division

# COVID-19 in LTC Homes

- The ministry continually analyzes data to understand patterns and trends in COVID-19 transmission in LTC Homes.
- Probing the relationship between home and community characteristics can provide valuable insights that drive policies and surveillance systems.
- This analysis provides clues for why outbreaks occur, why they spread, and the resulting mortality.
- It is not straightforward to identify these relationships, as they are complicated, nuanced and interdependent.
- We utilize statistical models to try and identify associations between home (ownership status, size, staffing) and community (size, community spread) characteristics and outbreak, spread, and mortality.
- These models cannot identify cause and effect and are not definitive.
- Additional intensive data collection combined with detailed knowledge of LTC home operations and structure would be required to gain a deeper understanding of the key factors.
- These models do not provide information on any given home. It is important to look at the distribution of performance across categories.
- For example, important factors such as differences in resident characteristics such as age, functional status and health conditions, staffing, infection control, and local practice patterns are not accounted for in these statistical models.
- The models need to be updated continually and will change as new data arrives. These should be interpreted as a “point in time analysis”.
- The variants of concern started to appear in Ontario near the end of the study period and haven’t been accounted for specifically in these models.

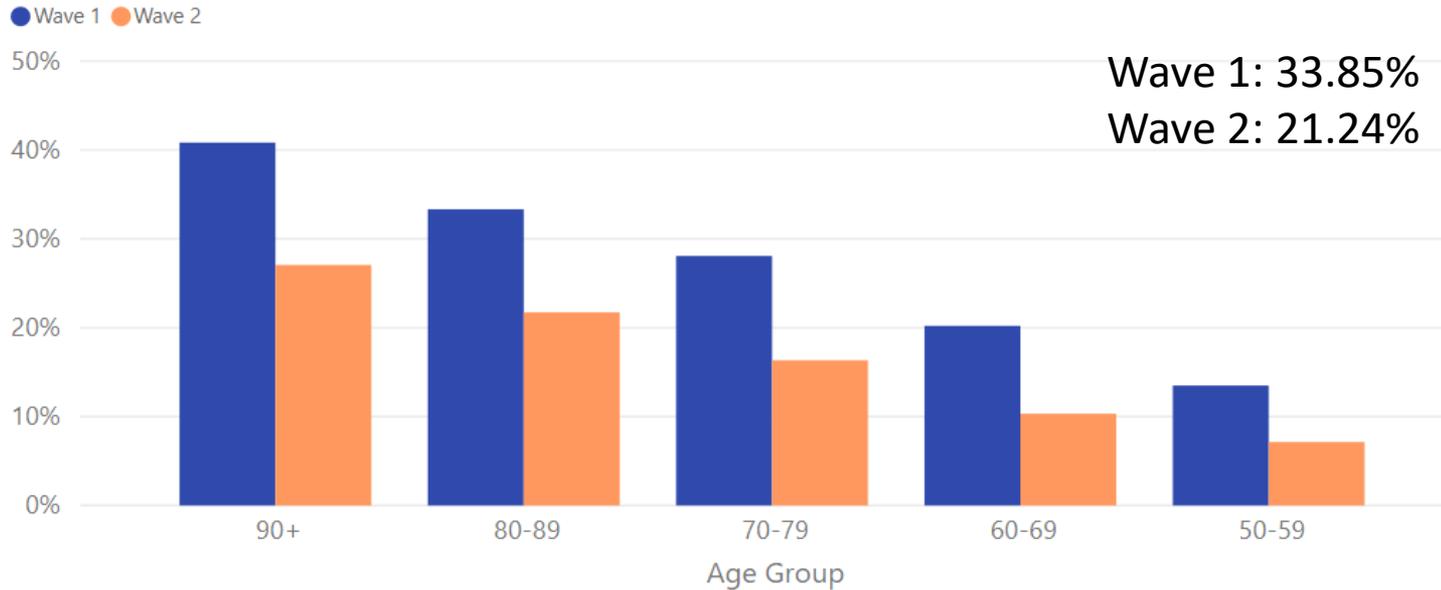
# Characteristics of LTCHs

Measure	Profit status of LTC home			p value
	No. (%)* of for-profit LTC homes n = 360	No. (%)* of nonprofit LTC homes n = 162	No. (%)* of municipal LTC homes n = 101	
No. of residents, mean	100.8	114.6	147.8	<.0001
Older design standard (before 1972)	196 (54.4)	45 (27.8)	12 (11.9)	<.0001
Accommodation type				
% single occupancy, mean	31.6	48.0	52.8	<.0001
% double occupancy, mean	38.4	37.8	39.7	0.8711
% quadruple occupancy, mean	28.4	12.0	6.6	<.0001
LTC home chain size				
≥ 20 homes	145 (40.28)	0 (0)	0 (0)	<.0001
10-19 homes	104 (28.9)	0 (0)	10 (9.9)	
2-9 homes	56 (15.56)	50 (31.06)	55 (54.46)	
1 home: not a chain	55 (15.28)	111 (68.94)	36 (35.64)	
Percent residents infected in wave 1				
No residents infected	238 (66.11)	104 (64.20)	72 (71.29)	0.229
≤50% residents infected	58 (16.11)	27 (16.67)	20(19.80)	
>50% residents infected	64 (17.78)	31 (19.14)	9 (8.91)	
Staff (full-time equivalent):bed ratio, mean	1.49	1.06	1.05	0.1063
Population size of the community in which the LTC home is situated				
≥ 500 000	145 (40.3)	82 (50.6)	28 (27.7)	0.0002
10 000 - 499 999	143 (39.7)	37 (23.0)	45 (44.6)	
< 10 000: rural	72 (20.0)	43 (26.5)	28 (27.2)	
Cumulative incidence of COVID-19 in the public health unit region surrounding the LTC home	13.25	13.45	11.32	0.0958

# Case Fatality Rate in LTC residents

The case fatality ratio in LTC residents in wave 2 is lower than that of wave 1 for all age groups

## Case Fatality Ratio



Age Group	Cases (wave 1)	Cases (wave 2)	Deaths (wave 1)	Deaths (wave 2)	CFR (wave 1)	CFR (wave 2)
90+	1857	2864	758	775	40.82%	27.06%
80-89	2257	3364	752	731	33.32%	21.73%
70-79	1026	1758	288	287	28.07%	16.33%
60-69	569	678	115	70	20.21%	10.32%
50-59	163	224	22	16	13.50%	7.14%

