

## COVID-19 Factbook

**Insights on risk of mortality and  
ICU and hospital admission per  
age group**

**MAY 15, 2020**

Insights based on official data April 30

Numbers preliminary and indicative; to be used as a basis for further research

# Our objective: enabling better cost-benefit trade offs around COVID interventions

## By creating new insights on a crucial topic: the real COVID impact per age group

- **Governments around the world are struggling to find the right set of interventions to manage the impact of COVID-19**
  - The assumption is that without interventions the health system would be overwhelmed and the death toll unacceptably high
  - However, these interventions also come at great economic and societal costs, so understanding the cost/benefit ratio is crucial
- **To understand the effectiveness of interventions to contain COVID-19, it is crucial to understand the impact of an infection**
  - We need to understand how many hospital admissions, ICU admissions and deaths we are actually preventing when we reduce the spread of the virus (in specific population groups) through an intervention
  - This will also enable us to calculate per intervention the costs that we make to prevent one hospital or ICU admission, or one death
- **Unfortunately, there is still a great deal of uncertainty and confusion on these impact numbers**
  - Estimates on mortality, ICU admissions and hospital admissions have varied greatly over time and still vary among different sources
  - Original WHO Case Fatality Rate (CFR) was estimated at 3.4%, while current CFRs in European countries vary between 4% and 15%
  - We know the actual mortality (IFR) is lower due to unreported milder cases, but not by what factor
  - We know that the elderly population has a higher risk of mortality, but not exactly how much higher
- **Our goal with this document is to provide a best-guess estimate of the real impact of a COVID-19 infection per age group**
  - Based on international official CFR data, IFR research, and with a deep dive on the situation in the Netherlands
  - This should help in ranking the COVID-19 interventions, but also in comparing what we are spending to prevent a COVID-19 death versus other the spend on other health and safety risks

Note: Case fatality rate (CFR) – the proportion of diagnosed cases of a particular medical condition that lead to death; Infection fatality rate (IFR) – the proportion of infected cases of a particular medical condition that lead to death. Similar to CFR, but adjusted for asymptomatic and undiagnosed cases

# Our five main insights on the real mortality and ICU admissions per age group

## Most important: When it comes to COVID-19 impact, averages are meaningless

- 1 The CFR in major European countries varies between 4% and 15%; the difference is mainly driven by testing and reporting**
  - Countries with more testing detect more mild cases (in all age groups) and therefore have a lower (and more realistic) CFR
  - A more important effect: more testing in high risk age groups leads to higher average CFR, as mortality is far higher in these groups
- 2 Dutch situation: 90% of deaths are in 70+ age group, 90% of ICU and hospital admissions in 50+ age groups**
  - Data shows health risks more concentrated in elderly groups than earlier media reporting ("50% of people in IC under 50") indicated
- 3 Recent international and Dutch "random sample" research indicates real mortality factor 10-20 lower than reported**
  - Number of random population samples to derive IFR (Infection Fatality Rate) suggest IFRs of ~0.5%, factor 10-20 lower than CFR
  - This would also imply that the number of real cases is a factor 10-20 higher than the officially reported cases
  - This research is preliminary: data samples are still small, not always cover all age groups, etc
- 4 Our current "best guess" for NL: ~0,5% average risk of mortality, ~0,3% ICU admission, and ~1,2% hospital admission**
  - This means that out of every 1000 real COVID-19 cases 12 would end up in the hospital, 3 in the IC, and 5 would die
- 5 Most important insight: national averages are meaningless and should not be used, since differences in age groups are huge**
  - Our estimate of the real mortality risk of a COVID infection under 50 is <0,01%, so less than 1 in 10.000 cases leads to mortality
  - For the 80+ population, we estimate this mortality risk almost 1.000 times higher, as 5-10% of cases lead to mortality
  - The real risk of being admitted to the ICU under 50 <0,1%, less than 1 in a 1.000. For 60-80 this is more than 10 times higher

