Risk of COVID-19 breakthrough infection in fully vaccinated patients with multiple comorbid conditions in the US

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Agenda

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Background and Study Objective

COVID-19 Statistics in US (Jan 2020 to April 2022)

80.3 million
Confirmed cases[1]

~1 million
Deaths[1]

556.4 million
Vaccine doses administered[1]

Breakthrough Infections (BIs)

1 in 5000
fully vaccinated individuals develop BI[2]

69%
BI hospitalizations are in elderly (65+)[3]

57,617+
BI Covid-19 deaths (as of Mar 2022)[4]

Comorbidities

Diabetes, Chronic Lung Diseases, and CKD
increased incidence of BI compared to general population[5]

1.83 times more likely
BI in solid organ transplant patients[6]

1.63 times more likely
BI in patients with immune system deficiency[6]

Objective – To assess association of multiple comorbid conditions with COVID-19 BIs in fully vaccinated adults ≥ 16 years old

1. WHO Health Emergency Dashboard – COVID-19 Homepage
2. Breakthrough Infections: Coronavirus After Vaccination – Johns Hopkins, Nov. 23, 2021
3. COVID-19 Breakthrough Hospitalizations – Peterson-KFF Health System Tracker, Dec. 15, 2021
4. Estimating the number of breakthrough COVID-19 deaths in the United States – MedRxiv, Apr. 4, 2022
5. The First Insights from the Truveta Platform: COVID-19 – Truveta, Nov. 9, 2021
6. Which Comorbidities Increase the Risk of a COVID-19 Breakthrough Infection, Mar. 31, 2022

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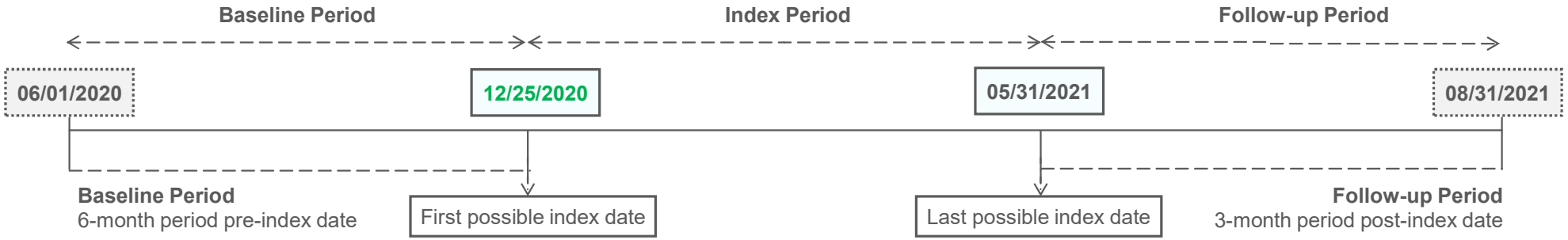
Study method (1/2)



Data Sources	Optum Research Database (ORD)
Study Design	Retrospective cohort study, using medical and pharmacy claims data
Study Population	Commercial and Medicare Advantage part D enrollees
Inclusion Criteria	▪ Patients aged 16 years and above, and ▪ Evidence of complete vaccination status for COVID-19 vaccine ○ 1 dose of Janssen vaccine OR ○ 2 doses of Pfizer-BioNTech vaccine at least 3 weeks apart OR ○ 2 doses of Moderna vaccine at least 4 weeks apart
Exclusion Criteria	▪ Patients with evidence of mixed vaccine series or more than 2 doses of vaccine, or ▪ Evidence of COVID-19 infection during baseline period, or ▪ Evidence of COVID-19 infection within 0-13 days of complete vaccination, or ▪ Evidence of pregnancy during baseline or follow-up period
Index Date	Identified as the date that is ≥14 days after complete vaccination[7]
Index Period	December 1, 2020 – May 31, 2021
Baseline Period	6 months prior to index date
Follow-up Period	3 months post-index date

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7. As defined by CDC, COVID-19 infection in >= 14 days following complete vaccination is called a breakthrough infection- COVID-19 breakthrough infections reported to CDC

Study method (2/2)