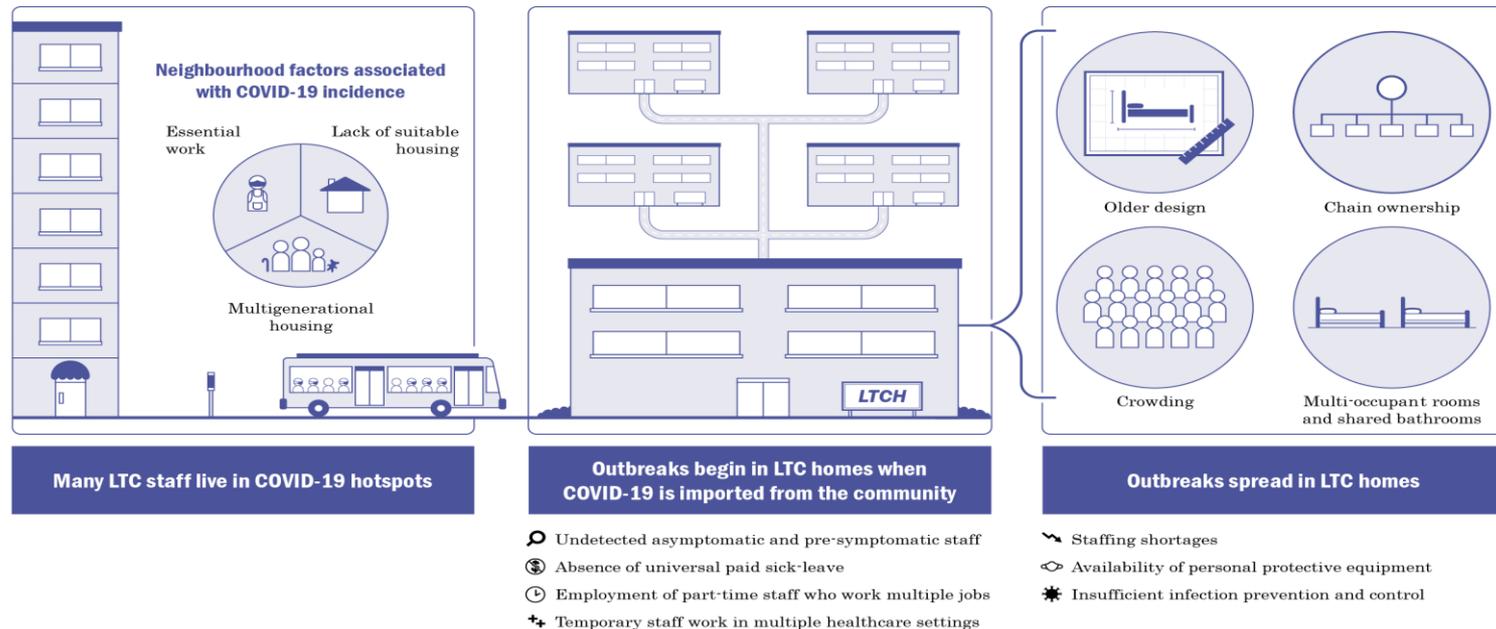
### Time frame:

First 155 days of waves 1 & 2  
IPHIS data as of 18/02/2021  
Based on Case Reported Date

# What we know from Wave 1: Ontario Science Table

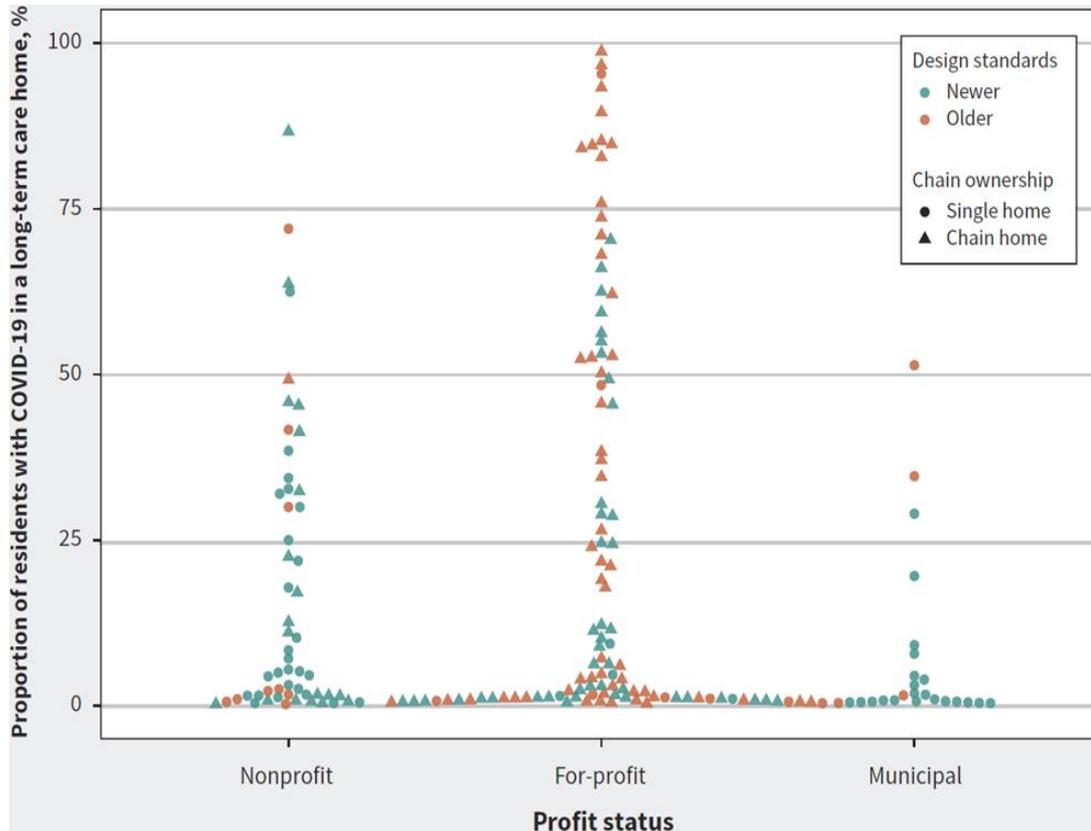
“Evidence from Ontario demonstrates that the risk factors for SARS-CoV-2 outbreaks and subsequent deaths in LTC are distinct from the risk factors for outbreaks and deaths in the community (Figure 1). The most important risk factors for whether a LTC home will experience an outbreak is the daily incidence of SARS-CoV-2 infections in the communities surrounding the home and the occurrence of staff infections. **The most important risk factors for the magnitude of an outbreak and the number of resulting resident deaths are older design, chain ownership, and crowding.**”

## Anatomy of COVID-19 outbreaks and spread in Ontario LTC homes



Nathan M. Stall, Kevin A. Brown, Antonina Maltsev, *et al.* on behalf of the Ontario COVID-19 Science Advisory Table: <https://covid19-sciencetable.ca/sciencebrief/covid-19-and-ontarios-long-term-care-homes-2/>

# What we know from Wave 1: LTC Home Analysis



Stall *et al* analyzed examined potential factors associated with COVID-19 outbreaks, spread, and mortality.

