

Project Title

Higher Risk of Severe COVID-19 Disease in Patients with Diabetes Mellitus

Project Lead and Members

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Organisation(s) Involved

National Centre for Infectious Diseases, Tan Tock Seng Hospital, Lee Kong Chian School of Medicine, Nanyang Technological University, Saw Swee Hock School of Public Health, National University of Singapore, Yong Loo Lin School of Medicine, National University of Singapore

Healthcare Family Group(s) Involved in this Project

Healthcare Administration, Medical

Applicable Specialty or Discipline

Endocrinology, National Public Health and Epidemiology Unit

Project Period

Start date: March 2022

Completed date: October 2022

Aims

To investigate the association of diabetes on clinical severity of COVID-19

Background

See attachment

Methods

See attachment

Results

See attachment

Lessons Learnt

Only NHG CDMS data base was used, the analysis might be more thorough if a national level diabetes data registry were available

Conclusion

See attachment

Additional Information

Singapore Health & Biomedical Congress (SHBC) 2022: COVID-19: Our Response to a new challenge (Posters category) – (Merit Award)

Project Category

Applied/ Translational Research

Quantitative Research

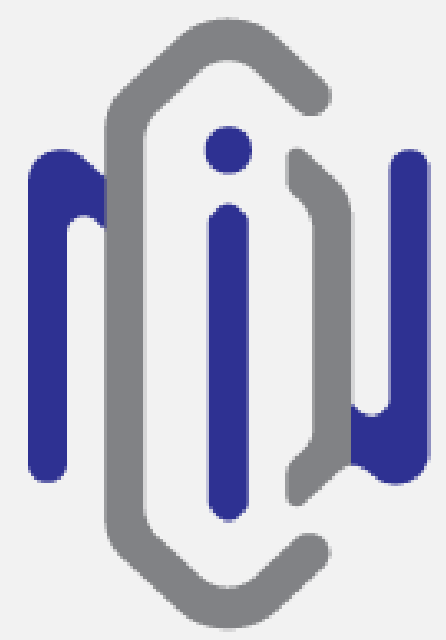
Keywords

Data Analytics, COVID-19, Diabetes Mellitus, Propensity Score Matching, Multivariable Logistic Regression

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Higher Risk of Severe COVID-19 Disease in Patients with Diabetes Mellitus

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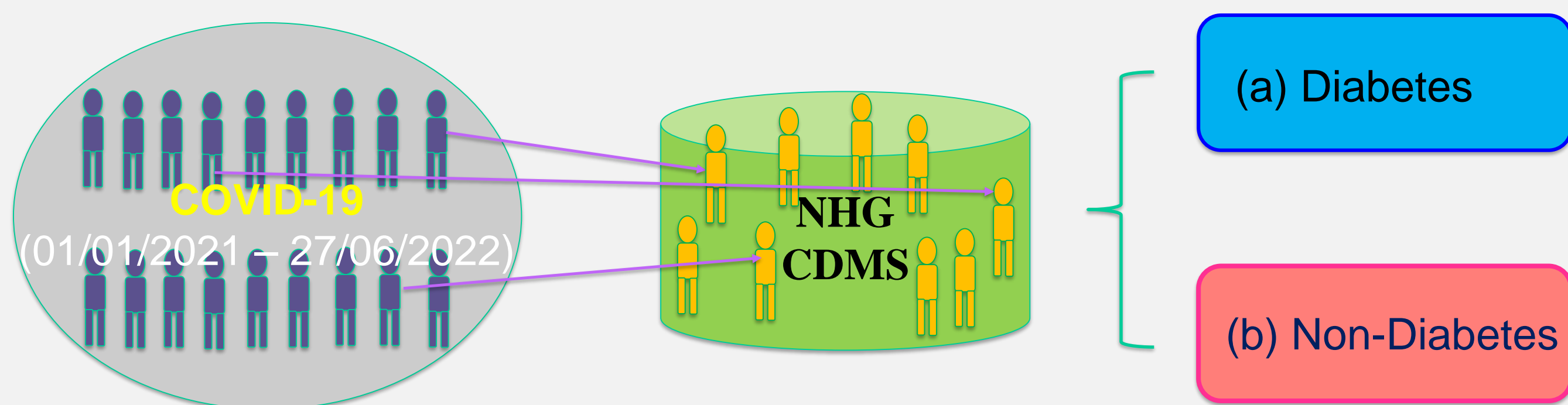
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Background