# Main implications of these insights regarding the benefits of COVID-19 interventions

## As a basis for further discussion

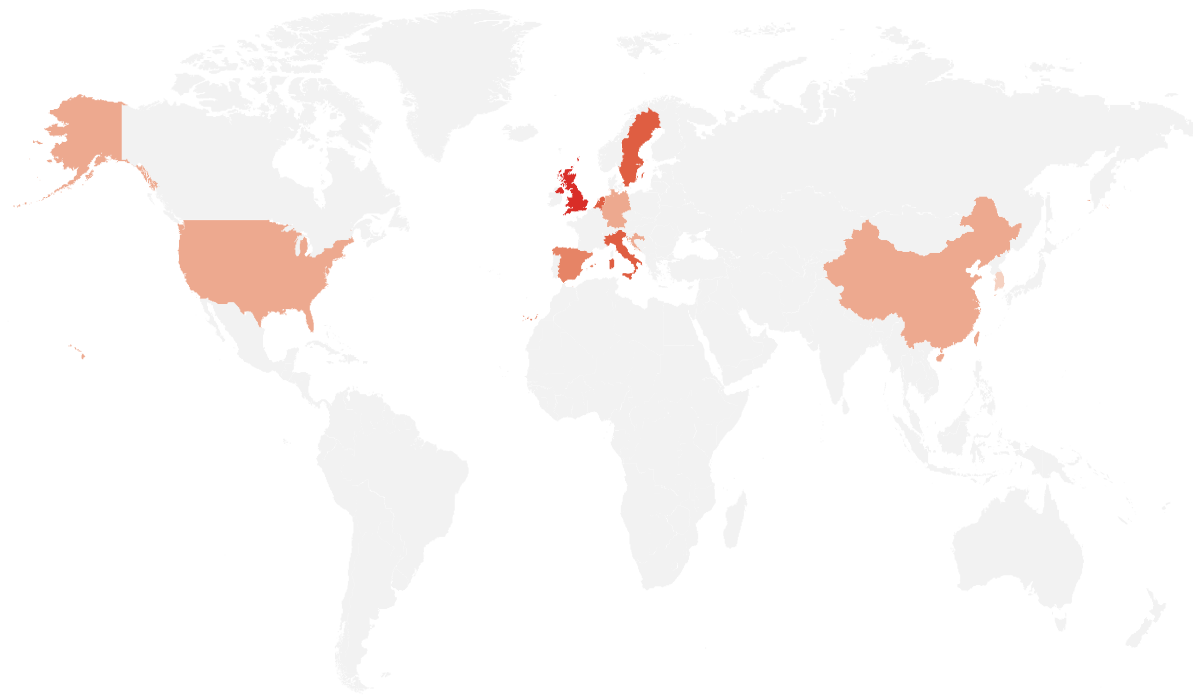
- 1 Even though the health impact of a COVID-19 infection is far less than originally thought, we will still need interventions**
  - An average risk of 0,3% ICU admissions per infection is low, but if more than 500.000 people get infected in the peak weeks, and they stay for >2 weeks, we will still need >3.000 ICU beds in those weeks, so more than our (upscaled) ICU capacity
- 2 Interventions should be strongly focused on protecting the real high risk groups: 70+ for mortality, 60-80 for ICU**
  - This might appear “common knowledge”, yet a great deal of the current interventions focus on restricting the movement of the younger (working) populations. Age is by far the most important predictor, further risk factors can be added to the analysis
- 3 Interventions aimed at younger population (under 50) mainly have indirect benefits in protecting the 60+ groups**
  - Given the low health risks for these groups even without calculations it should be apparent that the cost/ benefit ratio of interventions to protect the population under 50 from COVID are very poor compared to other health interventions
  - Main benefits of protecting the population under 50 of COVID are indirect: so they can not infect the older high risk segments
  - There is huge value in finding interventions to protect the high risk groups with less disruption to the working population
- 4 Important next step is to further refine these best guess estimates by more testing and immunity research**
  - Important to get more data, over a longer time period, with the right distribution of age groups
- 5 These insights can then be used to assess the real costs we are making to save COVID lives, and put these into perspective**
  - Versus the costs we make to protect our population from other health risks, such as other diseases, and health risks at work, traffic, environment, etc. To what extent are the economic costs we are making to prevent COVID-19 health risks proportionate?

# Details











# Mortality – CFR per country above 10% in most European countries, Germany outlier

Ratio between reported numbers on deaths and cases (CFR) across the globe shows a worrisome situation, especially in the UK, Italy, Spain and Netherlands

## Map of countries selected for CFR calculation



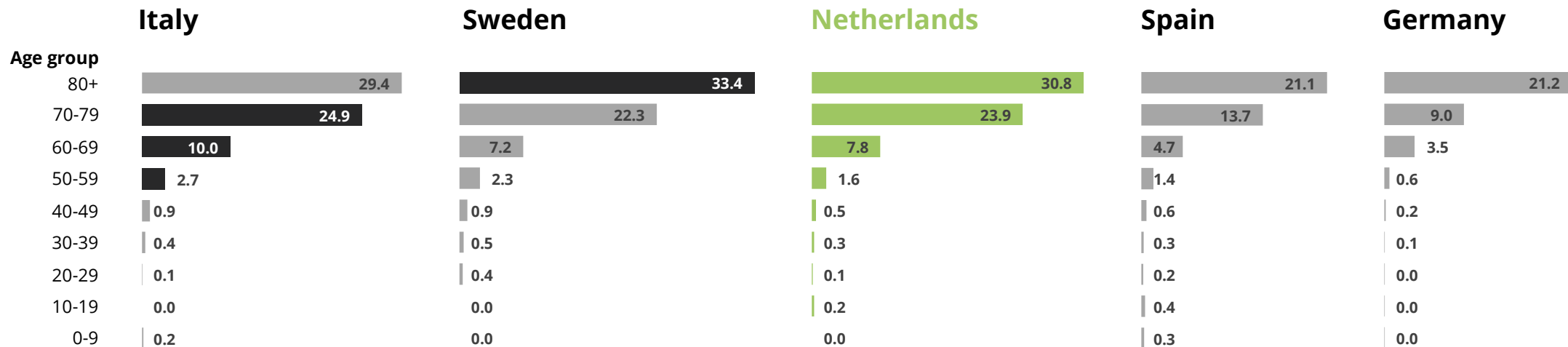
## Overview of CFR for selected countries (30 April 2020)

Country	Reported positive cases	Reported Deaths	Case fatality rate (%)
 UK	171,253	26,771	15.6%
 Italy	205,463	27,967	13.6%
 Sweden	21,092	2,586	12.3%
 Netherlands	39,305	4,794	12.2%
 Spain	213,435	24,543	10.3%
 Switzerland	29,586	1,737	5.9%
 US	1,095,023	63,856	5.8%
 China	82,862	4,633	5.6%
 Germany	163,009	6,623	4.1%
 South Korea	10,765	247	2.3%

# Mortality (CFR) in all countries almost completely driven by deaths in 60+ age groups

Available official data shows fatality risk for 60-70 age group more than 10 times higher than below 60 population, and for 80+ group this is more than 30 times higher