Study Outcome	*Incidence of COVID-19 BIs* in individuals with and without comorbidities ▪ Evidence of a diagnosis of COVID-19 infection at least 14 days after complete vaccination status
Study Exposure	*Patient with Comorbidity* (comorbidity is defined as co-occurrence of a disease or condition during the clinical course of a patient) [8] ▪ Evidence of any of the following 20 conditions at baseline: Asthma, COPD, Other Pulmonary Disease, Type I Diabetes Mellitus, Type II Diabetes Mellitus, Neoplasm, Liver Disease, Stroke, Chronic Kidney Disease, Immunodeficiency, Hypertension, Heart Failure, Other Cardiovascular disease, HIV, Overweight, Obesity, Dementia, Organ Transplantation, Sickle Cell Disease, Cystic Fibrosis, Smoking, Substance Use Disorder, and Dyslipidemia ▪ ICD-10 diagnosis codes were used to identify each of these conditions
	Patient with Multimorbidity (multi-morbidity is defined as the co-occurrence of multiple chronic or acute diseases and medical conditions within one person)[9] ▪ Evidence of >=3 of the above-mentioned comorbid conditions during the baseline
Study Covariates	▪ *Patient demographics* – Age, Gender, Race/ ethnicity, Geographical region, Insurance type (Commercial or Medicare)
Statistical Analyses	▪ *Descriptive analyses* (mean, SD, percentage) were used to describe study population, including demographics, baseline characteristics and rate of BI by comorbidities ▪ *Logistic regression models* were used to estimate the association of COVID-19 BI with patients' multimorbidity after adjusting for patient demographics

8. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2713155/
9. https://acmedsci.ac.uk/file-download/82222577

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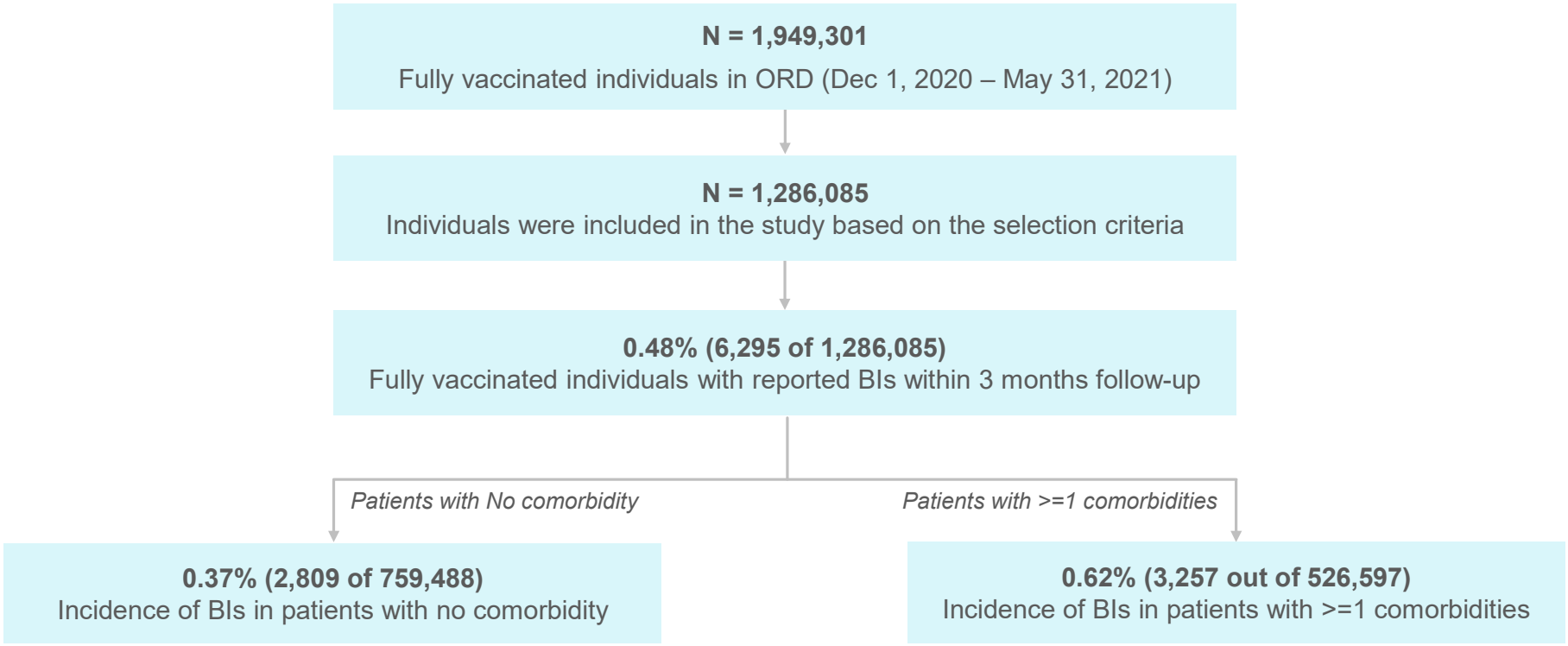
Results (1/4): Incidence of COVID-19 BIs is ~0.48%; incidence is significantly higher in patients with comorbidities than patients without comorbidities