Their analysis from Wave 1 found that COVID-19 spread, and deaths had an association with older homes that were part of a chain.

There were a smaller number of older homes that had very high rates of resident infection.

# Key Findings

## What did we find

- The rates of COVID-19 in the community (local public health unit), and the number of residents in a home is associated with the occurrence of outbreaks, spread of COVID-19 and death.
- A home that experienced an outbreak in wave 1 had better COVID-19 outcomes in wave 2.
- In wave 1, older homes and membership in a chain was associated with increased extent of an outbreak and number of resident deaths (but not with the risk of an outbreak).
- Chain ownership was not a risk factor in wave 2.
- Ownership status and older design standards were associated with increased extent of an outbreak and number of resident deaths (but not with the risk of an outbreak).
- We examined not-for-profit homes operated by for-profit corporations and did not find any evidence of association with outbreak, spread, or mortality.
- Ownership status was not associated with any outcome when all of the data from the beginning of the pandemic is used. This indicates that the effect changes over time and depends highly on the selected time period. The experiences of specific homes in Wave 2 may be driving the overall effect.
- We also looked at specific chains and found no difference between them.
- This statistical analysis does not conclude that all homes in the for-profit category are equally likely to be associated with increased spread and mortality.
- Further study is needed to understand cause and effect and the mediating factors leading to the associations detected in this analysis. These studies would require extensive observation and data collection.

# Our approach – Modelling methodology

Associations for three different outcomes were studied:

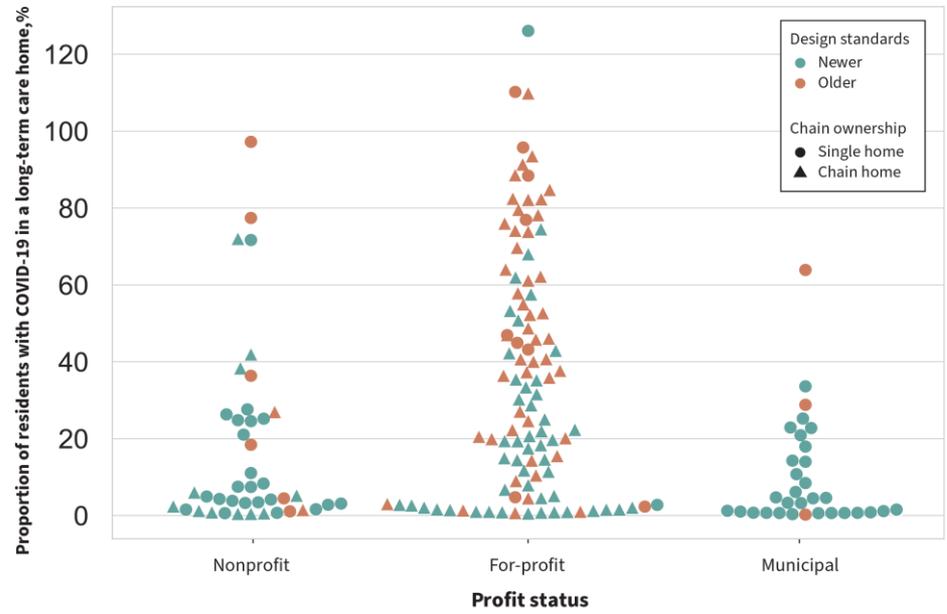
1. Risk of an outbreak, which was modelled using a logistic regression model
2. Extent of outbreak (i.e., number of cases), which was modelled using a quasi-Poisson regression model
3. Number of COVID-19 Deaths, which was modelled using a quasi-Poisson regression model.

The modelling methodologies were the same as used by authors for the original paper [Stall et al., 2020](#).

## Methods Details

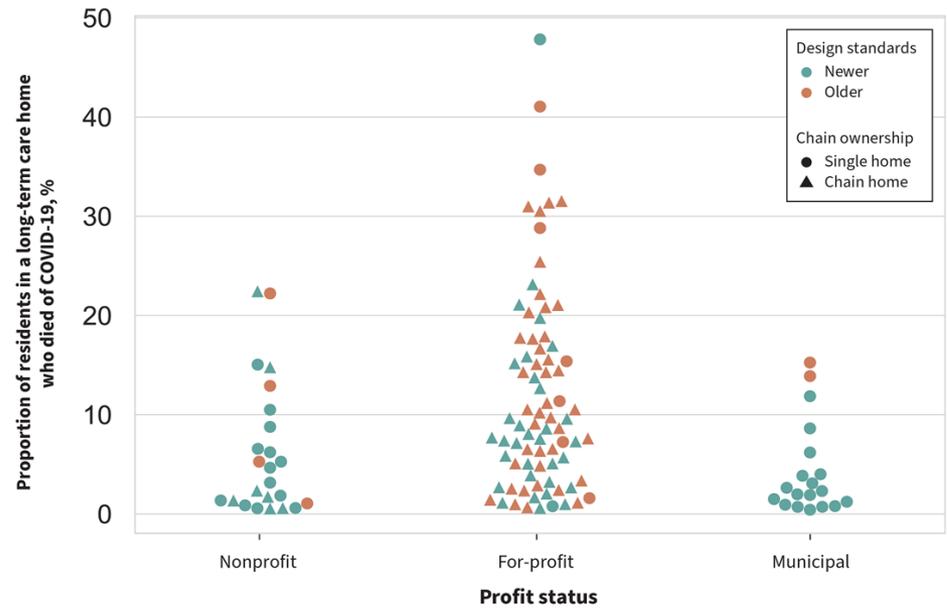
- Date from September 1, 2020 to January 22, 2021 from the MLTC Tracker Database was used.
- The fully adjusted model included profit status, cases per PHU population, community size (population), number of residents, older design standards, chain ownership, FTE staff-to-bed ratio
- The fully adjusted model for wave 2 also includes % residents infected in wave 1, which provides a good marker for a potential ‘herd immunity effect’ or healthy survivors.
- Other factors that may have changed from wave 1 to wave 2, such as resident health, IPAC practices, staff preparation, were not accounted for in the model.
- Each of the models included a random intercept term for Public Health Unit (PHU).
- For each model, the estimates and confidence intervals are presented in a graphical format.