## CFR per age group per country (based on available information published)



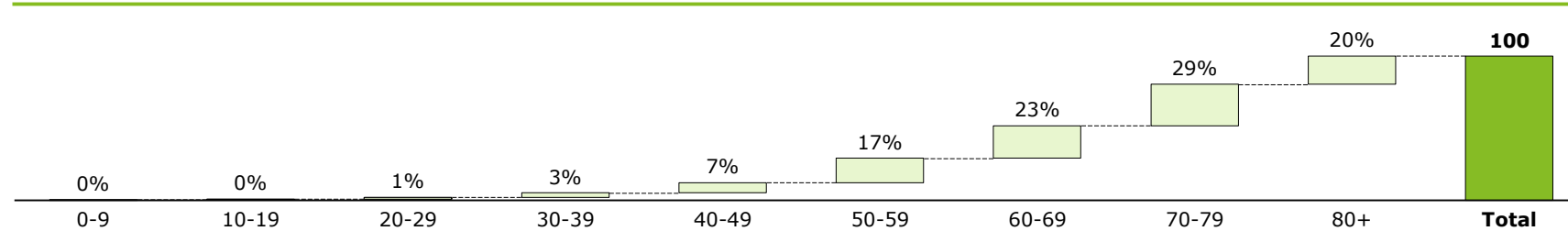
Used small multiples  
to facilitate better  
comparisson

Note: Italy based on 23<sup>rd</sup> April, Spain data based on 30<sup>th</sup> April, available information only, Germany data based on 28<sup>th</sup> April, approximated  
Source: Worldometers.info, localchef.IT, Ministry of Health Spain, RIVM, Statista, Deloitte analyses on 30<sup>th</sup> April

# Netherlands: distribution of hospital & ICU admissions and deaths by age groups

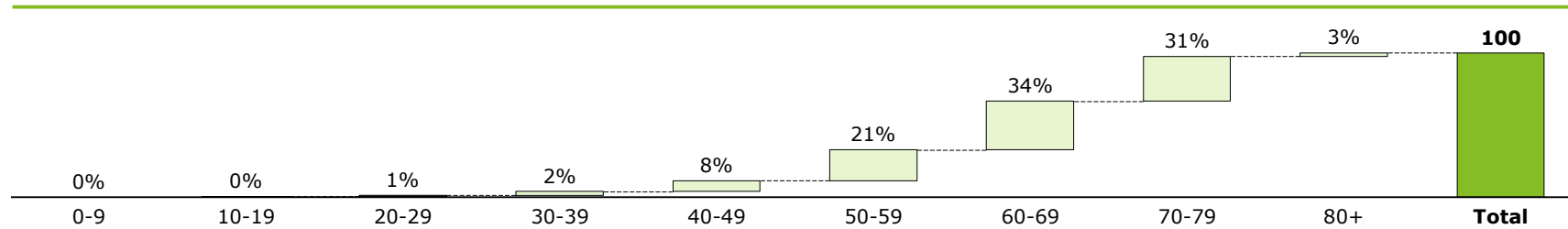
Around 90% of deaths is in 70+ age group, less than 1% in age groups below 50.  
Almost 90% of ICU admissions is between 50 and 80 (and much less in 80+ group)

## Hospital admissions distribution by age groups



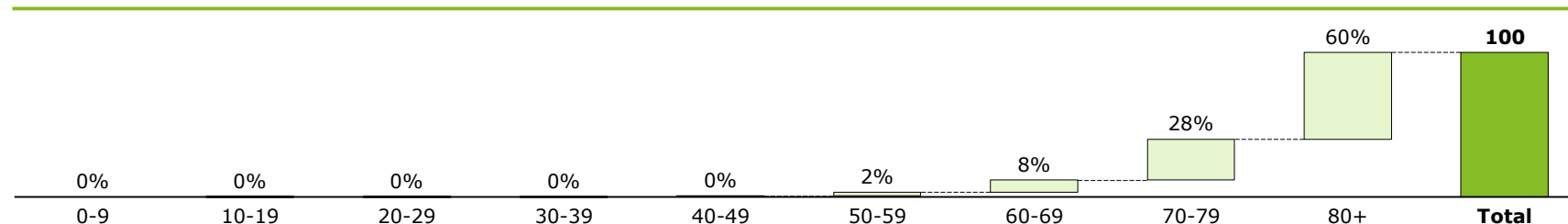
~90% of hospital admissions were patients in age groups 50+

## ICU admissions distribution by age groups



~90% of ICU admissions were in 50-80 age group (80+ in NL significantly less due to patient choices)

