



## Delta variant and vaccination coverage

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## Delta variant and vaccination coverage in Brazil vs. USA and EU

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**Delta variant** – the Indian variant (delta) already represents more than 90% of the specimen of infected people with Covid-19 in the world. In Brazil, the prevalence is already high in some capitals and it seems to be a matter of time for it to be dominant in the rest of the country.

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**Efficacy** – studies suggest that efficacy against severe cases of Covid-19 from Pfizer and Astrazeneca vaccines are unchanged when infected with the delta variant (Slide 5). First pieces of evidence suggest that efficacy is still high after two doses of Coronavac as well (Slide 6).

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**Vaccination coverage** – the delta variant outbreak had a much smaller impact on hospitalizations in Europe than in the USA. This difference is explained by the higher vaccination coverage among older people. Brazil's vaccination coverage of the elderly similar is to that of Europe. However, coverage is much lower among young people (Slides 13-17).

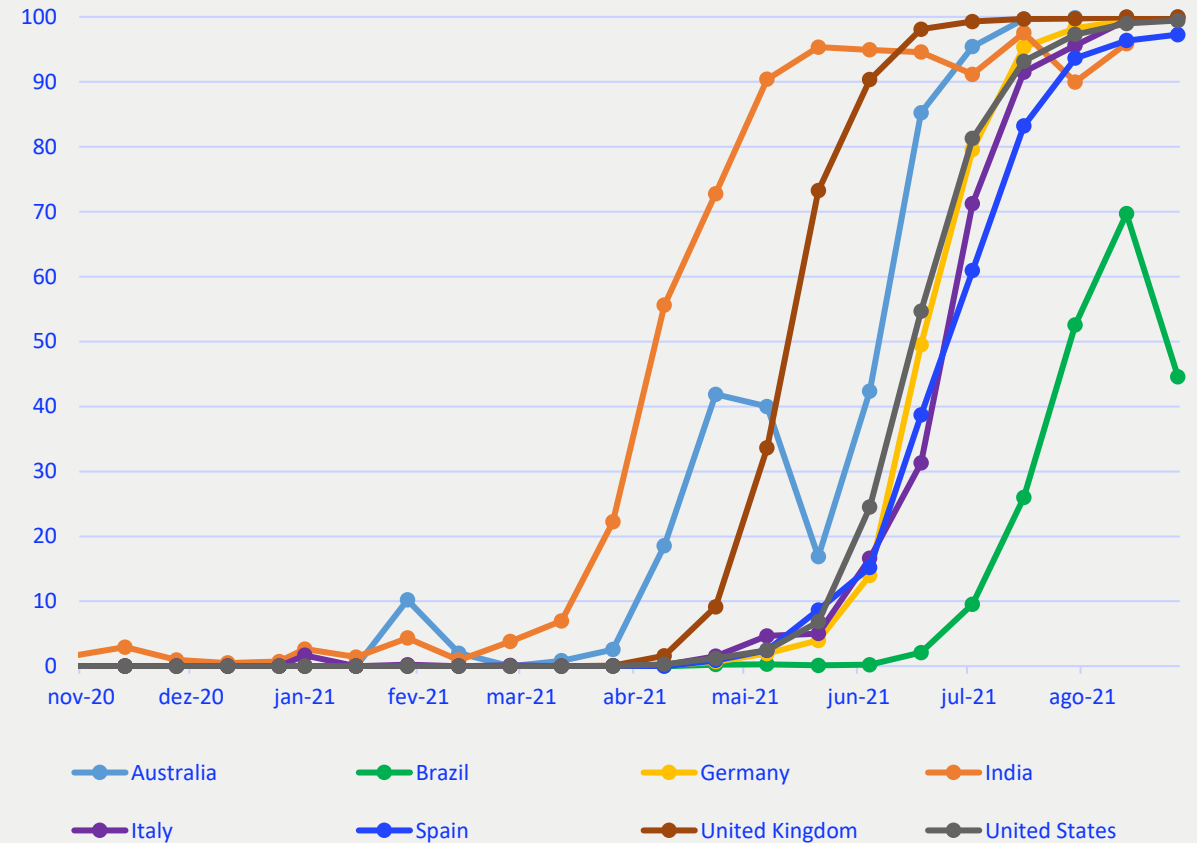
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**Pfizer doses** – the coming months will see a sharp increase in Pfizer vaccine supply. In our view, the best way to deploy those vaccines would be as a third dose for people over 60 year-old who have taken Coronavac and/or as a second dose for those who initially took the Astrazeneca vaccine (Slides 18 and 19).

# Delta variant is dominant in most of the world

- The delta variant is surprising for its high transmissibility. In countries that have recently experienced new outbreaks of Covid-19, the prevalence of this variant has increased rapidly to levels close to 100%.
- In Brazil, the prevalence of the variant has been increasing rapidly in recent weeks. In Rio de Janeiro, the municipal health secretary stated that the delta variant represented half of the samples with sequenced DNA. It seems to us a matter of time before the variant prevails in the country.
- Most likely, this variant implies an increase in new cases in Brazil, as occurred in Europe and the USA. The impact on hospitalizations and deaths is not that clear. On the one hand, Brazil's vaccination coverage among people over 60 years old is similar to that of the UK and higher than that of the USA. On the other hand, the vaccine used in this group was Coronavac, whose effectiveness against the Indian variant has not yet been broadly tested.
- Our baseline scenario is that hospitalizations will remain under control. However, this premise depends on how effective Coronavac is to prevent more severe cases of the disease, which is still uncertain at this time.

**Prevalence of delta variant by Country (%)**



# Indian variant (delta) reduces vaccines effectiveness

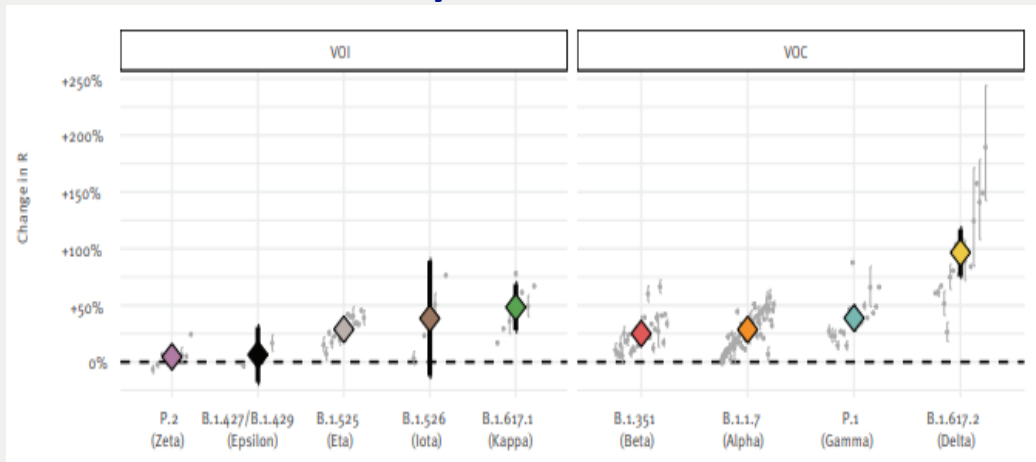
- The Indian (Delta) variant is more dangerous than those known hitherto for two reasons.
  - It is 97% more contagious than the original variant. In comparison, the Manaus variant (Gamma) is 38% more transmissible.
  - The variant reduces the efficacy of vaccines against symptomatic Covid-19 cases. For example, a population study by PHE shows that vaccines effectiveness in the country is reduced from 49% after the first dose and 89% after the second to 35% and 79%, respectively when compared to people infected with the delta variant in relation to the English variant (alpha).
- So far, studies have shown Pfizer, Moderna, Astrazeneca, Bharat Biotec and Janssen effectiveness. However, there are still no studies on the effectiveness of the Coronavac vaccine against this variant.

## Comparative effectiveness of delta variant vaccines in UK (%)

Symptomatic cases		
	Alpha (English)	Delta (Indian)
Dose 1	49 (46 to 52)	35 (32 to 38)
Dose 2	89 (87 to 90)	79 (78 to 80)

Hospitalizations		
	Alpha (English)	Delta (Indian)
Dose 1	78 (64 to 87)	80 (69 to 88)
Dose 2	93 (80 to 97)	96 (91 to 98)

## Transmissibility of variants vs. Wuhan's



## Effectiveness of different vaccines vs. the delta variant

	Clinical Effectiveness Studies with 2-Doses		
	Lab Studies	Protection vs Symptomatic infections	Protection vs Hospitalizations and Deaths
Pfizer/BioNtech	✓	79-88%	96%
Moderna	✓	72%*	96%*
Astra Zeneca	✓	60-67%	92%
Bharat Biotech	✓	65%	NA
J&J	✓	NA	NA

\*Only 1-dose data available for Canada and UK studies, NA-not available, no data for Novavax, Sputnik-V, CoronaVac or Sinopharm; Range provided when reports vary