# Looking at the distribution of LTC homes



**% of Residents with COVID-19**

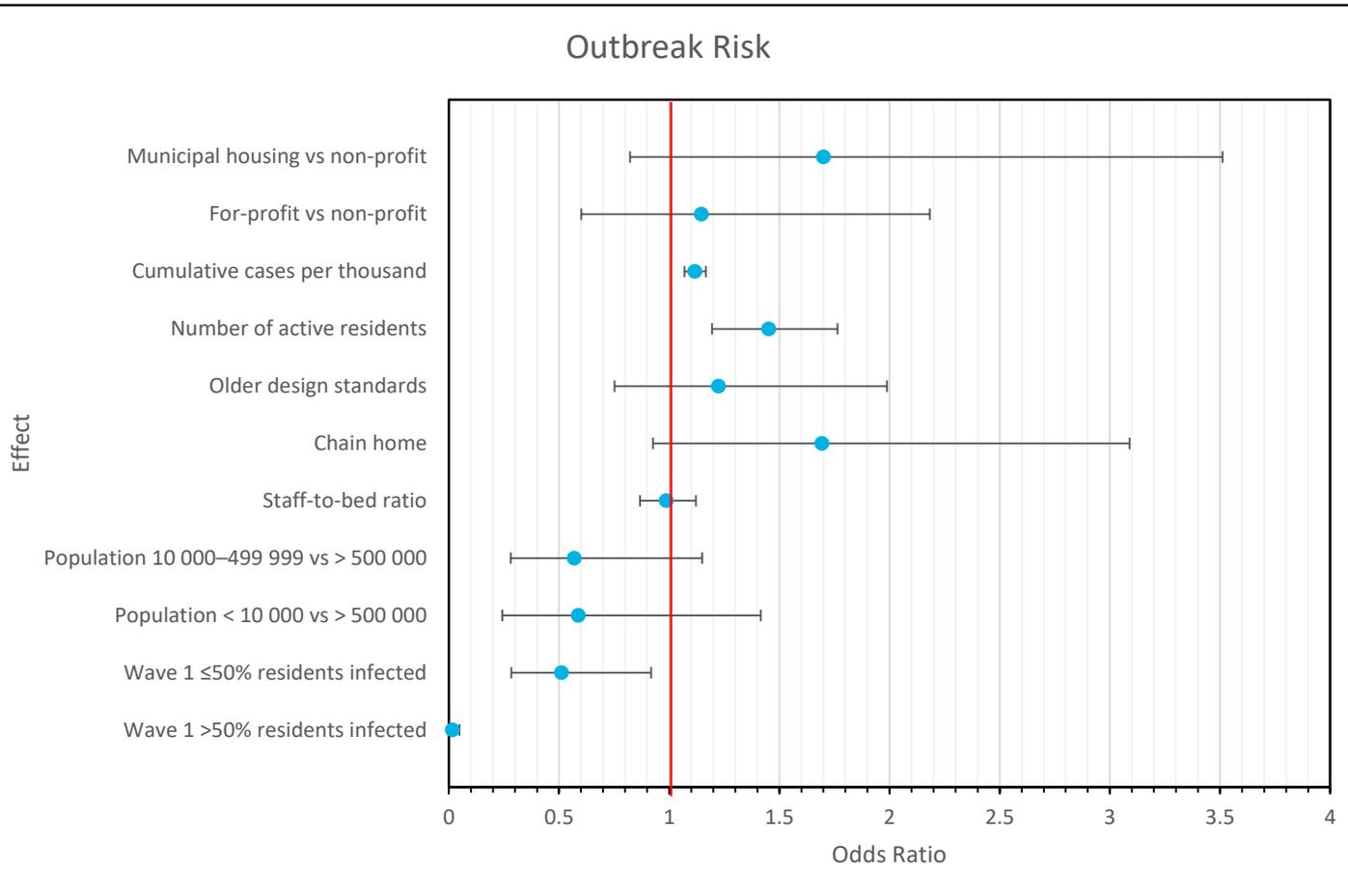
- It is mostly older, for-profit homes that are associated with the high number of residents with COVID.
- Some homes have more than 100% residents with COVID-19 because it is cumulative from the beginning of Wave 1



**COVID-19 Mortality**

- Like the point above, the older homes in all ownership types are associated with higher number of LTC resident death.