## Deaths distribution by age groups



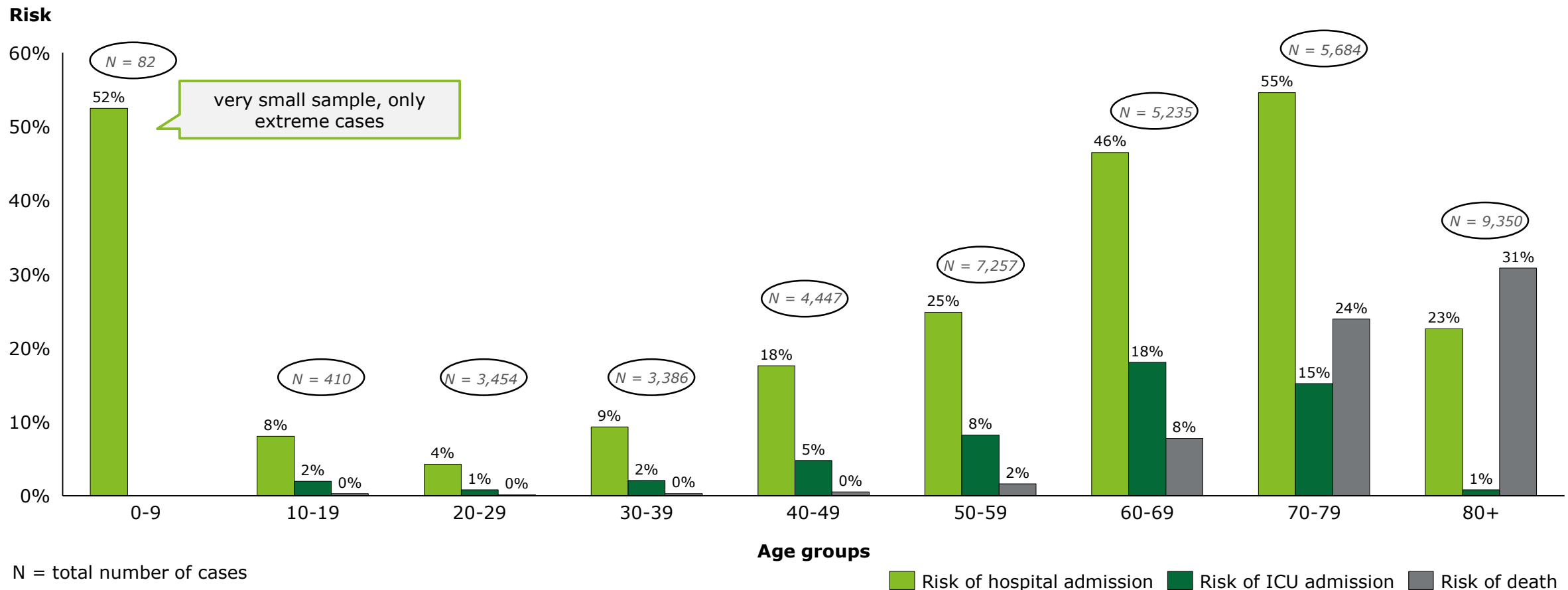
~90% of deaths is above 70, vast majority in 80+ group, less than 1% under 50 age group

Source: RIVM data extracted on 30<sup>th</sup> April 2020, Deloitte analyses



NL: risk of hospital & ICU admission and death per reported case per age group  
Official data suggests risk of ICU admission and especially mortality strongly skewed to older age groups

### Risk of hospital admission, ICU admission and death per age group



Source: RIVM data extracted on 30<sup>th</sup> April 2020, Deloitte analyses

# Real mortality risk is expected to be far lower than the official CFR rates

## Recent IFR studies indicate mortality $\sim 0.5\%$ , which is $>10$ times lower than the CFR

### Main findings

- Case Fatality Rate (CFR) will always be **overrated** due to undiagnosed cases (especially those with no to mild symptoms)
- Aside from undiagnosed cases, a **further distortion of CFR** is caused by relatively more testing of the highest risk population
  - These groups with high testing penetration (e.g. 60+) have a far higher risk of mortality than the untested cases in the younger population, resulting in overestimation of the average population mortality when not correcting for age
  - E.g. in Italy, Spain and NL  $>50\%$  of official cases are in 60+ population;  $>$  factor 3 per capita more than 60- population
  - By contrast: Germany did less than 30% of tests in 60+ population, providing more even per capita distribution
- We would therefore expect CFR to be more **reliable**, and **lower**, when countries test **more intensively** and/or test **more equally distributed** over the population age groups
- Since even in the highest testing countries the CFRs will be overestimated, **random population samples** to see who is infected and thus deriving Infection Fatality Rate (IFR) **should be more reliable**. However, current samples are still small and insights thus preliminary
- From the first insights from the IFR studies, such as Sanquin in NL, one can deduct that **the real infection cases are much higher** and thus the **mortality rate is much lower**: most studies point to IFR around **0.5%**
- More importantly, based on the combination of testing, cases and CFR distribution per age group, combined with IFR, we can estimate the **real risk per age group for mortality** (and following from that, also hospital and ICU admissions)

Note: Case fatality rate (CFR) – the proportion of diagnosed cases of a particular medical condition that lead to death; Infection fatality rate (IFR) – the proportion of infected cases of a particular medical condition that lead to death. Similar to CFR, but adjusted for asymptomatic and undiagnosed cases

# Understanding the underreported cases – Sanquin research (I/II)

Sanquin research suggests the estimated real number of infections in the Netherlands is much higher than the reported cases

## Overall findings

- In collaboration with the National Institute of Public health and the Environment (RIVM), blood bank Sanquin has announced on March 20<sup>th</sup> that it will study **herd immunity against COVID-19**
- Starting from April, Sanquin will start measuring **antibodies in all blood donors** during a period of approximately **one week**
- By testing all blood samples from all over the Netherlands for a short period of time, **a representative sample** of Dutch population aged between **18-69** will be obtained
- The test results will be used to give a picture of the **spread of the virus** in the Netherlands; the study will be ongoing
- The first results published by Sanquin and RIVM (8 April) show the following:

Age group	Sample size	# of people with antibodies	Probability (%)
<b>18-30</b>	688	25	3.6%
<b>31-40</b>	494	17	3.4%
<b>41-50</b>	752	26	3.5%
<b>51-60</b>	1,234	38	3.1%
<b>61-70</b>	1,030	29	2.8%
<b>71-80</b>	10	0	(0%)

Source: Sanquin.org, RIVM, Zorg.nu, Deloitte analyses

## What we can derive from the Sanquin study

- The conclusions we draw from this sample study have the following assumptions and limitations:
  - Sample is **small** and we assume the selection is **completely random**
  - We have **no data** on the age groups **<18** and **>70**
  - We assume there is **no big delay** between antibodies and time of infection
- Using the next available sample data from Sanquin would increase the **reliability** of the results

*Nevertheless, we used this study to derive the following insights and calculate the underreporting factor in the next slide as the **first best-guess calculation...***

- About **3% of blood donors** in the Netherlands have developed antibodies against COVID-19
- This implies **3% of the Dutch population** has had a COVID-19 infection before 8<sup>th</sup> of April, which is a factor of 20 times more than the official cases around that period suggests