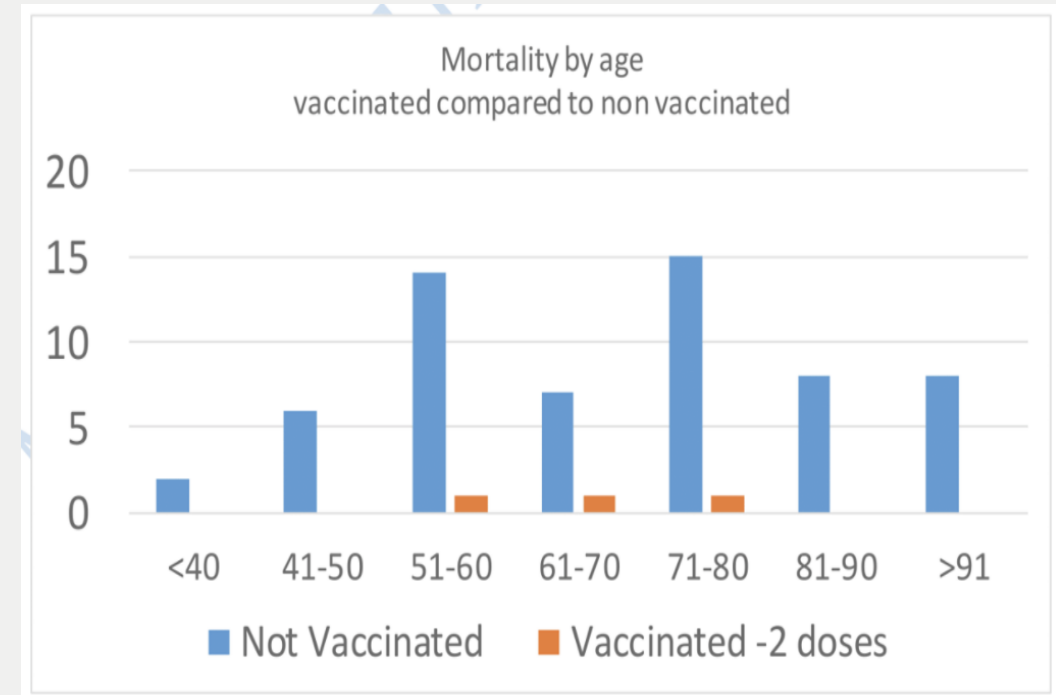
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# First evidence suggests that Coronavac is effective

Early evidence suggest that Coronavac is effective against the Indian variant:

- **Rio de Janeiro** - According to the Municipal Secretary of Health, 95% of hospitalizations occur among those who had not taken the first vaccine ([link](#)).
- **Turkey** – unvaccinated people represent 95% of hospitalizations cases, according to Turkey's Minister of Health ([link](#)). In Turkey, people over 60 years old had been vaccinated with Coronavac ([link](#)). However, Turkey made available an extra (third) dose of the vaccine for people who were vaccinated at the beginning of the process, which may be increasing the observed effectiveness. The goal was to boost the immunization of the population to prepare for the Delta variant.
- **Mongolia** - Sinopharm represents 80% of vaccines in the country, whose technology is the same as that of Coronavac. The health secretary stated that “Based on our analysis, we observed that Sinopharm reduced mortality by 94%, and was 74% effective for fully vaccinated people compared to those who received the first dose ([link](#)).
- **Seychelles** - the country deployed Sinopharm to vaccinate people under 60 and Astrazeneca for people over 60. The results show that most deaths were among non-vaccinated people ([link](#) e [link](#)).
- **China**- Study shows 77% efficacy of Sinovac against cases of Covid-19-derived pneumonia. None of the 19 cases of severe Covid occurred in the vaccinated group ([link](#)).

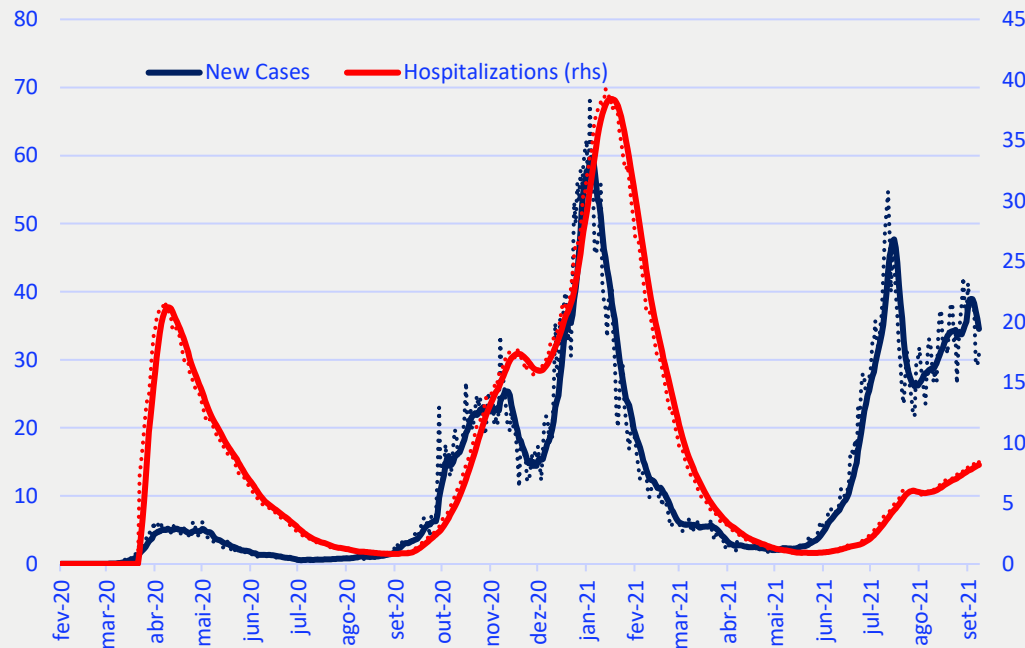
## Mortality by age among vaccinated and unvaccinated in Seychelles



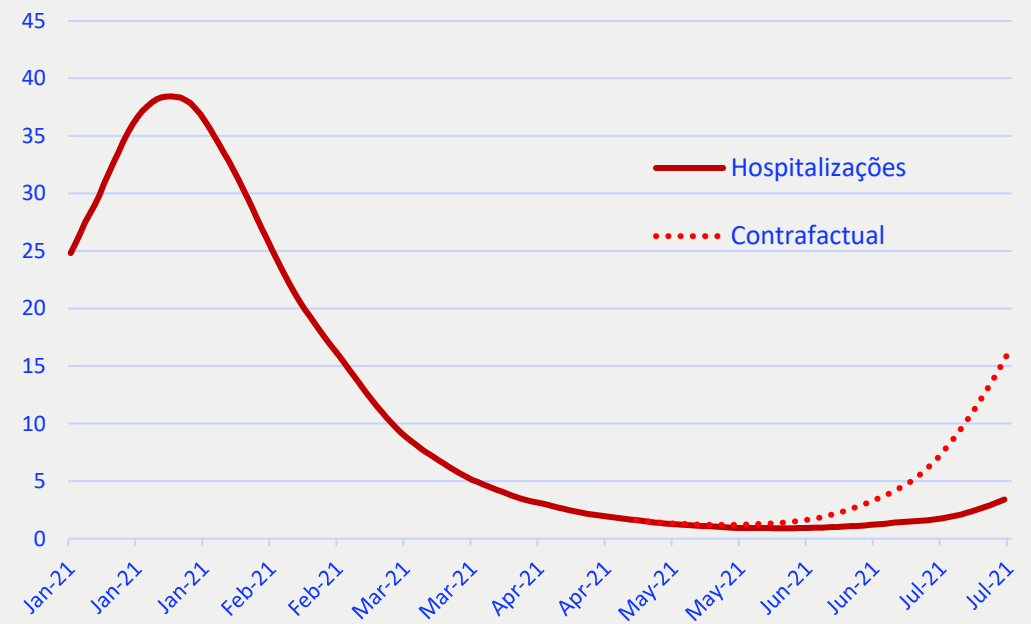
# Hospitalizations remain low in UK

- England is experiencing the second worst outbreak of Covid-19 when the number of new cases is taken into account. The current peak (40 thousand/day) is below only that observed at the beginning of this year (60 thousand/day). Nevertheless, hospitalizations remain fairly well-behaved and well below the level compatible with the current stage of the outbreak of cases.
- We calculated the level of hospitalizations compatible with the observed increase in cases, based on the relationship of historical data. On July 16, the counterfactual of hospitalizations was 16.3 thousand, compared to 3.4 thousand observed at that time.