# LTC Home Outbreak risk model: Wave 2 (Sept 1 – Jan 22)



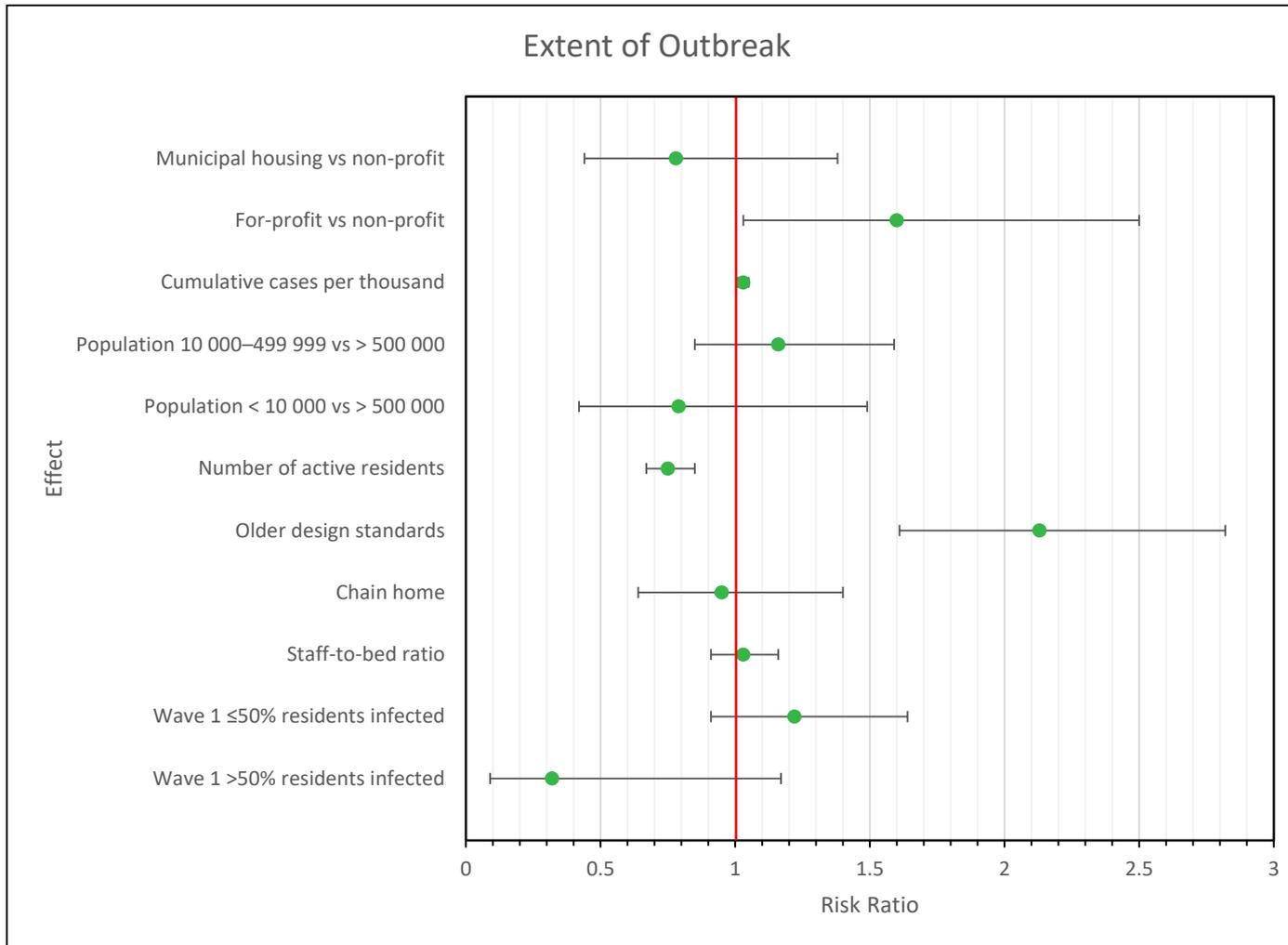
- Estimate of risk or benefit.
- The factor is associated with risk when above 1
- The factor is associated with benefit when below 1
- |—| 95% Confidence Interval
- When this interval crosses 1, the factor is not significant

- Size of the home and neighborhood community spread of COVID are factors associated strongly with higher odds of outbreak in an LTC home
- The number of previously infected LTC residents is associated with lower risk of COVID importation into a home

# Outbreak risk model (wave 2 = Sept 1 – Jan 22)

Variable	Adjusted OR (95% CI)					
	Wave 1			Wave 2		
	Unadjusted	Partially adjusted	Adjusted	Unadjusted2	Partially adjusted3	Adjusted4
<b>Profit status</b>						
Nonprofit (Ref.)			-			-
For-profit	1.01 (0.64–1.57)	0.96 (0.61–1.49)	0.71 (0.40–1.25)	1.68 (0.92-3.07)	1.28 (0.81-2.03)	1.15 (0.6-2.18)
Municipal	0.83 (0.45–1.54)	0.85 (0.46–1.58)	0.71 (0.36–1.42)	1.36 (0.86-2.16)	1.72 (0.94-3.16)	1.7 (0.82-3.51)
<b>Health region characteristics</b>						
COVID-19 cumulative incidence in the public health unit region (1 case per 1000)		2.02 (1.20–3.38)	1.91 (1.19–3.05)		1.08 (1.04-1.11)	1.12 (1.07-1.17)
<b>Population</b>						
≥ 500 000 (Ref.)			-			
10 000–499 999		0.57 (0.32–1.00)	0.56 (0.33–0.95)		0.87 (0.49-1.54)	0.57 (0.28-1.15)
< 10 000 (rural)		0.27 (0.13–0.58)	0.39 (0.18–0.83)		0.59 (0.28-1.25)	0.59 (0.24-1.42)
<b>LTC home characteristics</b>						
No. of residents (unit of 50)			1.38 (1.18–1.61)			1.45 (1.19-1.76)
Older design standards			1.55 (1.01–2.38)			1.22 (0.75-1.99)
Chain ownership (v. single home)			1.47 (0.86–2.51)			1.69 (0.93-3.09)
Staff (full-time equivalent):bed ratio			1.98 (0.39–9.97)			0.99 (0.87-1.12)
<b>No residents infected (Ref.)</b>						
≤50% residents infected						0.51 (0.28-0.92)
>50% residents infected						0.01 (0-0.05)