- Over 1.8 million COVID-19 cases were reported in Singapore since COVID-19 outbreak. While most infected people developed mild to moderate illness, about 1% needed oxygen supplementation, ICU care or died of COVID-19 and its complications.
- There were about 400,000 Singaporeans with diabetes mellitus who may be at higher risk of severe COVID-19 infection.
- This study aimed to investigate the association of diabetes on clinical severity of COVID-19.

Methods

- All confirmed COVID-19 cases from 1 January 2021 to 27 June 2022 that were in the database of NHG Chronic Disease Management System (CDMS) were included in the analysis.



- Propensity score matching** to balance the confounders including age, gender, vaccination status and other chronic diseases in (a) diabetes and (b) non-diabetes groups for Delta and Omicron VOC.
- Multivariable logistic regression** to examine the impact of diabetes on severe COVID-19
 - Adjusted by presence of other chronic diseases including cardiovascular diseases, chronic kidney disease, nephritic syndrome, nephritis/nephrosis, COPD and cancer, age, vaccination status and VOC.

Results

- Patient age, COVID-19 vaccination status and having co-existing chronic diseases were significantly different between diabetes and non-diabetes groups.
- Characteristics** of the diabetes and non-diabetes groups were **balanced** after propensity score matching (Table 1).
- In **Delta** cohort, severe COVID-19 disease was significantly higher with increasing age, among the diabetes group and unvaccinated. (Figure 1). However, this was not observed within the **Omicron** cohort. (Figure 3)
- Among the **Delta diabetes** group, more severe COVID-19 with increasing age, unvaccinated and having poor glycaemic control of HbA1c>8% within last 6 months (Figure 2).
- Adjusted odds of severe disease was **11% higher in Diabetes group compared to Non-diabetes group** (Table 2).