## Understanding the underreported cases – Sanquin research (II/II)

Based on this our estimate is that on 8<sup>th</sup> April there were already ~400,000 COVID-19 infections in the Netherlands and now the number is close to 1 million cases

### Prediction of underreporting factor and real number of positive cases in NL (sampling day of 8 April 2020)

Sanquin age groups <sup>1</sup>	0-9	10-19	18-30 <sup>1</sup>	31-40	41-50	51-60	61-70	71-80	80+	Total
Sample size	n/a	n/a	688	494	752	1,234	1,030	10	n/a	4,208
# of positive cases	n/a	n/a	25	17	26	38	29	n/a	n/a	135
Probability of being tested positive	n/a	n/a	3.63%	3.44%	3.46%	3.08%	2.82%	n/a	n/a	3.21%
Population NL in that range	1,783,519	2,008,187	2,201,748	2,108,424	2,260,507	2,507,642	2,089,414	1,522,559	798,436	17,280,435
# of estimated positive cases in that range	n/a	n/a	80,005	72,557	78,156	77,221	58,828	n/a	n/a	358,280
Reported cases on 8 <sup>th</sup> April	58	147	1,330	1,597	2,072	3,511	3,114	3,861	4,830	20,520
Underreporting factor (estimated/ reported cases)	65	65	60	45	38	22	19	10	5	17
Estimated positive cases on 8 <sup>th</sup> April (underreporting factor * reported cases)	3,770	9,555	80,005	72,557	78,156	77,221	58,828	38,610	24,150	405,377
Reported cases on 30 <sup>th</sup> April	82	410	3,454	3,386	4,447	7,257	5,235	5,684	9,350	39,305
Estimated real positive cases on 30 <sup>th</sup> April (assuming underreporting factor remains the same)	5,330	26,650	207,773	153,837	167,741	159,610	98,897	56,840	46,750	923,429

Due to the unavailable samples in the Sanquin study, we assume that the underreporting factor is larger for 0-20 groups and smaller for 70+ groups; the rationale is that currently in NL only older patients with severe symptoms are being tested for COVID-19.

Note: 1) Age group in Sanquin differs slightly, for simplification and standardization purpose we assume the data for 18-30 applies to 20-29

Source: RIVM, Deloitte analyses

# "Real" mortality, hospital and ICU admissions in Netherlands – First estimate

Applying Sanquin insights about the real cases, we can assess real risk per age group

## Overview of analyses in relation to real cases in the Netherlands (30 April 2020)

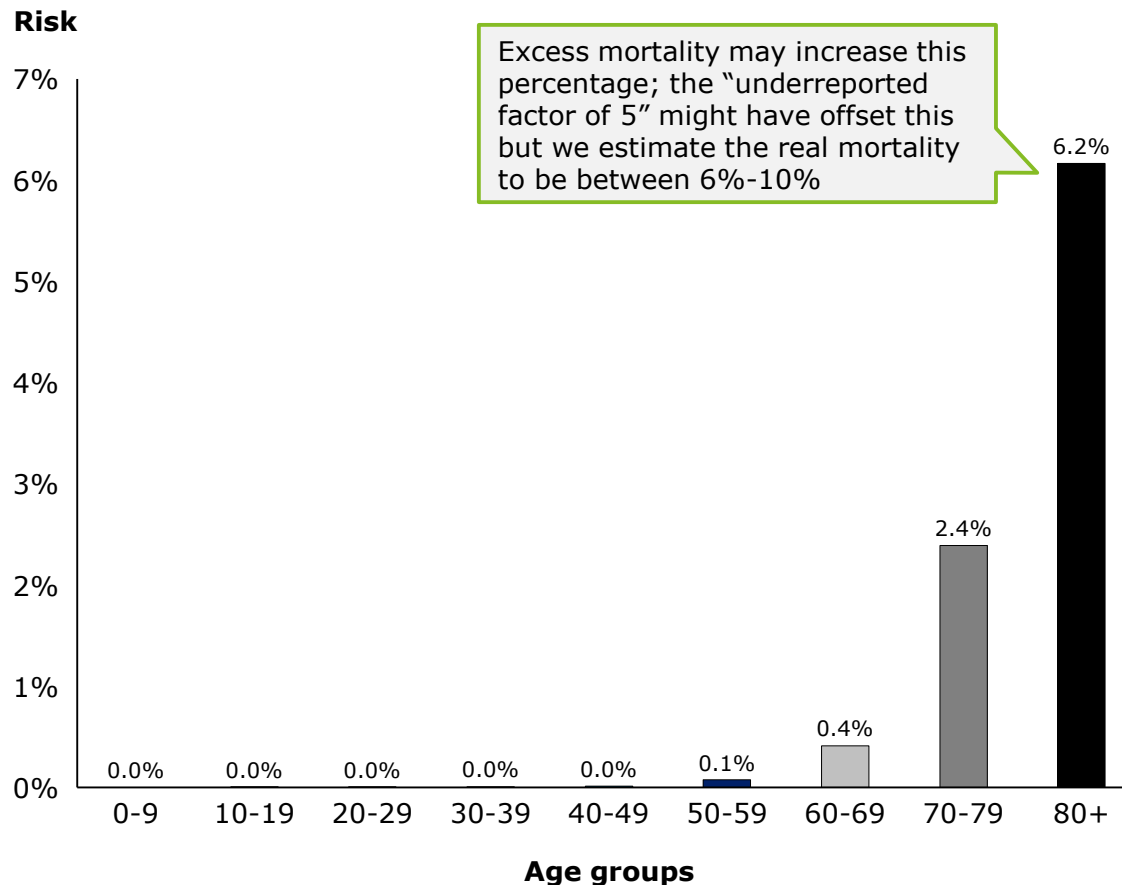
Age groups	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80+	Total
<b>Officially reported cases</b>	82	410	3,454	3,386	4,447	7,257	5,235	5,684	9,350	<b>39,305</b>
<b>Official hospital admissions</b>	43	33	147	315	782	1,800	2,434	3,101	2,113	<b>10,768</b>
<b>Confirmed ICU cases</b>	0	8	26	69	211	596	943	861	73	<b>2,787</b>
<b># of deaths</b>	0	1	3	9	21	116	406	1,358	2,880	<b>4,794</b>
<b>% of hospital admissions</b>	52.44%	8.05%	4.26%	9.30%	17.58%	24.80%	46.49%	54.56%	22.60%	<b>27.40%</b>
<b>% of ICU admissions</b>	0.00%	1.95%	0.75%	2.04%	4.74%	8.21%	18.01%	15.15%	0.78%	<b>7.09%</b>
<b>CFR per age group</b>	0.00%	0.24%	0.09%	0.27%	0.47%	1.60%	7.76%	23.89%	30.80%	<b>12.20%</b>
<b>Estimated real positive cases on 30<sup>th</sup> April</b>	5,330	26,650	207,773	153,837	167,741	159,610	98,897	56,840	46,750	<b>923,429</b>
<b>Estimated "real" hospital admissions</b>	0.81%	0.12%	0.07%	0.20%	0.47%	1.13%	2.46%	5.46%	4.52%	<b>1.17%</b>
<b>Estimated "real" ICU admissions</b>	0.00%	0.03%	0.01%	0.04%	0.13%	0.37%	0.95%	1.51%	0.16%	<b>0.30%</b>
<b>Estimated IFR</b>	0.00%	0.00%	0.00%	0.01%	0.01%	0.07%	0.41%	2.39%	6.16%	<b>0.52%</b>