# Extent of outbreak model wave 2 (Sept 1 – Jan 22)



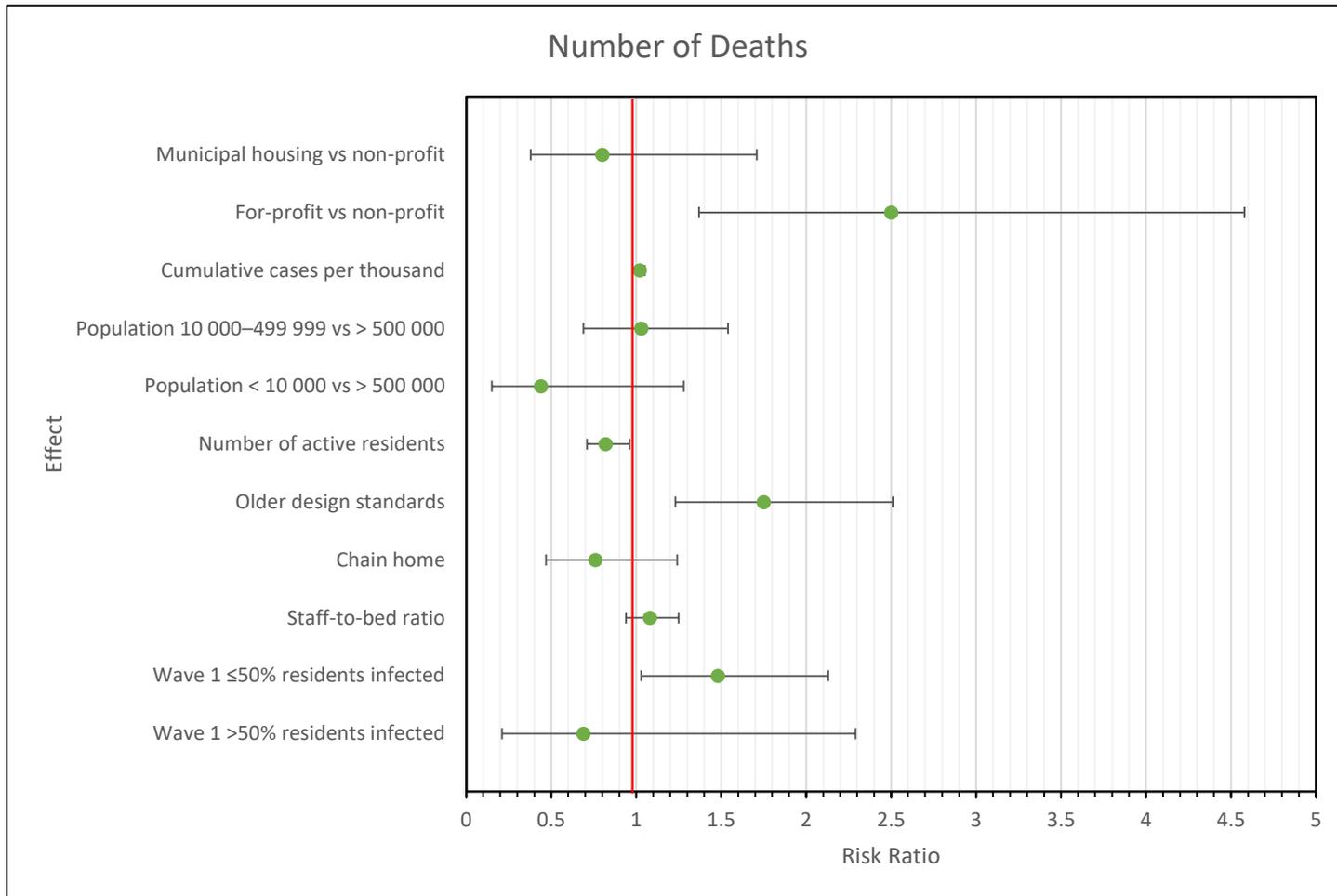
- Estimate of risk or benefit.
- The factor is associated with risk when above 1
- The factor is associated with benefit when below 1
- | 95% Confidence Interval
- When this interval crosses 1, the factor is not significant

- Older design standards, for-profit status and community spread of COVID are factors associated with higher number of infected residents in an LTC home
- The size of the home represented by the number of active clients appears to be associated with lower number of infected residents

# Extent of outbreak model (wave 2 = Sept 1 – Jan 22)

Variable	Adjusted RR (95% CI)					
	Wave 1			Wave 2		
	Unadjusted	Partially adjusted	Adjusted	Unadjusted2	Partially adjusted3	Adjusted4
<b>Profit status</b>						
Nonprofit (Ref.)			-			-
For-profit	1.83 (1.18–2.84)	1.96 (1.26–3.05)	0.96 (0.57–1.61)	2.65 (1.71-4.09)	2.55 (1.65-3.94)	1.6 (1.03-2.5)
Municipal	0.60 (0.28–1.30)	0.64 (0.29–1.40)	0.85 (0.40–1.82)	0.69 (0.35-1.36)	0.71 (0.36-1.4)	0.78 (0.44-1.38)
<b>Health region characteristics</b>						
COVID-19 cumulative incidence in the public health unit region (1 case per 1000)		1.84 (1.10–3.08)	1.65 (1.02–2.67)		1.03 (1-1.05)	1.03 (1.01-1.05)
<b>Population</b>						
≥ 500 000 (Ref.)						
10 000–499 999		0.65 (0.33–1.24)	0.55 (0.30–0.99)		1.21 (0.84-1.74)	1.16 (0.85-1.59)
< 10 000 (rural)		0.85 (0.22–3.28)	0.53 (0.15–1.83)		1.11 (0.53-2.33)	0.79 (0.42-1.49)
<b>LTC home characteristics</b>						
No. of residents (unit of 50)			0.84 (0.73–0.95)			0.75 (0.67-0.85)
Older design standards			1.88 (1.27–2.79)			2.13 (1.61-2.82)
Chain ownership (v. single home)			1.84 (1.08–3.15)			0.95 (0.64-1.4)
Staff (full-time equivalent):bed ratio			0.73 (0.10–5.35)			1.03 (0.91-1.16)
Percent infected residents from wave 1						
No residents infected (Ref.)						
≤50% residents infected						1.22 (0.91-1.64)
>50% residents infected						0.32 (0.09-1.17)