Figure 1: Study Population and Incidence of BI



Significant difference (p<0.001) between incidence of BIs in patients with no comorbidities and incidence of BIs in patients with 1 or more comorbidities

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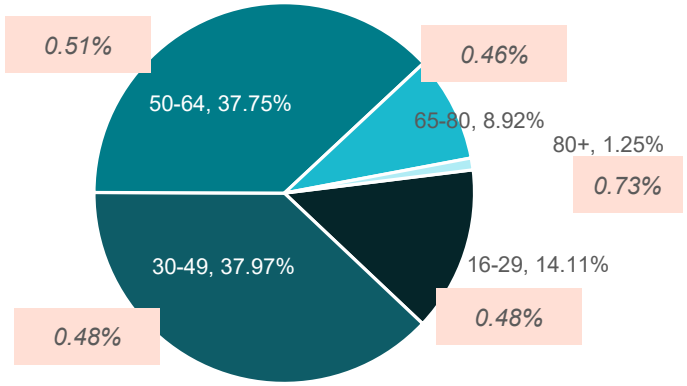
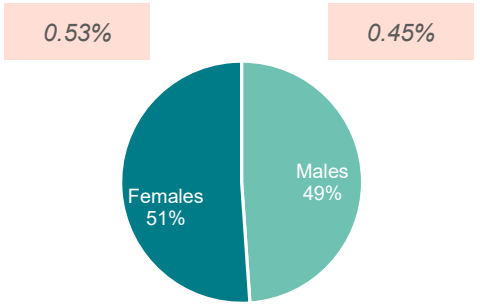
Results (2/4): Incidence of BI is higher in patients aged 80+, Hispanics & African Americans, and those living in Northeast & South regions

Figure 2- Patient distribution by:

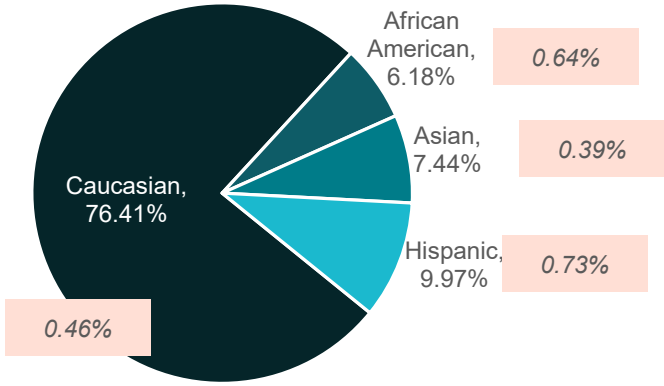
Age *



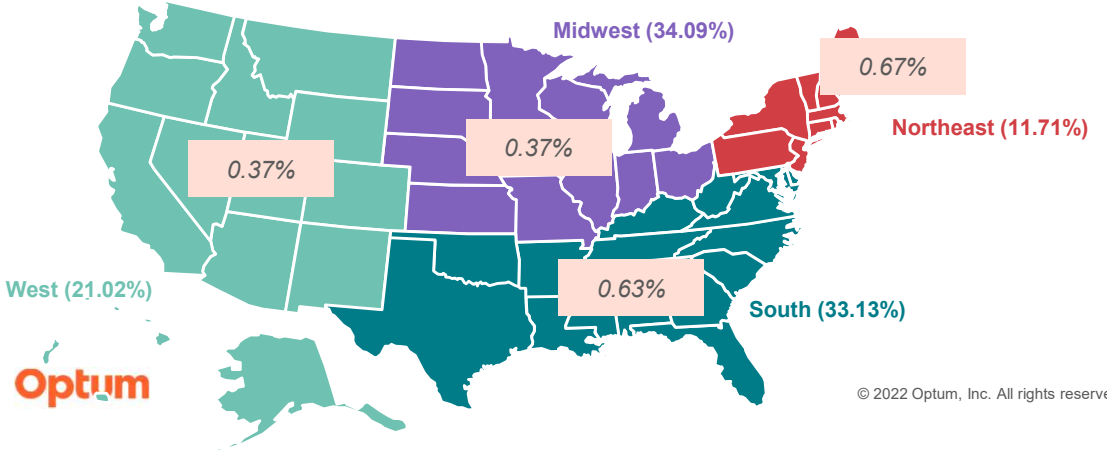
Gender *



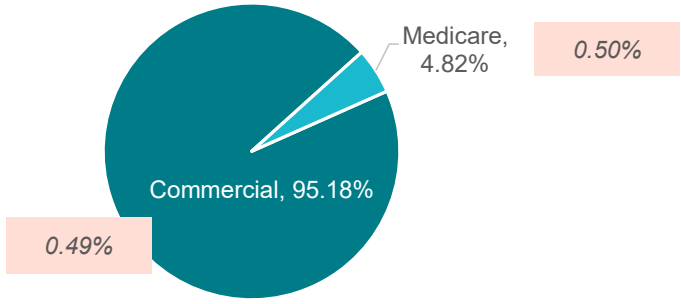
Race/ ethnicity *



Geographic Region *



Insurance type



Values in this box represents incidence of BI

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Results (3/4): Incidence of COVID-19 Breakthrough Infections is higher in patients with multi-morbidities & comorbidities than patients without comorbidities

Figure 3: Breakthrough Infection Rate by Comorbidity status

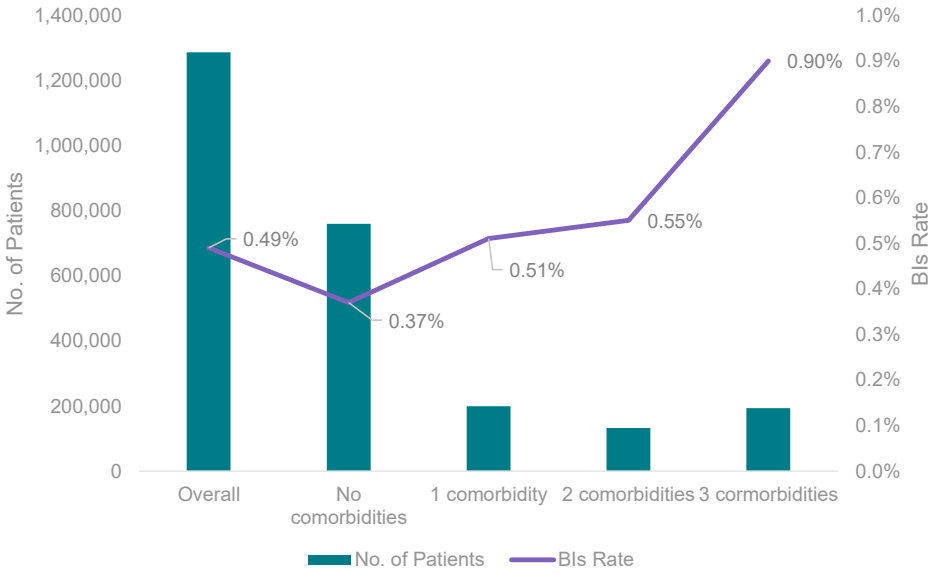
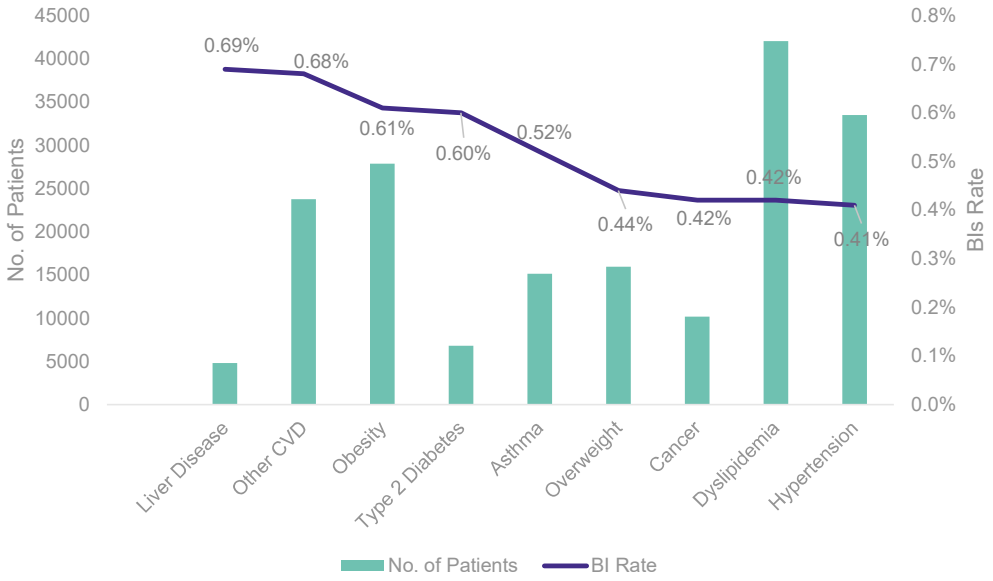