**New cases vs. Hospitalization in UK  
(thousands/day, MM7 days)**



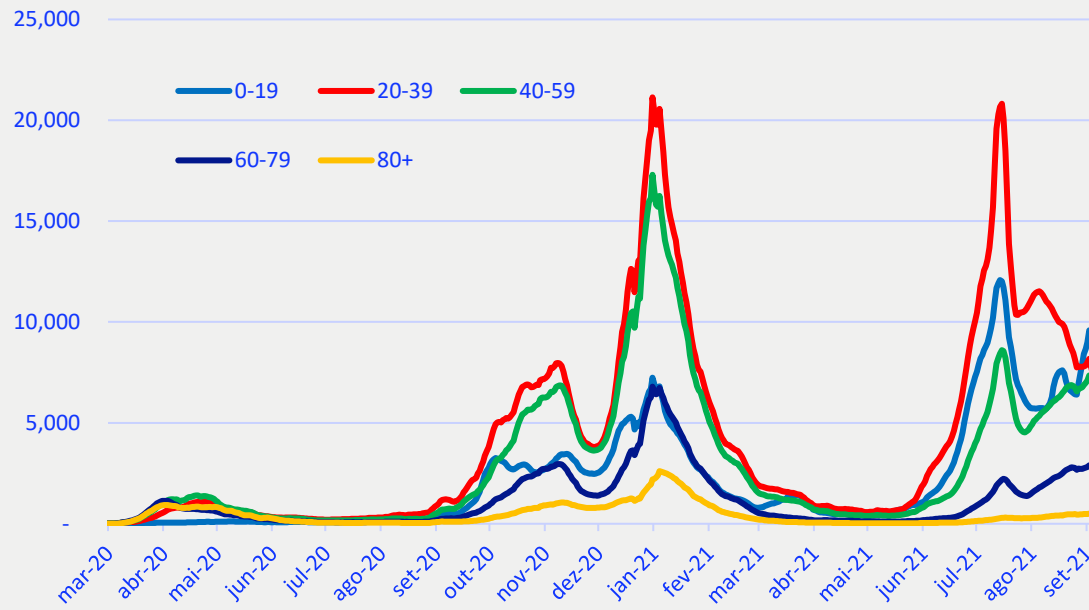
**Counterfactual hospitalizations in UK  
( MM7 days)**



# New cases concentrated in the unvaccinated population

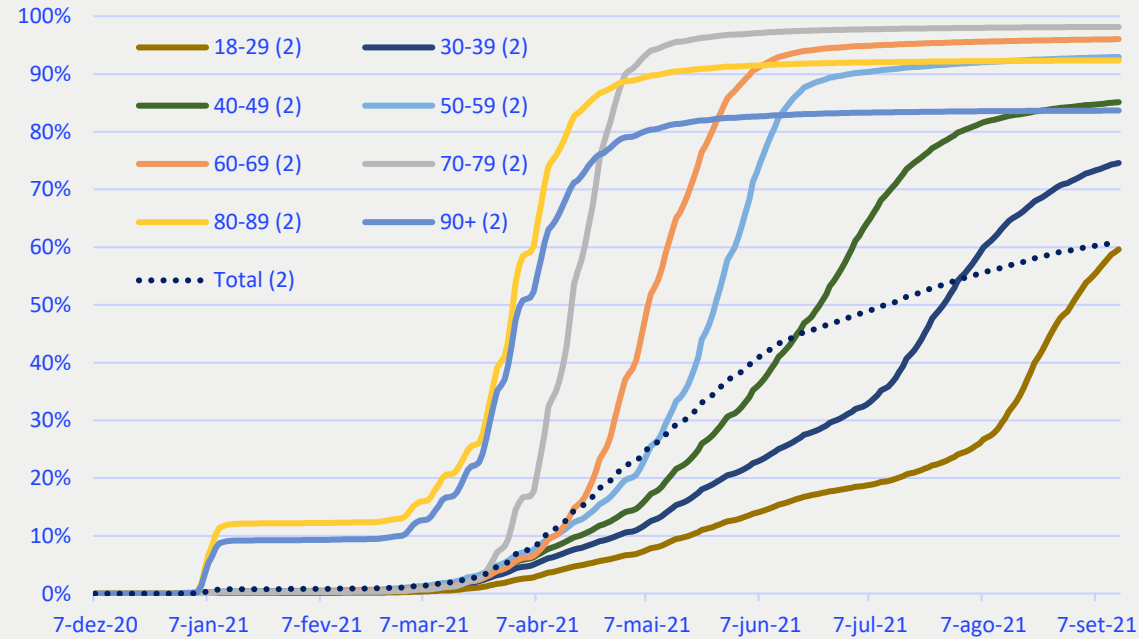
- The increase in cases in England in the current outbreak has been more concentrated among younger people, the ones who were late in the vaccination process.
- England is quite an illustrative case of the risk of the Indian variant. Even a widely vaccinated population with prior infection immunity (88% of the adult population has antibodies<sup>1</sup>) had a new Covid-19 outbreak.

**New cases by age group in England (thousands/day, MM7 days)**



<sup>1</sup> COVID-19 vaccine surveillance report – week 27

**Population that has already been vaccinated with two doses in England (% of population by age group)**

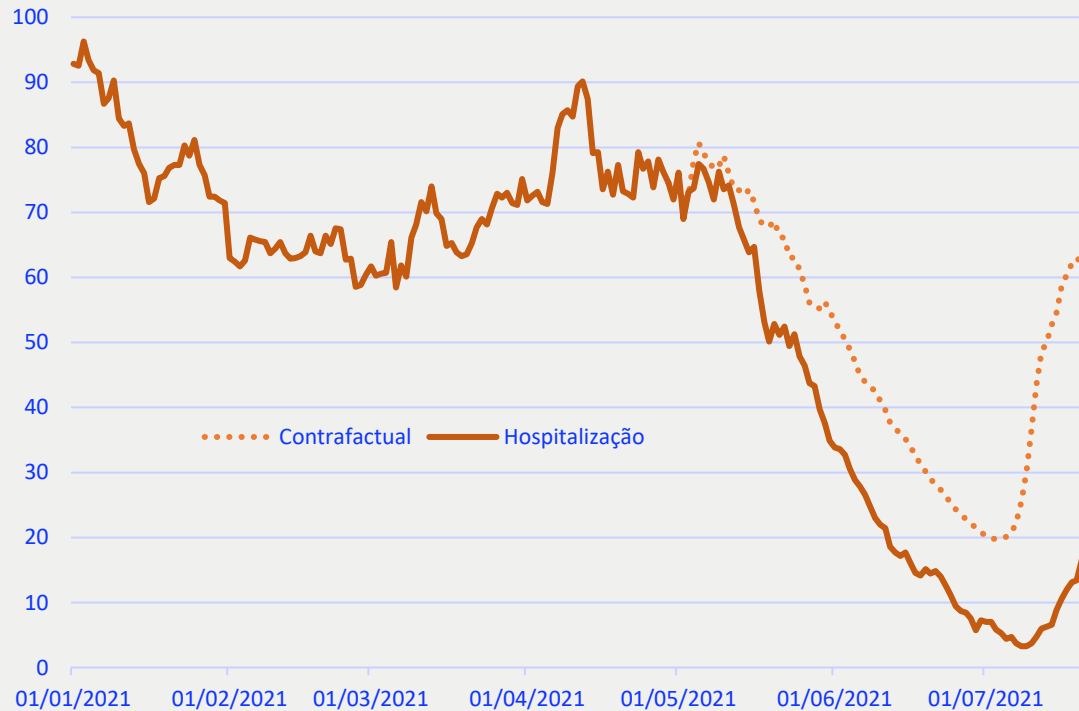




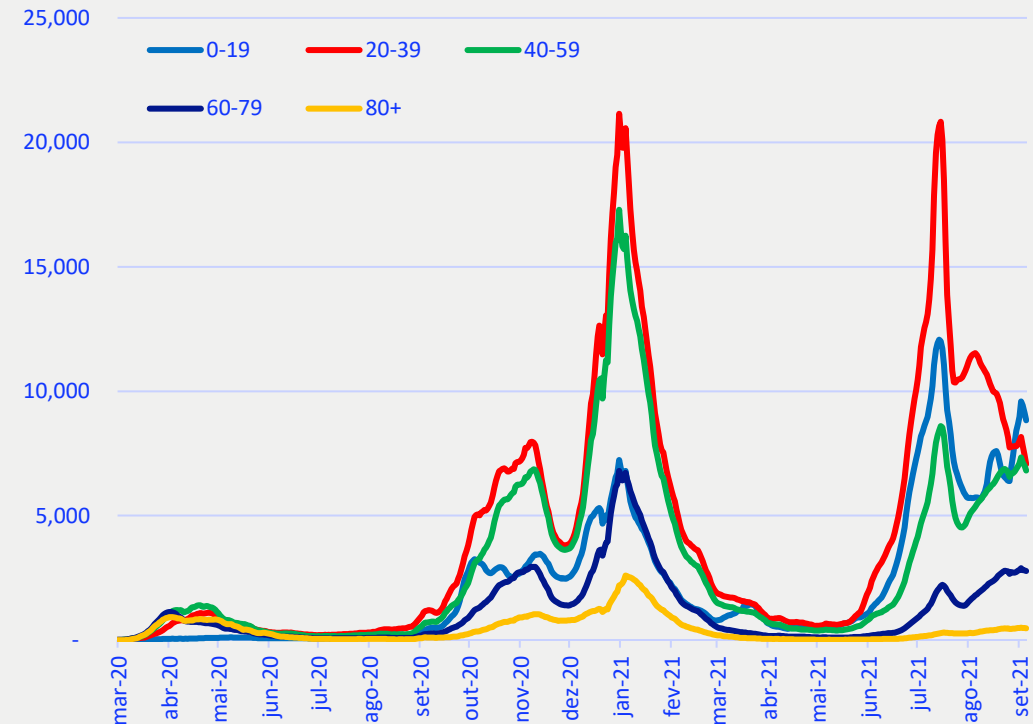
# Netherlands outbreak shows a similar pattern to that of UK

- The Netherlands is experiencing an outbreak of Covid due to the Delta variant. As in the UK, the outbreak is more concentrated among younger people (10-29 years old) and the increase in cases was not accompanied by a proportional increase in hospitalizations. On July 20, the counterfactual of the new hospitalizations was 65 in MM7 days, compared to 18 observed at that time.