Source: RIVM data extracted on 30<sup>th</sup> April 2020, Deloitte analyses

# COVID-19 Mortality (IFR) in the Netherlands: estimated “real” risk per age group

Risk of death for age group <50 is less than 0.01%, for 80+ group >6%

## Risk of death per age group (%)



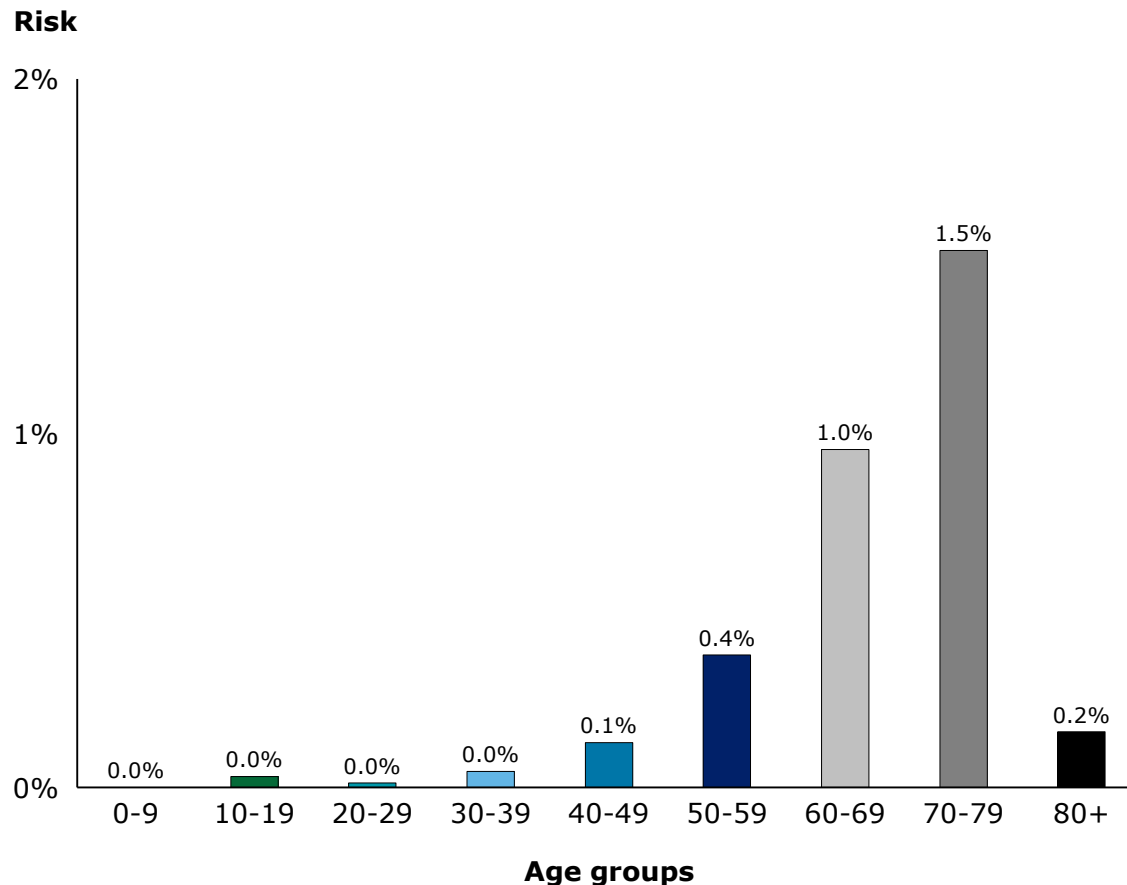
## Observations and conclusions

- Based on our analysis, overall **real chance of mortality for COVID-19 is ~0.5%**, and that average is driven almost exclusively by higher rates in the older age segments
- The chance of dying due to a COVID infection under 50 is less than 1 in 10.000**, far less even for the younger age groups
- From 60 the risk of mortality jumps significantly, 5 times higher** than the group 50-60. The same “**factor 5 increase**” we see for the 70-80 age group, with an estimated real mortality risk of 2,4%
- Highest risk age group is 80+**, with a **mortality risk more than 100 times higher** than the population under 60, and more than 1.000 higher than the population under 50