# Mortality Wave 2 (Sept 1 – Jan 22)



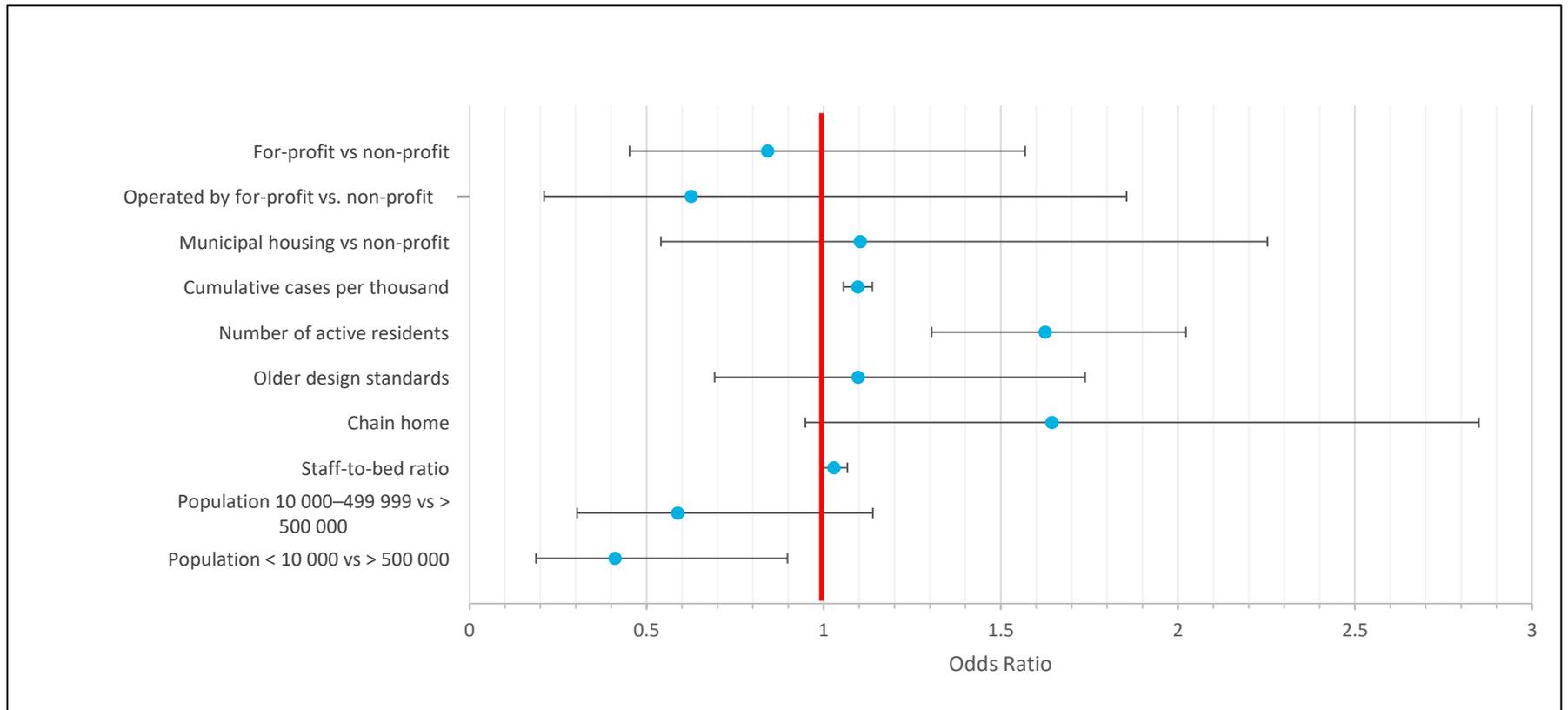
- Estimate of risk or benefit.
- When above 1, the factor is associated with risk.
- When below 1, the factor is associated with benefit.
- 95% Confidence Interval
- When this interval crosses 1, the factor is not significant.

- For-profit status, older design standards and lower than 50 percent of resident surviving previous outbreaks are associated with higher number of deaths
- Size of the home appears to be somewhat associated with lower number of death in an LTC home.

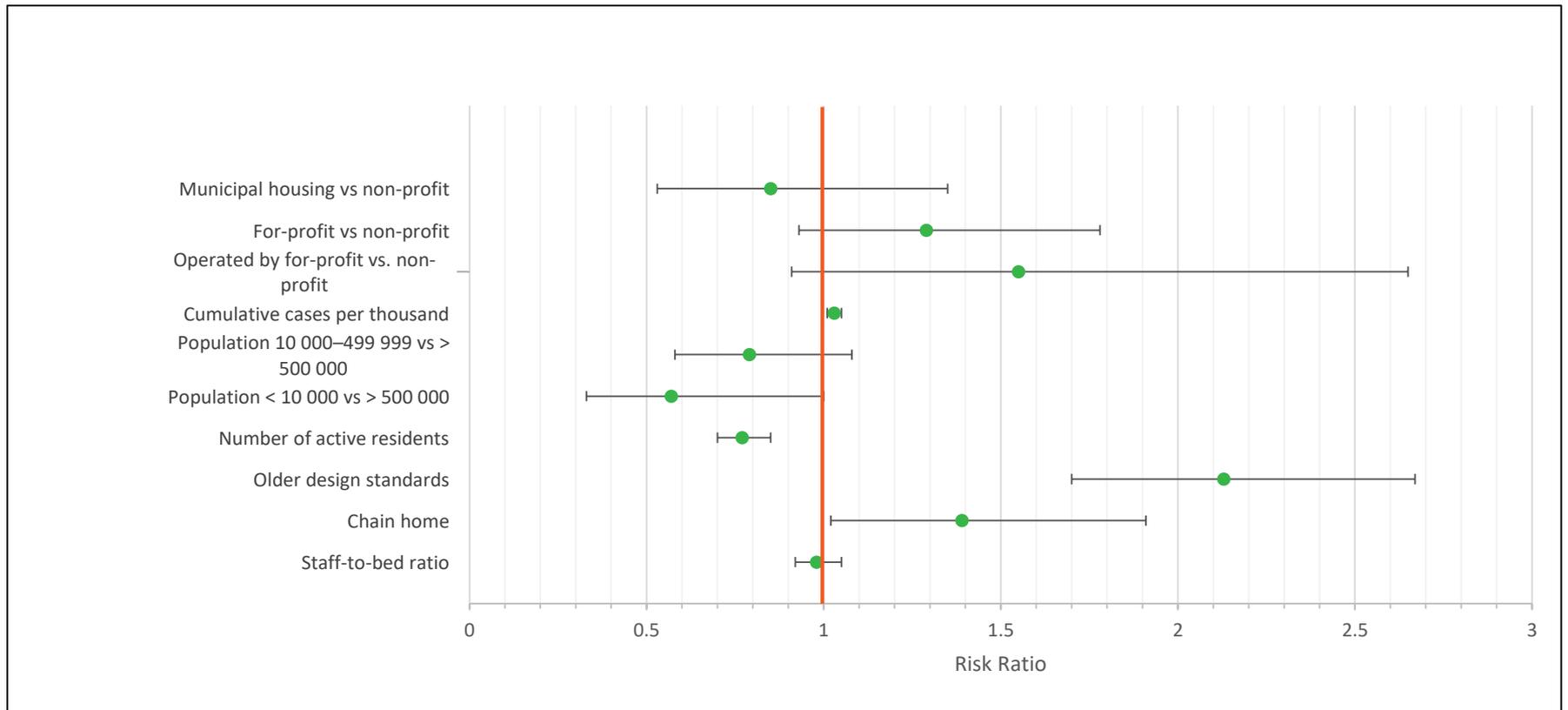
# Mortality Wave 2 = Sept 1 – Jan 22)