### Counterfactual of hospitalizations in the Netherlands (MM7 days)



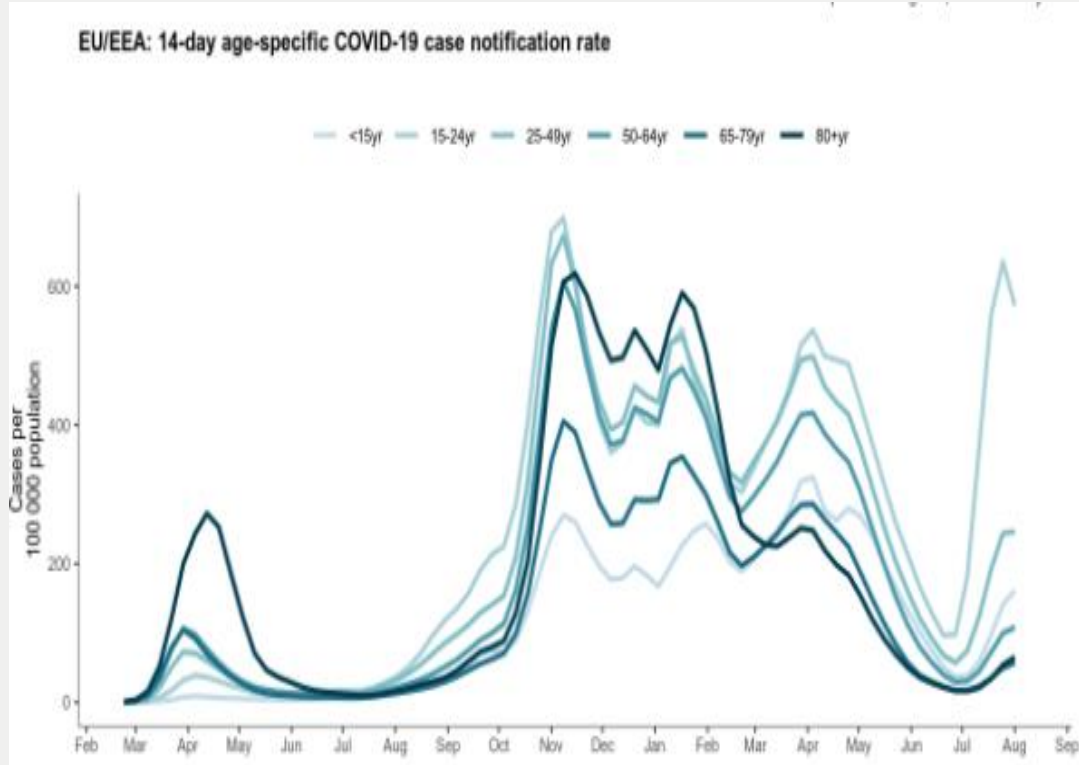
### New cases by age group in UK (cases/100k inhabitants, MM7 days)



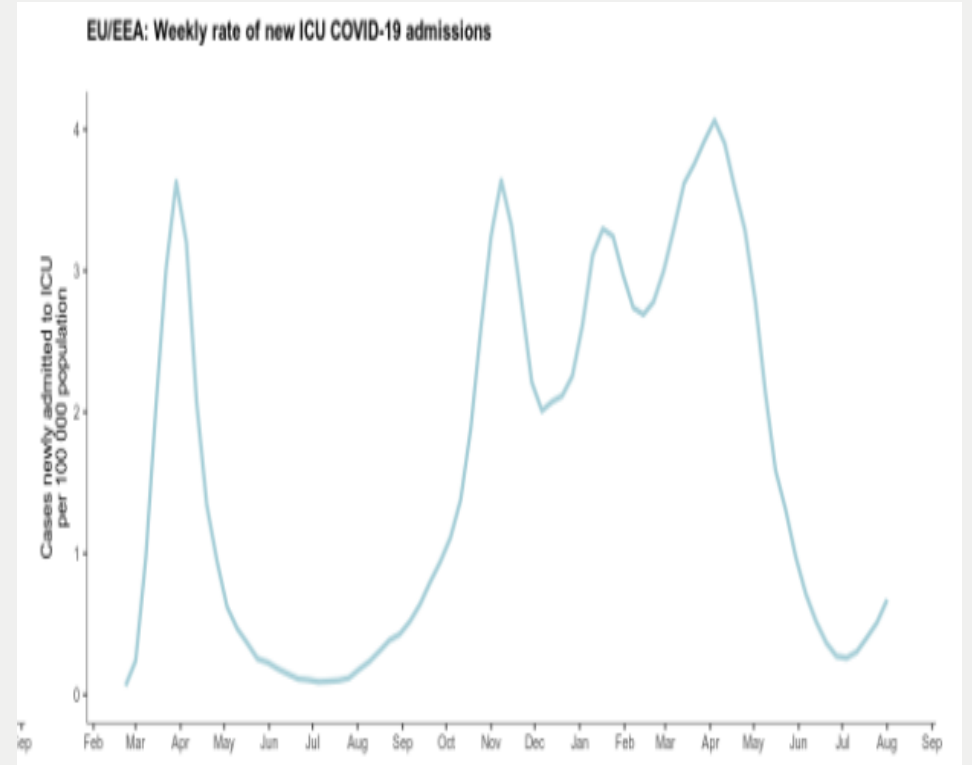
# Outbreak in Europe has been concentrated on younger people

- Except for Portugal, all European countries that had a significant increase in new cases showed a strong concentration among younger people, whose vaccination coverage was much lower. This characteristic is also behind the very small increase in hospitalizations in the current outbreak compared to the increase in the number of cases.

**New cases by age group  
(cases/100k inhabitants)**



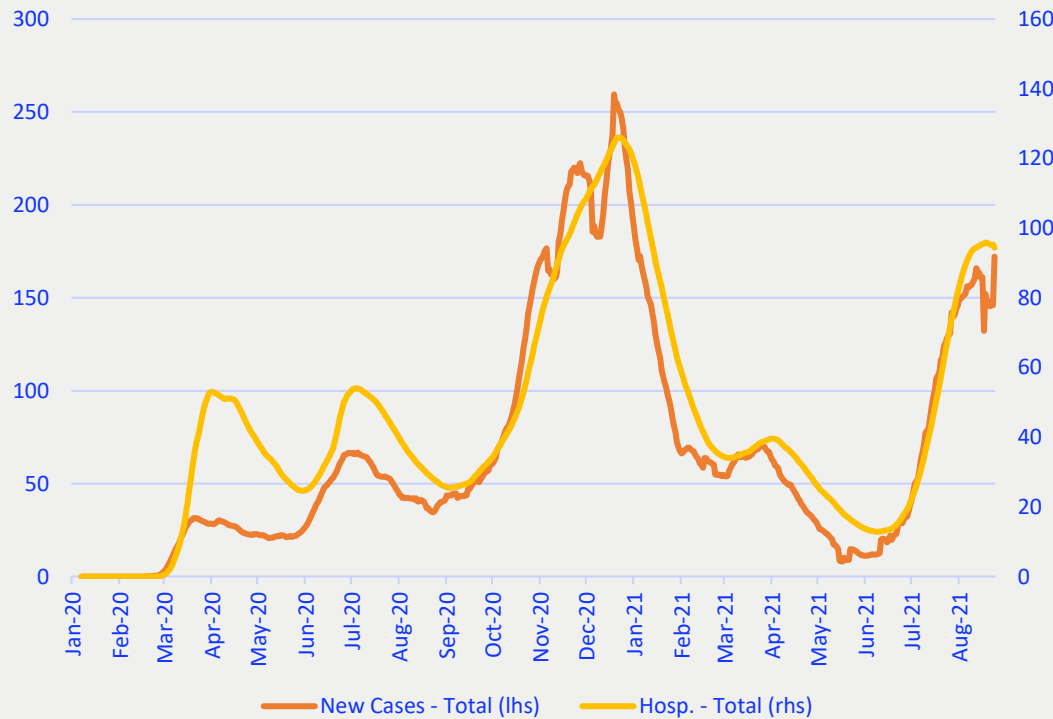
**ICU admissions in Europe  
(admissions/100k inhabitants)**



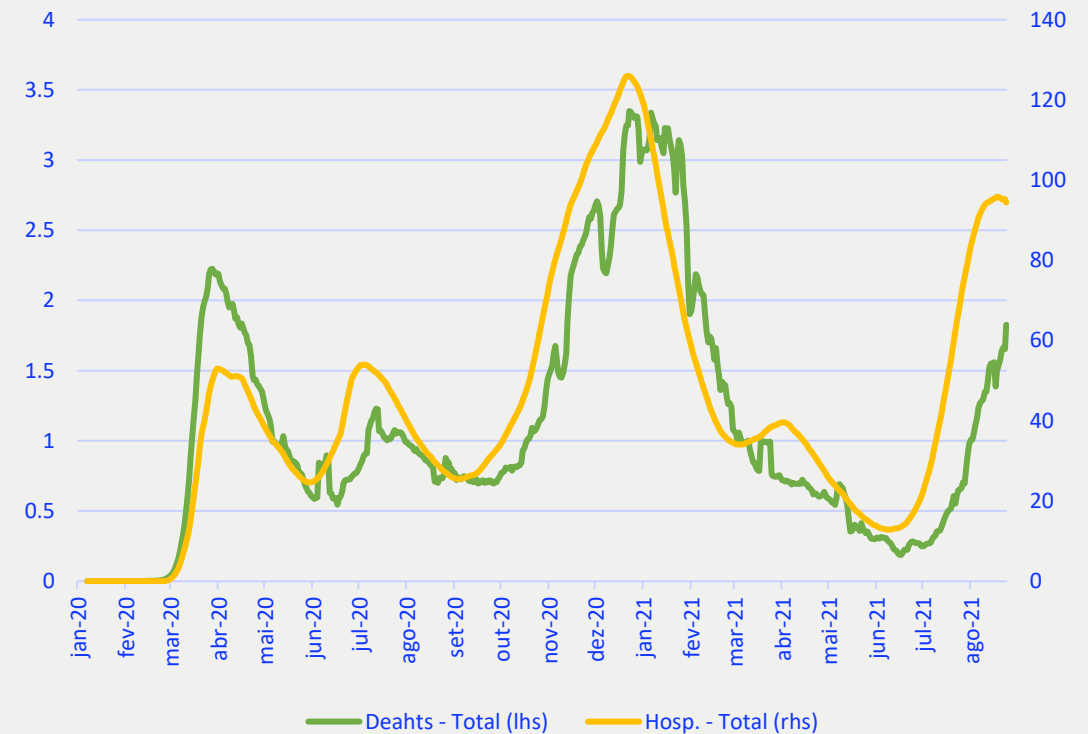
# Increase in cases and hospitalizations in the USA