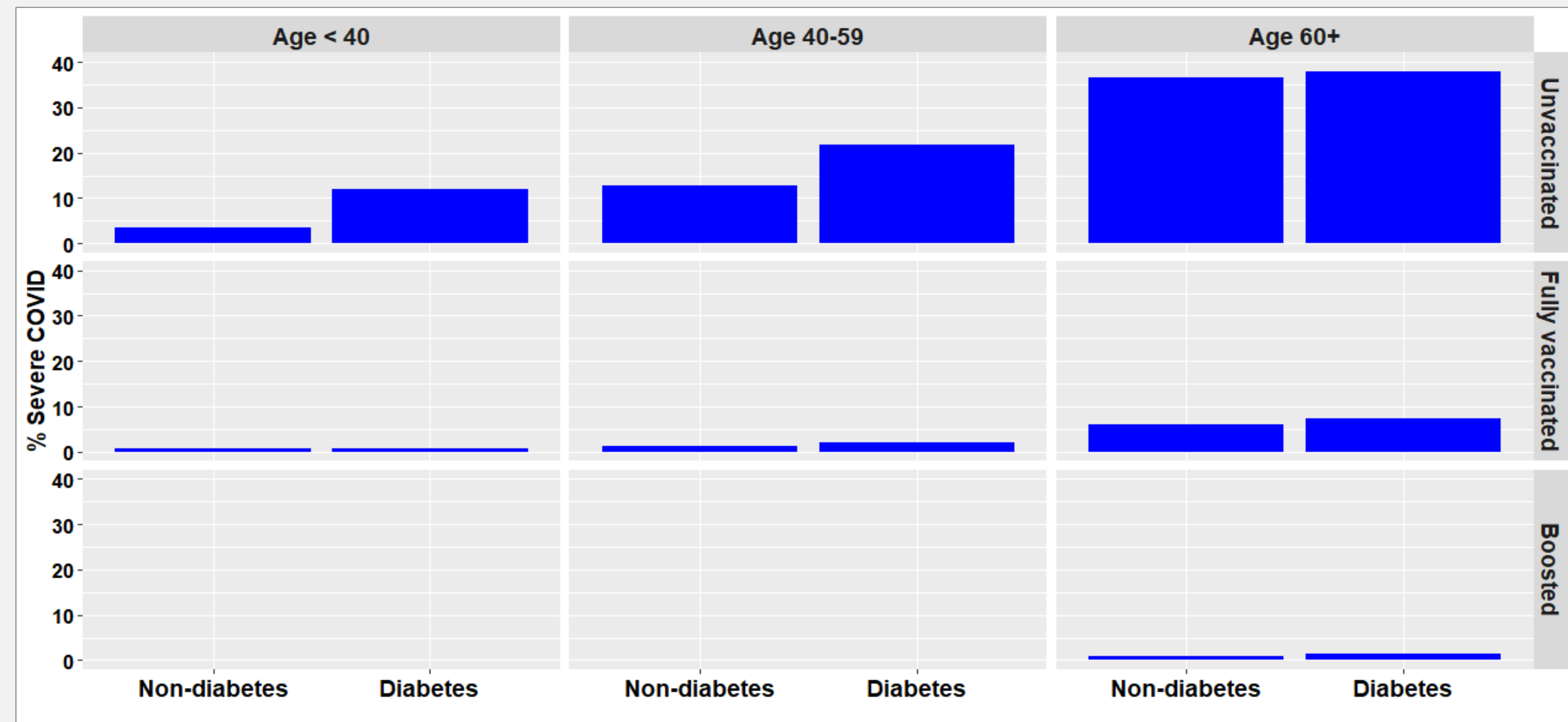


Figure 1. Percentage of severe disease by age, vaccination status and diabetes diagnosis (**Delta** cohort)