# COVID-19 ICU admission in the Netherlands: estimated “real” risk per age group

ICU admission risk for under 50 group less than 0,1%, for 60-80 group >1%

## Risk of being admitted to ICU per age group (%)



Source: RIVM, Deloitte analyses

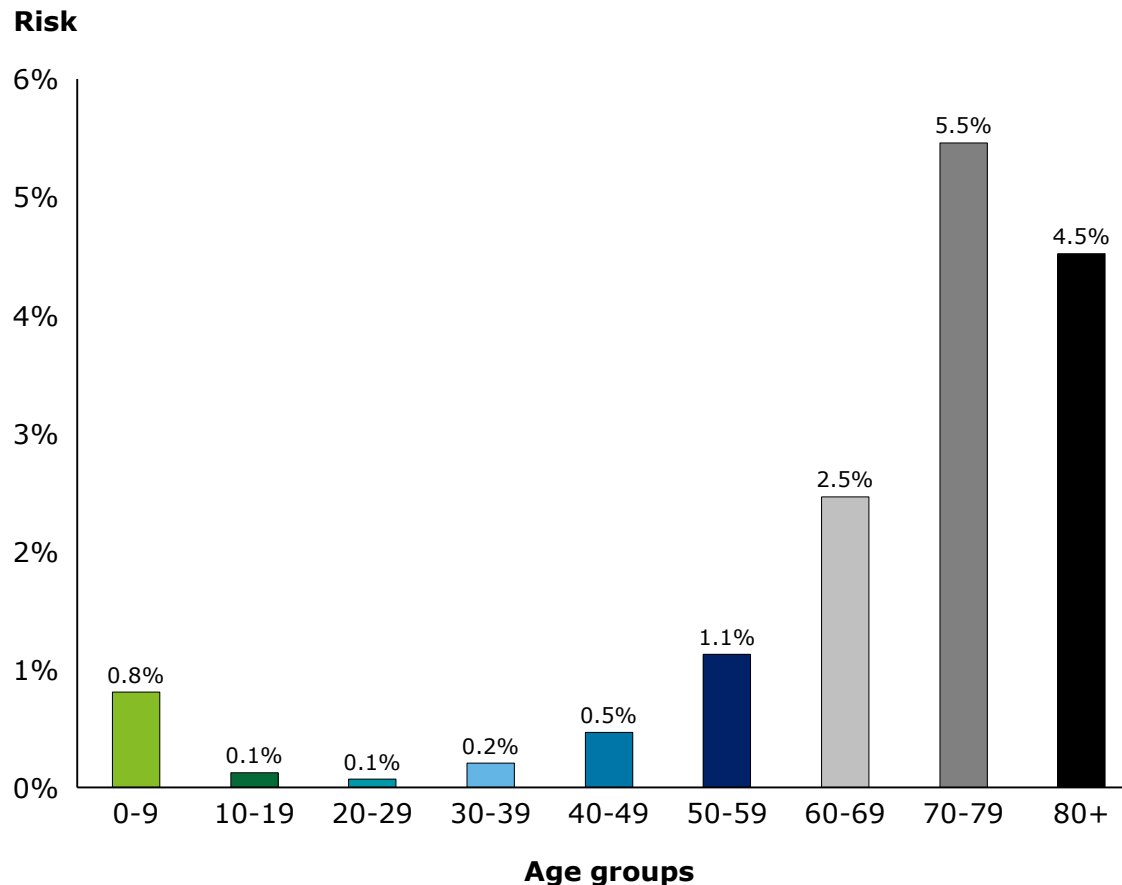
## Observations and conclusions

- Based on our analysis, overall **real chance of being admitted to the ICU for COVID-19 is less than 0.5%**, and that average is driven mostly by higher rates in the older age segments
- The chance of being admitted to the ICU if you are under 50 is less than 0,1%, so **less than 1 in 1.000 COVID-19 infections under 50 will end up in the hospital**, for the group younger than 30 even less than 1 in 10.000
- **Highest risk group is the group between 60-80**, who have a chance of **1-1,5%** of being admitted to the ICU when diagnosed with COVID-19. 80+ age group in the Netherlands often does not get admitted to ICU
- This still means, that even in the highest risk group **less than 1 in 50 patients** getting COVID-19 will end up in the ICU