- Unlike Europe, the USA shows a strong increase in hospitalizations due to the current Covid-19 outbreak. Hospitalizations increased proportionally to new cases. The number of new deaths remains under control, but most likely we will see a significant increase in the coming weeks.

**New cases and hospitalizations in the USA (thousands)**



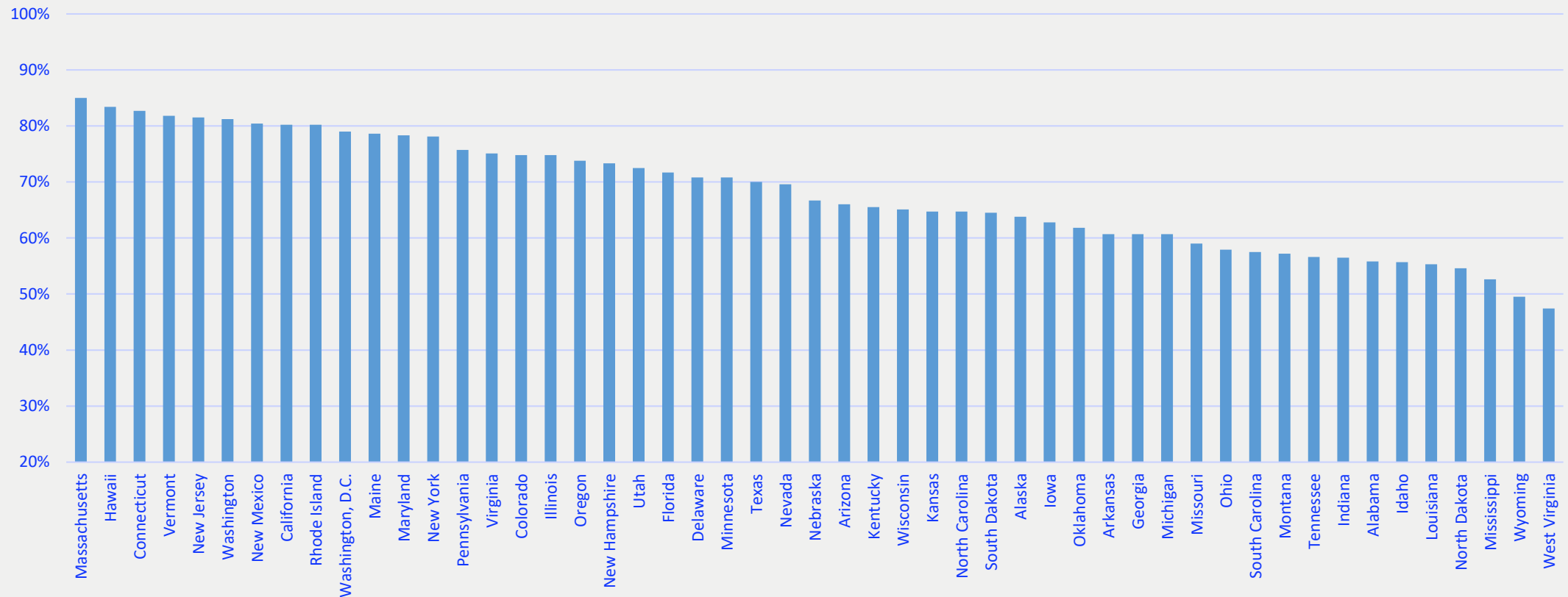
**New deaths and hospitalizations in the USA (thousands)**



# Vaccination coverage in the US varies widely across states

- Vaccination coverage in the US varies widely across US states. While MA has 80% of its population between 18-64 years old vaccinated, MS has only 39%.

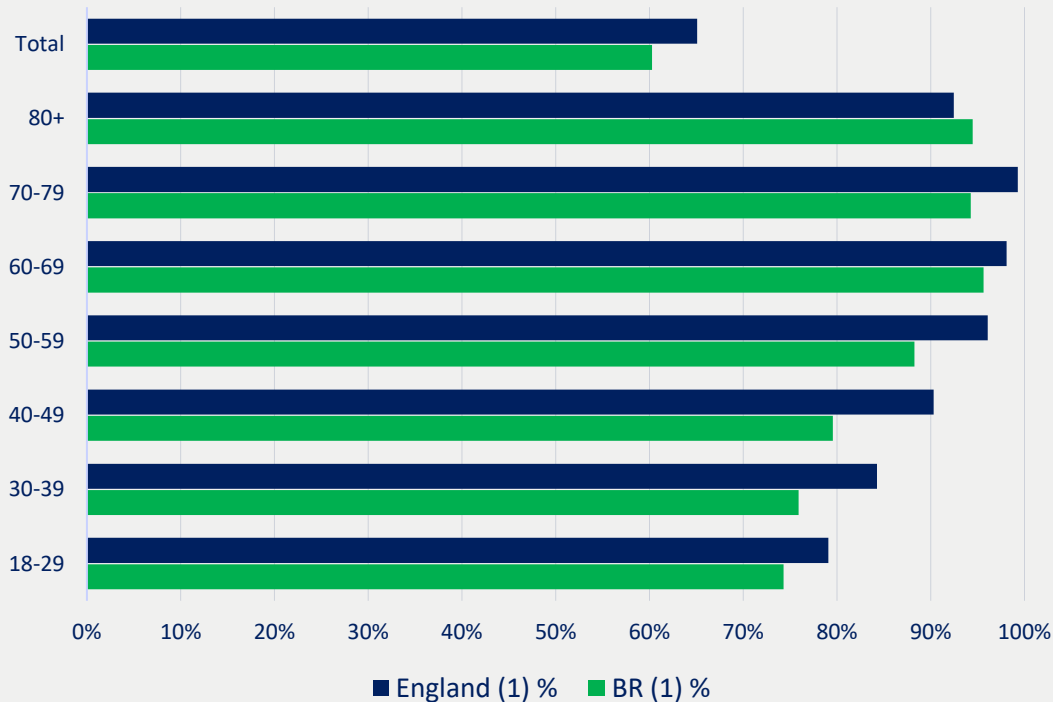
**Vaccination (at least one dose) among 18-64 years old population**



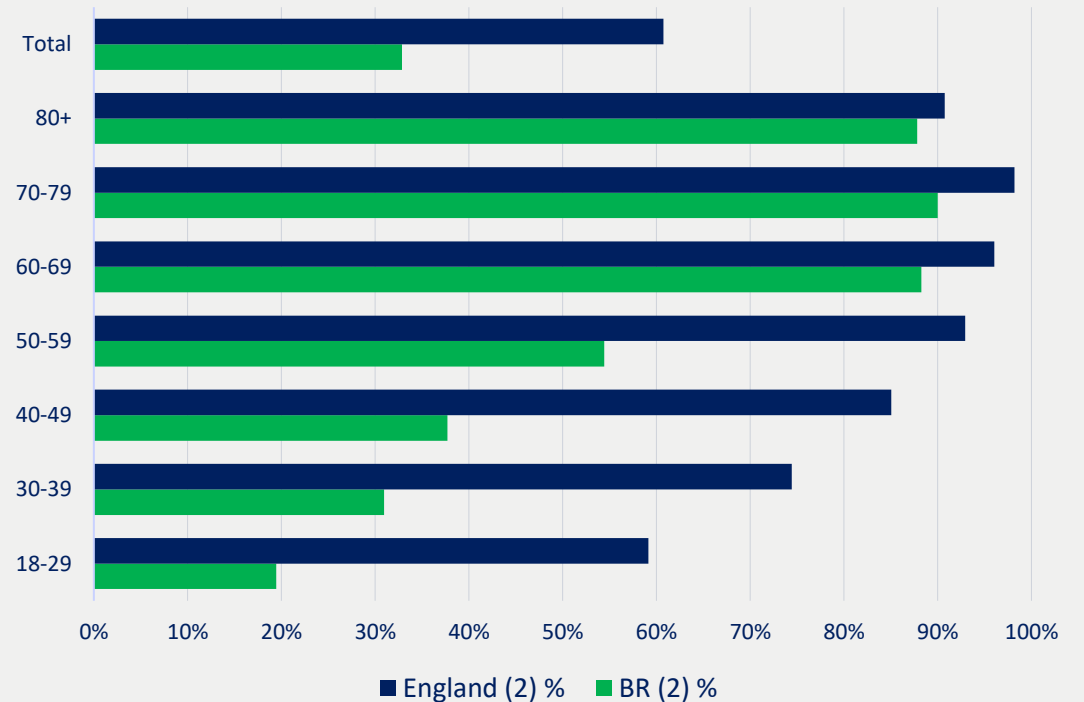
# Vaccination coverage in the UK is higher than in Brazil

- Europe had greater protection than Brazil in terms of vaccination coverage. In the UK, for example, 63% of the population has been vaccinated with at least one dose of the vaccine, while Brazil has 48%. The difference is explained by the low vaccination coverage among people under 60 for the first dose. In relation to the second dose, vaccination coverage in Europe is much higher than in Brazil.