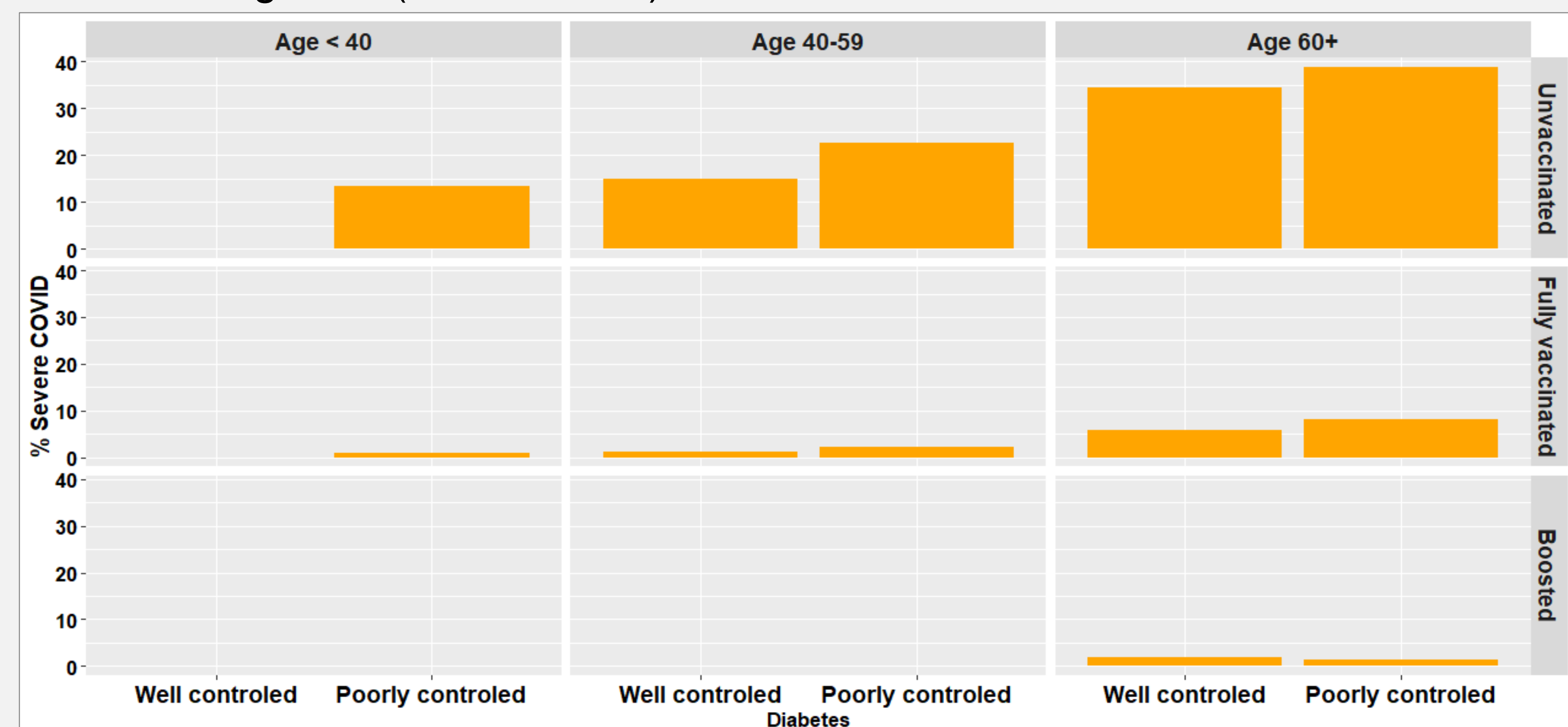


Figure 2. Percentage of severe disease by age, vaccination status and degree of diabetes control (**Delta** cohort with diabetes)