Figure 4: Breakthrough Infection Rate by individual comorbidity



Note: Patients with BI n=0 and population n=<25 were excluded (Type 1 Diabetes, HIV, Organ Transplant, COPD, Chronic Kidney disease, heart failure, other pulmonary diseases, immunodeficiency, dementia, sickle cell disease, substance use disorder, cystic fibrosis and smoking)

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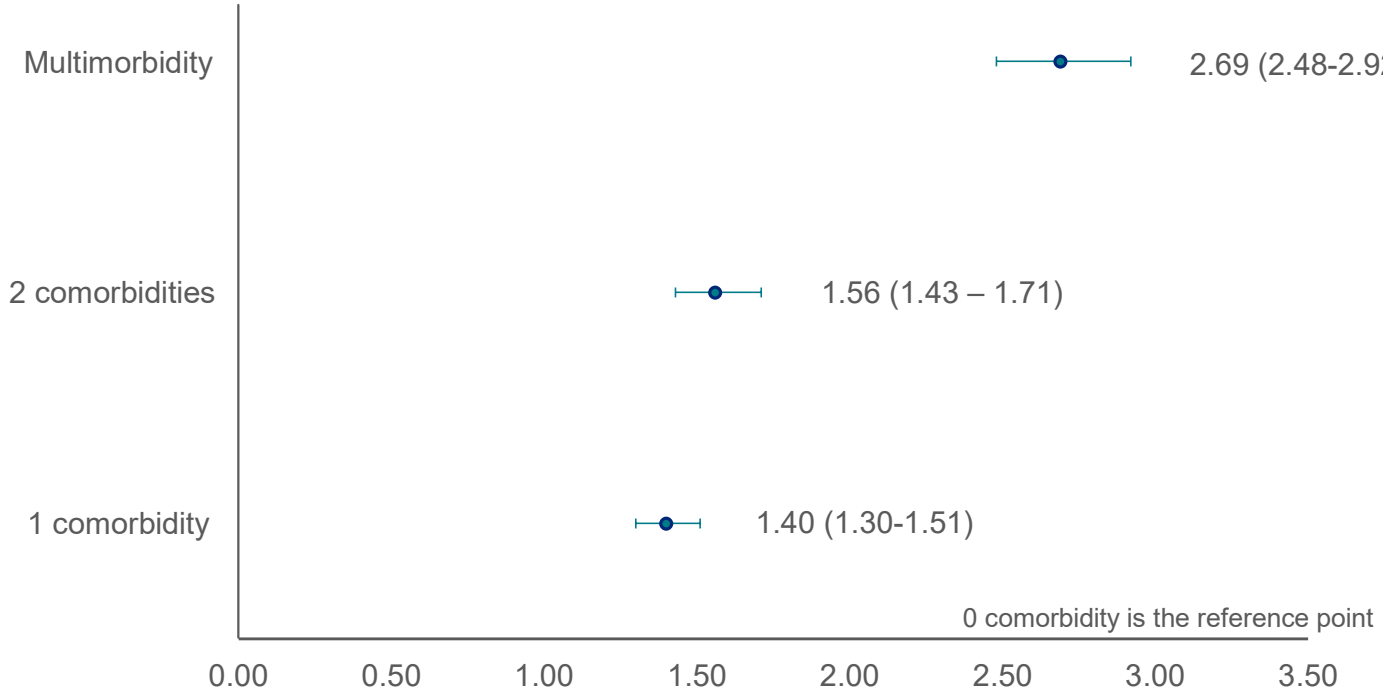
Results (4/4): The odds of COVID-19 BI are significantly higher in patients with multi-morbidities and comorbidities than patients without comorbidities

Figure 5: Odds ratio of BIs with count of comorbidities



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Study Limitations

- Inherent limitations of claims data analysis, including misclassification and misinformation – possibility of incomplete, inaccurate, or missing data. Undetected coding errors could have resulted in the misidentification of COVID-19 vaccination, comorbidities, and BIs.
- Possibility of unmeasured and residual confounding.
- Analysis was restricted to a defined study window with a minimum continuous enrollment of 180 days pre-index and 90 days post-index date. Due to this continuous enrollment constraint, our study did not address BIs related deaths.
- Role of booster vaccination shots for COVID-19 was not evaluated.

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Conclusion

- There is significant burden of COVID-19 BI in individuals with comorbidities. The odds of BIs in individuals with >=1 comorbidities were at least 1.5 times higher than the odds of BIs in individuals without comorbidities.

- The incidence of BI was significantly higher in individuals aged 80 years or more, Hispanics and African Americans, and those residing in Northeast and South regions.

- Our findings may serve as useful resource for researchers and policymakers to further evaluate role of quarantine and booster doses among patients with comorbidities.

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Thank you

Q&A

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