**Vaccination coverage by age group – 1 dose  
UK vs. Brazil (% of population)**



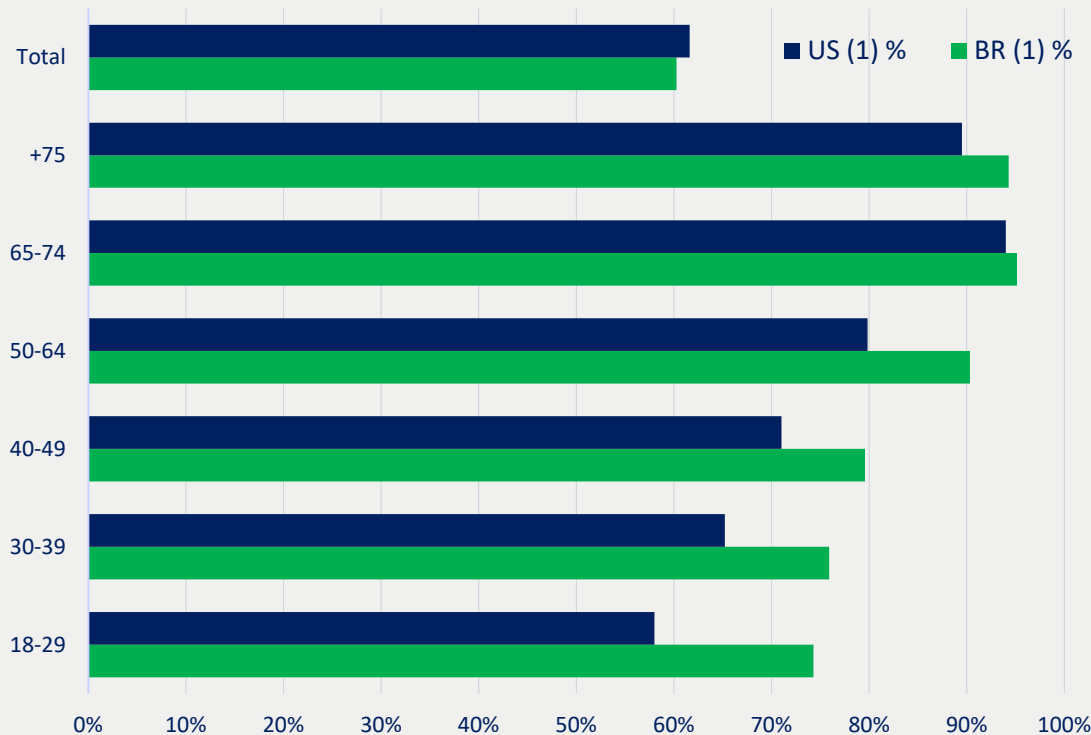
**Vaccination coverage by age group – 2 dose  
UK vs. Brazil (% of population)**



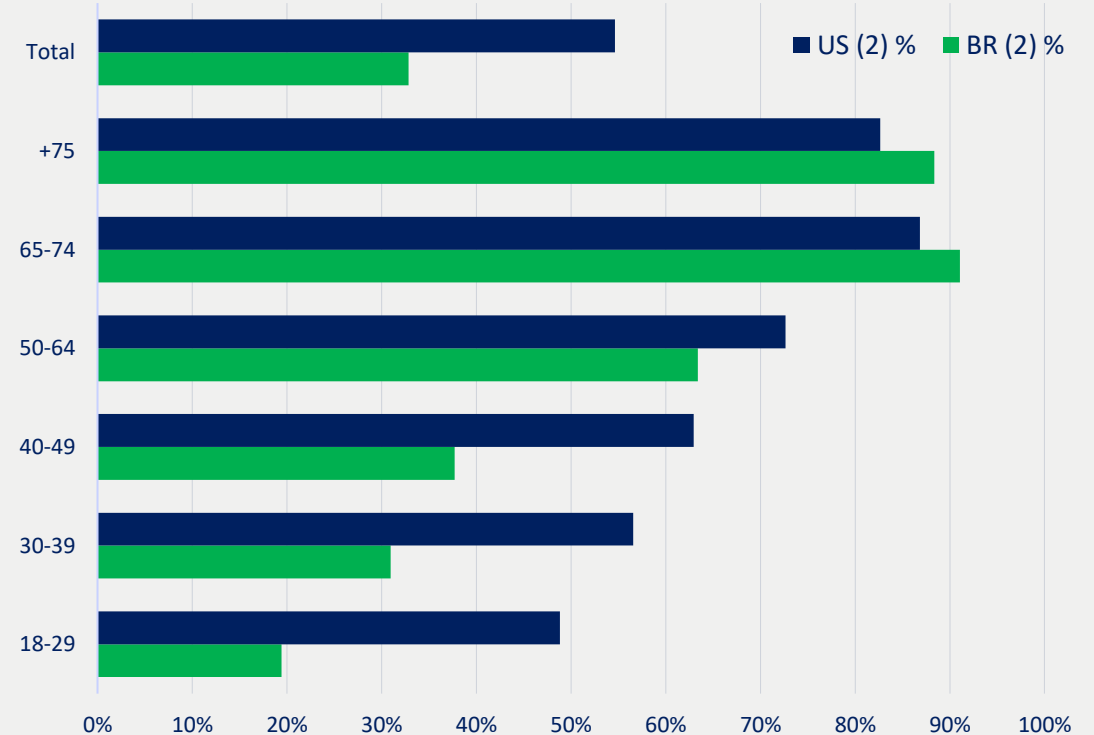
# But we cannot say the same in relation to the USA

- Vaccination coverage in the USA is higher than in Brazil even for the first dose. However, the composition is quite different. Brazil has a higher vaccination coverage than the USA for the first dose among people over 40 years old. As most hospitalizations and deaths occur in this age group, Brazil would be more protected in this metric, everything else remaining equal. In relation to the second dose, Brazil vaccinated a higher proportion of the population over 65 years old.

**Vaccination coverage by age group – 1 dose  
USA vs. Brazil (% of population)**



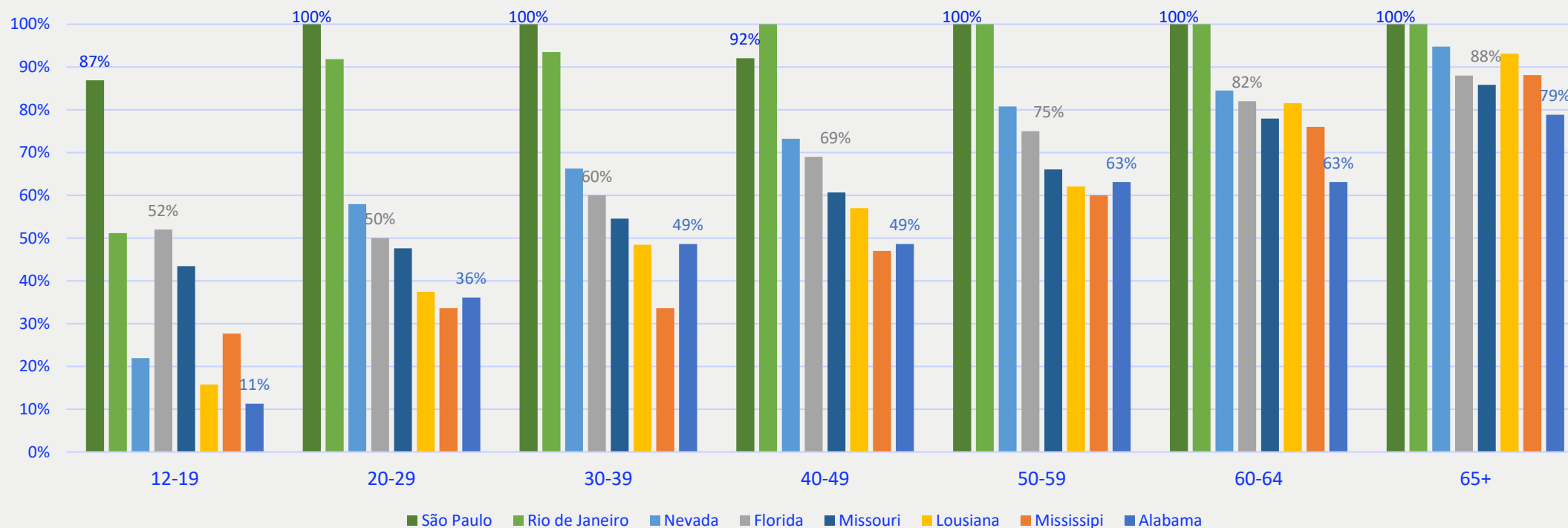
**Vaccination coverage by age group – 2 dose  
USA vs. Brazil (% of population)**



# Coverage in SP and RJ is higher than in part of the USA

- This difference is even greater when considering the states with the lowest vaccination coverage in the USA. The proportion of the population that has already been vaccinated with one dose in the older age groups in states that suffer most in the current outbreak in the USA is substantially lower than that seen in SP and RJ.