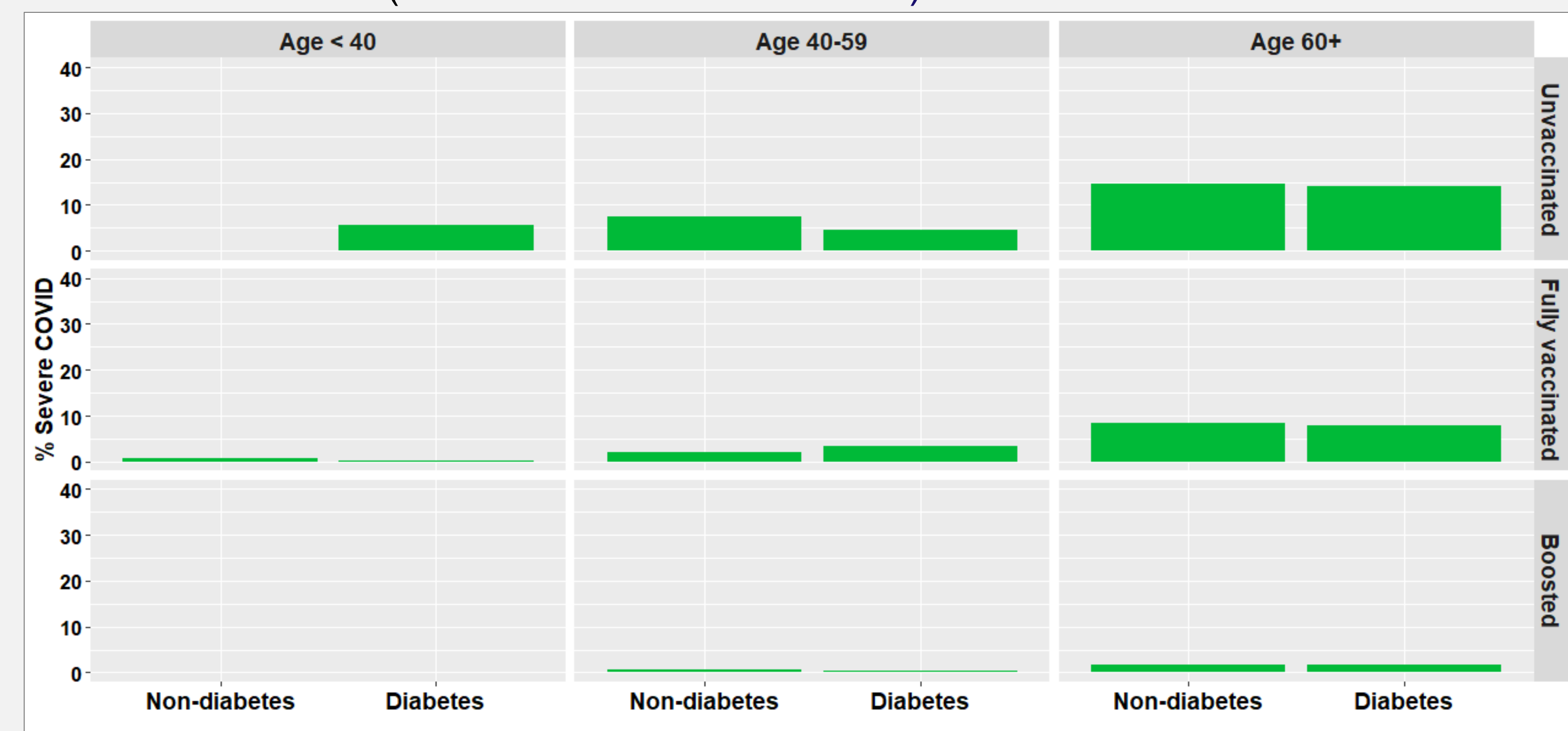


Figure 3. Percentage of severe disease by age, vaccination status and diabetes diagnosis (**Omicron** cohort)

	Univariable model			Multivariable model		
	cOR [‡]	95% CI	p value	aOR	95% CI	p value
Non-diabetic	1.00	Referent		1.00	Referent	
Diabetes	1.10	(1.03, 1.17)	0.004	1.11	(1.04, 1.19)	0.002
No other Chronic diseases	1.00	Referent		1.00	Referent	
Have other Chronic disease(s)	2.65	(2.44, 2.89)	< 0.001	4.27	(3.87, 4.71)	< 0.001
Partially / Un-vaccinated	1.00	Referent		1.00	Referent	
Fully Vaccinated	0.17	(0.16, 0.19)	< 0.001	0.25	(0.23, 0.28)	< 0.001
Boosted	0.04	(0.04, 0.05)	< 0.001	0.07	(0.07, 0.08)	< 0.001
Delta	1.00	Referent		1.00	Referent	
Omicron	0.26	(0.24, 0.27)	< 0.001	0.37	(0.34, 0.41)	< 0.001

Table 2. Crude and adjusted odds ratios for severe COVID-19 disease

[‡]cOR: crude odds ratio, aOR: adjusted odds ratio, CI: confidence interval

Conclusion

- Patients with diabetes** are at 11% higher risk of severe COVID-19 disease than people without diabetes
 - Risk increases in the presence of other co-morbid chronic cardiovascular, respiratory conditions and cancer
- COVID-19 vaccination** is highly protective against severe disease for both diabetes and non-diabetes patients
- Well-controlled diabetes** may reduce risk of severe COVID-19 disease

Variable	Delta VOC			Omicron VOC		
	Diabetes (N=13122)	Non-diabetes (N=13122)	p-value	Diabetes (N=45879)	Non-diabetes (N=45879)	p-value
Age (years)	64 (55-72)	64 (55-72)	1	66 (57-74)	66 (57-74)	1
Female	5047 (38.5)	5159 (39.3)	0.16	22061 (48.1)	22078 (48.1)	0.916
Other chronic diseases	3385 (25.8)	3385 (25.8)	1	35689 (77.8)	35689 (77.8)	1
Partially / Un-vaccinated	1824 (13.9)	1824 (13.9)	1	39521 (86.1)	39521 (86.1)	1
Fully Vaccinated	10225 (77.9)	10225 (77.9)		5193 (11.3)	5193 (11.3)	
Boosted	1073 (8.2)	1073 (8.2)		1165 (2.5)	1165 (2.5)	
Severe COVID	1129 (8.6)	944 (7.2)	< 0.001	987 (2.2)	990 (2.2)	0.964
LOS in hospital	8 (4-13)	6 (4-11)	< 0.001	8 (5-11)	7 (5-10)	< 0.001

Table 1. Balanced characteristics after propensity score matching and comparison of outcomes in the diabetic and non-diabetic group by VOC

*IQR, interquartile range