Variable	Adjusted RR (95% CI)					
	Wave 1			Wave 2		
	Unadjusted	Partially adjusted	Adjusted	Unadjusted <sup>2</sup>	Partially adjusted <sup>3</sup>	Adjusted <sup>4</sup>
<b>Profit status</b>						
Nonprofit (Ref.)			-			-
For-profit	1.67 (0.99–2.79)	1.78 (1.03–3.07)	0.82 (0.44–1.54)	3.05 (1.77-5.25)	3.05 (1.8-5.19)	2.5 (1.37-4.58)
Municipal	0.50 (0.19–1.29)	0.54 (0.20–1.49)	0.73 (0.28–1.88)	0.73 (0.32-1.69)	0.81 (0.36-1.83)	0.8 (0.38-1.71)
<b>Health region characteristics</b>						
COVID-19 cumulative incidence in the public health unit region (1 case per 1000)		1.77 (0.47–6.60)	1.44 (0.81–2.55)		1.03 (1-1.05)	1.02 (1-1.05)
<b>Population</b>						
≥ 500 000 (Ref.)					1.01 (0.66-1.56)	1.03 (0.69-1.54)
10 000–499 999		0.62 (0.26–1.47)	0.51 (0.25–1.05)		0.51 (0.16-1.61)	0.44 (0.15-1.28)
< 10 000 (rural)		0.72 (0.12–4.25)	0.40 (0.08–1.89)			
<b>LTC home characteristics</b>						
No. of residents (unit of 50)			0.81 (0.70–0.95)			0.82 (0.71-0.96)
Older design standards			2.08 (1.28–3.36)			1.75 (1.23-2.51)
Chain ownership (v. single home)			1.89 (1.00–3.59)			0.76 (0.47-1.24)
Staff (full-time equivalent):bed ratio			0.84 (0.09–8.75)			1.08 (0.94-1.25)
<b>Percent infected residents from wave 1</b>						
No residents infected (Ref.)						
≤50% residents infected						1.48 (1.03-2.13)
>50% residents infected						0.69 (0.21-2.29)

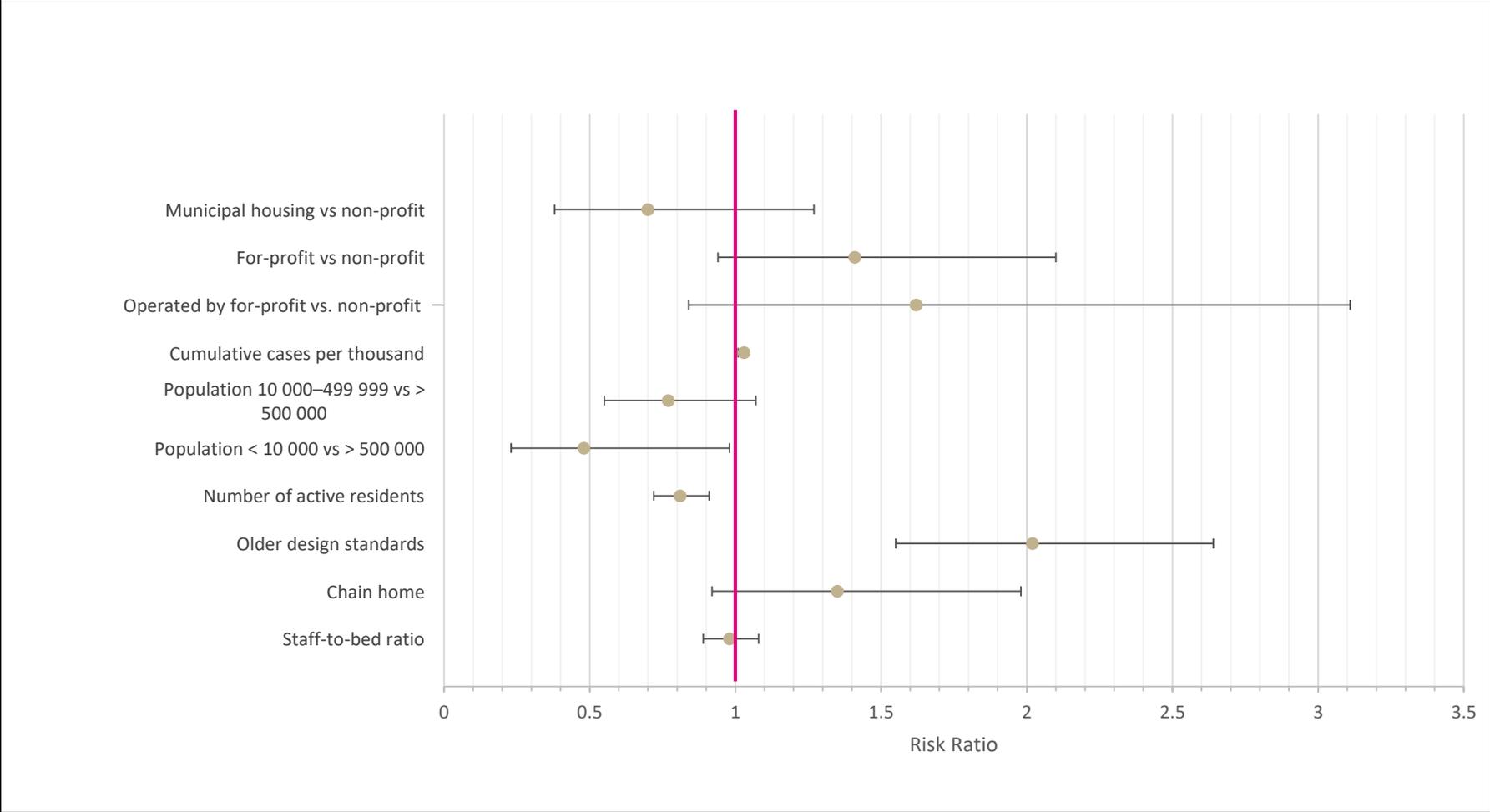
# Risk of outbreak: March 29 until Feb 16



# Extent of outbreak: March 29 until Feb 16



# Mortality: March 29 until Feb 16



# Modelling on full data set

Additional analysis was completed on the entire duration of COVID pandemics in Ontario.

The same factors as in wave 1 analysis were used.

No effect of ownership was found when using all of the data from the beginning of the pandemic.

# Conclusions

To study the factors associated with the risk of outbreak in an LTC home, the number of LTC resident cases and deaths, the approach presented above is just a first step in understanding the factors and relationships that lead to high number of outbreaks and COVID cases and death in Long-Term Care sector.

Additional, in-depth studies with collection of data unavailable from administrative sources are required to fully understand the phenomenon.

Current analysis has several caveats that limit its application to understand the root causes of COVID-19 impact on the LTC sector. These caveats include:

1. Not all possible factors associated with outcomes of interest are included in the models, most importantly because not all the factors are captured in data.
2. The study design for this analysis does not allow the important question “why” to be answered.
3. These models are “point of time” models and association of factors with outcomes changing with new data, practice patterns, policies, public health measures, and disease transmission dynamics.