**Vaccination coverage by age group – 1 dose**  
**Selected states of Brazil and the USA (% of population)**

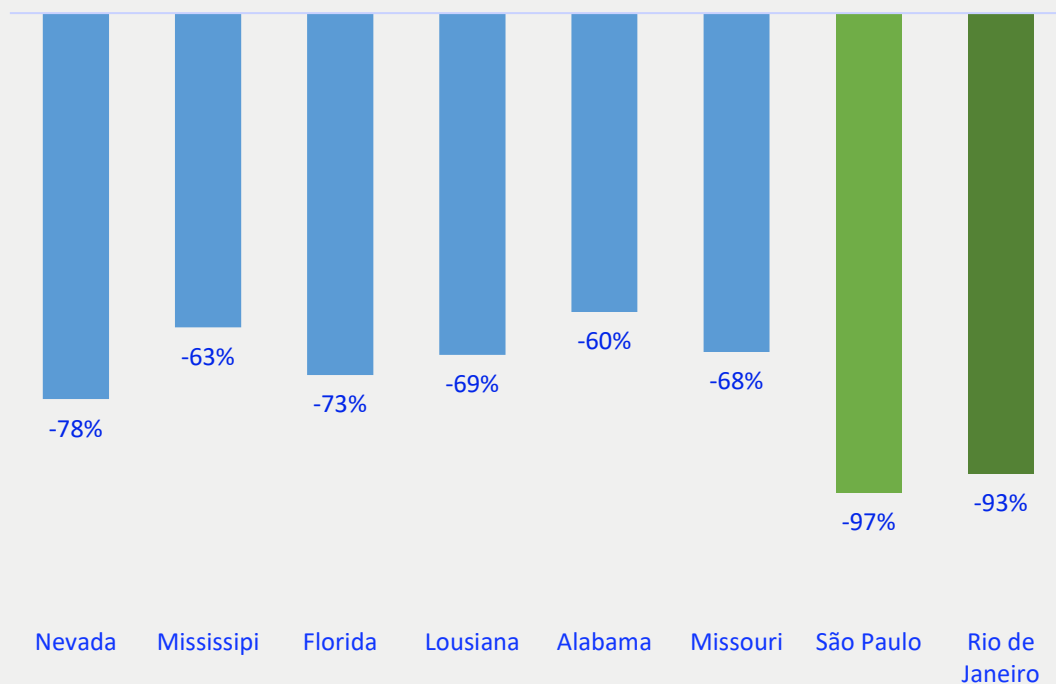


Source: Municipal Departments of RJ and SP, Health Departments of FL,NV, MO,LA and AL, Mar Asset Management

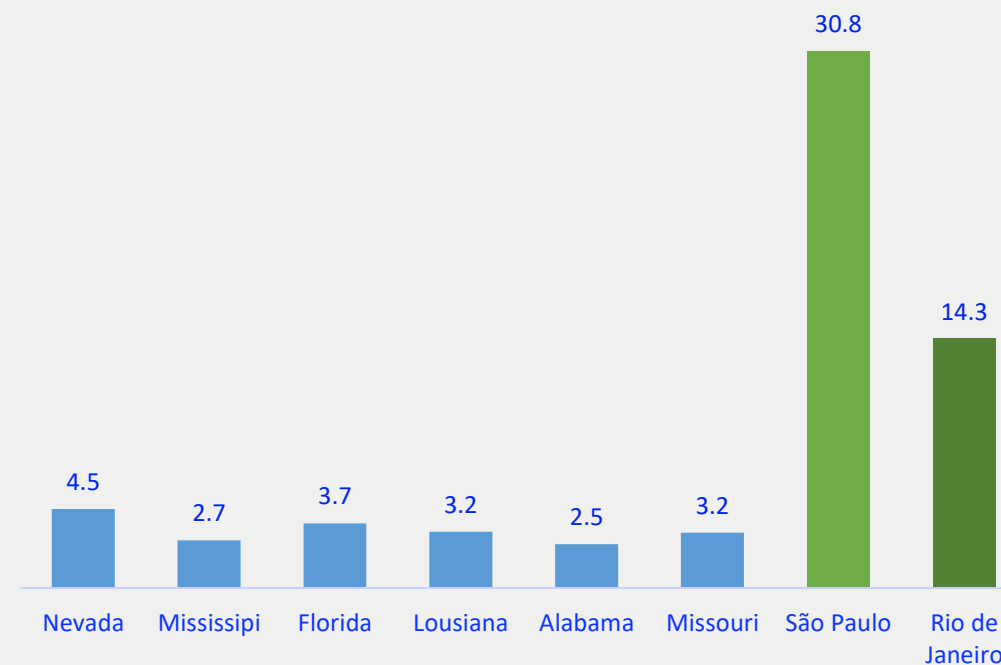
# Brazil may be more protected than part of the USA 1

- Given the above vaccination coverage and assuming that vaccine efficacy is 95% against severe cases of Covid-19, hospitalizations should be reduced by almost 90% in SP versus 53% in Alabama and Mississippi. Hospitalizations in the latter states would be slightly more than double that observed in the counterfactual without vaccination.

**Estimated reduction in hospitalizations due to vaccination (%)**



**How greater would hospitalizations be without vaccination**

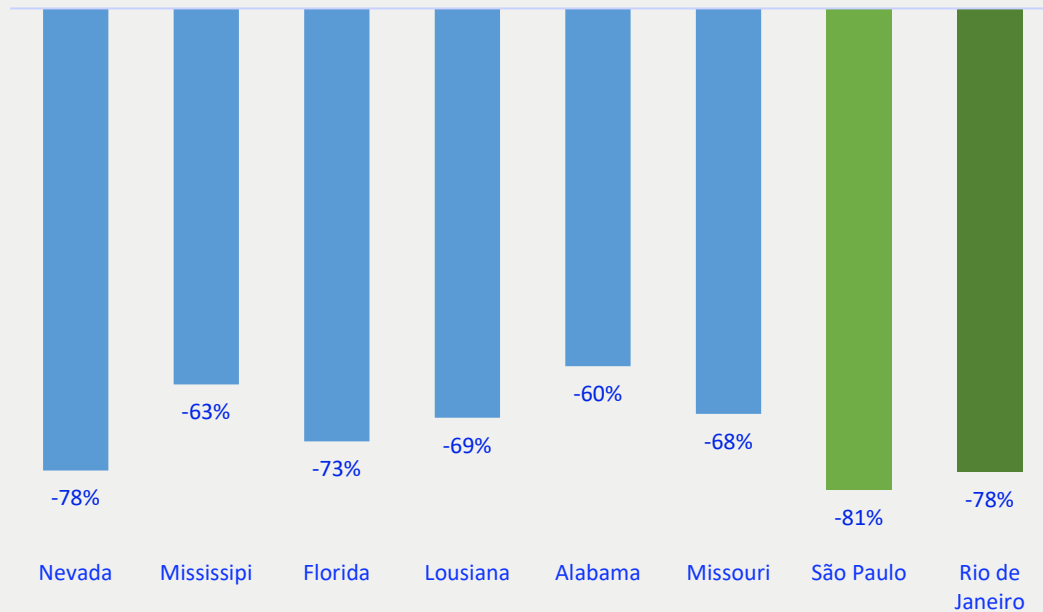




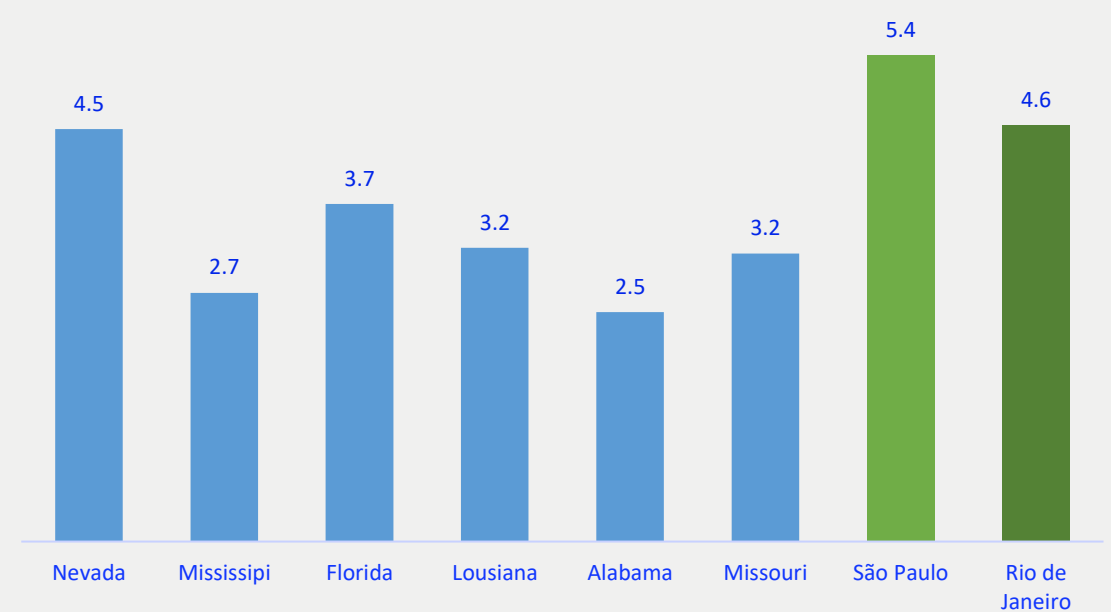
# Brazil may be more protected than part of the USA 2

- However, the overall effectiveness of the vaccine in reducing hospitalizations in Brazil is likely to be less than the 95% assumed in the calculations on the previous slide. The majority of the population over 60 years old in Brazil was vaccinated with Coronavac, which is a vaccine with lower antibody production. In addition, a large part of the population under 60 yearsold took only one dose of Astrazeneca or Pfizer. As we have seen above, the effectiveness of only one dose of these vaccines to prevent hospitalization was 80% in England compared to 96% among those taking two doses.
- Even considering 80% efficacy, vaccination coverage in RJ and SP would be sufficient to reduce hospitalizations by a greater magnitude compared to these selected US states.

**Estimated reduction in hospitalizations due to vaccination (%)**



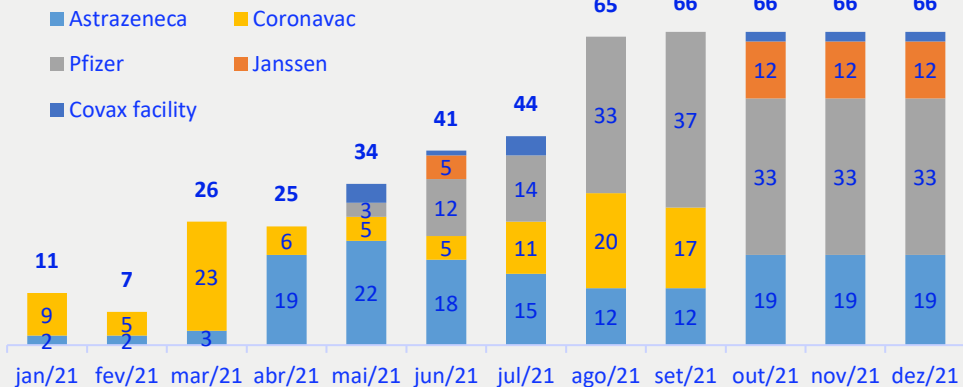
**How greater would hospitalizations be without vaccination**



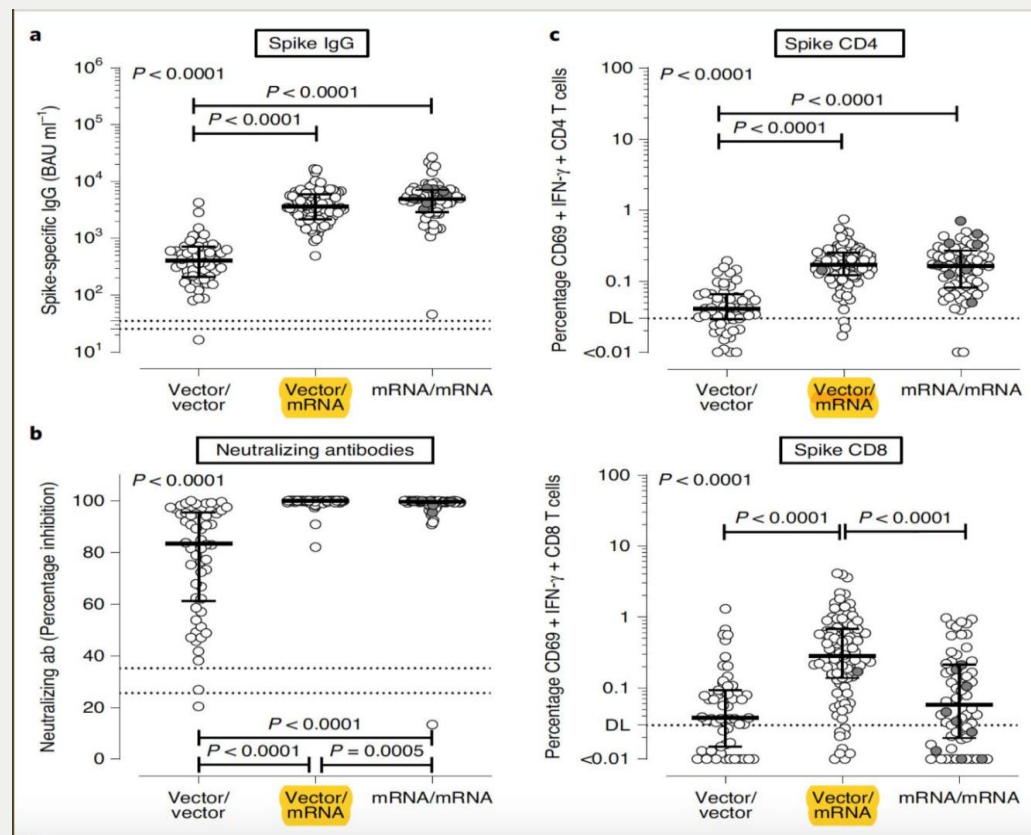
# Vaccine Combination Increases Antibody Production

- We will see in the coming months a strong increase in the supply of the Pfizer vaccine. In our view, the best way to deploy them would be as a third dose for people over 60 years old who have taken Coronavac and a second dose for those who initially took the AstraZeneca vaccine.
- There are already some studies that show that the mixture between the vaccines of AstraZeneca and Pfizer produces a greater amount of antibodies than two doses of Pfizer ([link 2](#), [link 3](#), [link 4](#)). Not only the production of antibodies, but also the production of T and B cells, which guarantee long-term protection, is greater when mixing doses of vaccines.
- Some countries, such as Germany, already offer Pfizer as a second dose for those who took AstraZeneca as their first. Turkey already offers a third dose of Pfizer to elderly people who have taken both doses of Coronavac.

## Dose Receipt Schedule (millions)



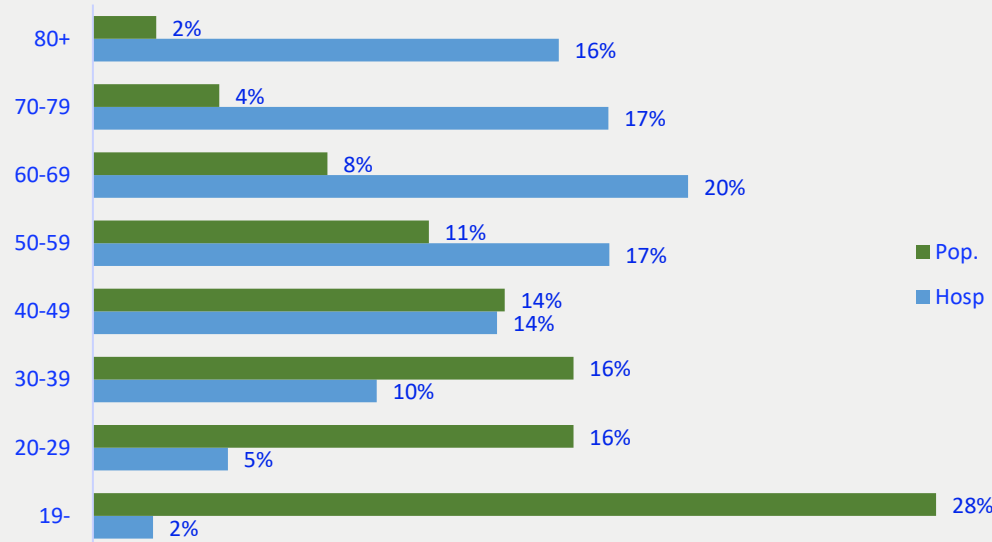
## Production of antibodies and T cells with different combinations of AstraZeneca and Pfizer vaccines



# Booster dose is a strategy that minimizes hospitalizations

- The table below shows the impact on hospitalizations of offering 3 million doses of Pfizer for different age groups and different hypotheses of increased vaccine efficacy. For example:
  - If these doses were allocated to people over 80 years old and these doses increased the efficacy among this group by more than 10pp, total hospitalizations would decrease by 1.0%.
  - If doses were allocated among people 20-29 years old and the increase in efficacy was 80pp, then hospitalizations would be reduced by 0.3%.

**Proportion of each age group in hospitalizations for Covid-19 and in the population of Brazil (%)**



**Reduction of hospitalizations by 3 million doses as a function of increased efficacy and age group (%)**

/Aumento eficácia	5%	10%	15%	25%	50%	80%
<b>Idade</b>						
19-	0.0	0.0	0.0	0.0	0.1	0.1
20-29	0.0	0.0	0.1	0.1	0.2	<b>0.3</b>
30-39	0.0	0.1	0.1	0.2	0.4	0.7
40-49	0.1	0.1	0.2	0.3	0.7	1.1
50-59	0.1	0.2	0.3	0.5	1.1	1.7
60-69	0.2	0.4	0.5	0.9	1.8	2.9
70-79	0.3	0.6	0.9	1.4	2.9	4.6
80+	0.5	<b>1.0</b>	1.6	2.6	5.2	8.3



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