# COVID-19 Hospital admissions in the Netherlands: estimated “real” risk per age group

Hospitalization risk of under 50 age group lower than 0.5%, for 70+ group >5%

## Risk of being admitted to hospital per age group (%)



Source: RIVM, Deloitte analyses

## Observations and conclusions

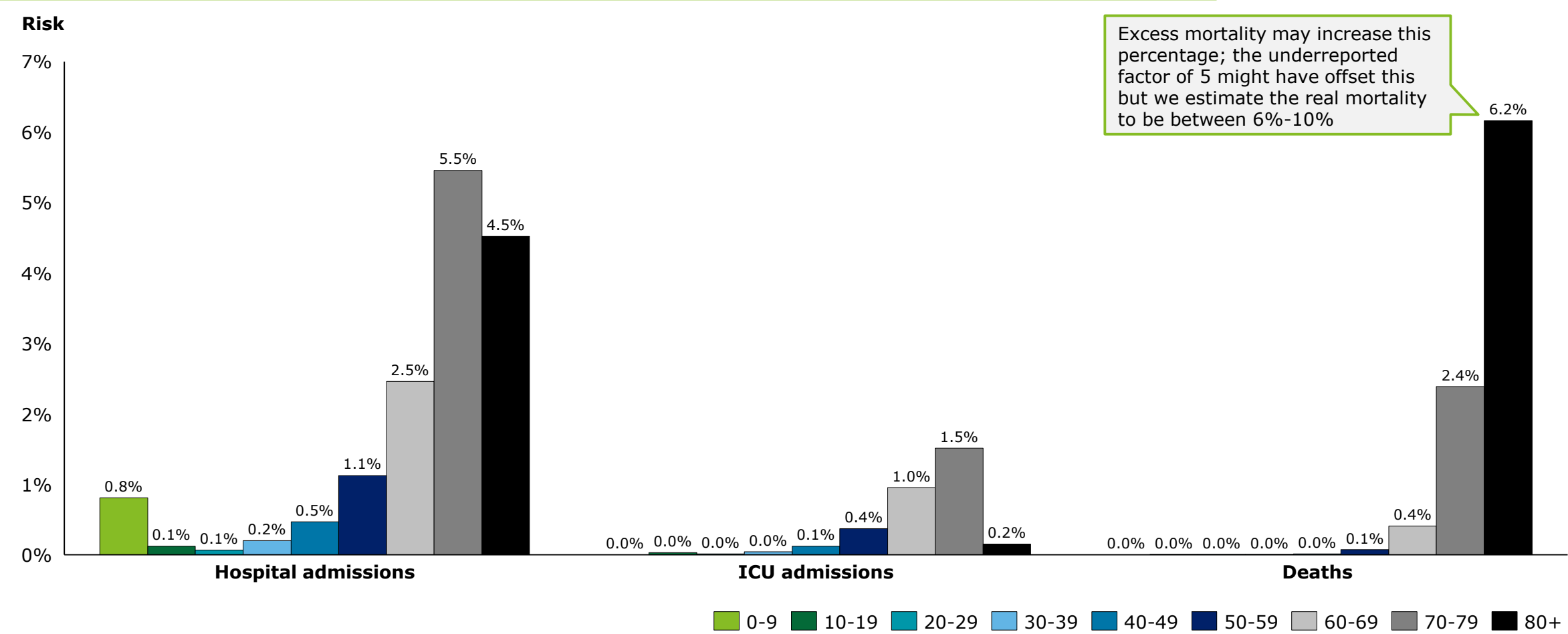
- Based on our analysis, overall **real chance of being hospitalized for COVID-19 is 1.17%**, and that average is driven mostly by higher rates in the older age segments
- The chance of being hospitalized if you are under 50 is less than 0.5%, so **less than 1 in 200 COVID-19 infections under 50 will end up in the hospital**, with relatively high amount in the youngest age group
- From 40-50 to 50-60 risk doubles, and doubles again for 60-70 and 70+; **70+ group runs more than 10 times higher risk of being hospitalized** than group under 50
- According to official cases the **highest risk** of being hospitalized lies in the age group 70-79 at **~54.6%**, whilst based on our analysis it is **~5.5% of real cases**



Overview: best-guess real risk of mortality, hospital & ICU admission per age group

Below 50 group less than 0.1% chance of ICU admission and less than 0.01% chance of death, risks for 60+ population significantly higher

Overview of best-guess real risk of hospital & ICU admission and death per age group



Source: RIVM data extracted on 30<sup>th</sup> April 2020, Deloitte analyses

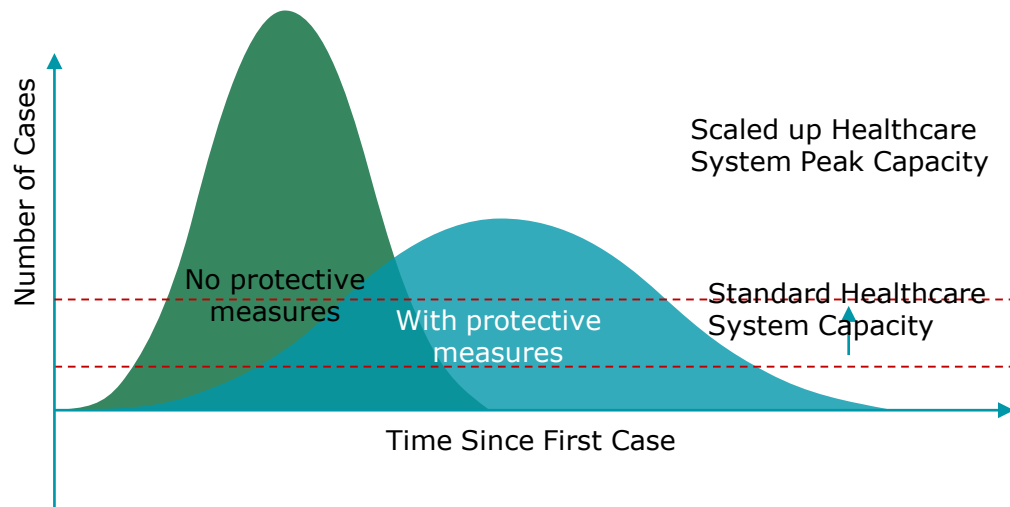
# Appendix

# COVID-19 Factbook: details on the key infection and infection impact variables

## Infection rate and infection impact- hospital admissions, ICU admissions, mortality

### Core concept: Flattening the Curve

#### Delaying the developments of outbreaks "flatten the curve"



Source: Deloitte analyses

### Core concept: Flattening the Curve

- **The infection rate** : how fast does the virus spread. Without interventions, how many people would be infected (based on the  $R_0$ ), in what time, and thus with what peak?

- **The (health) impact: hospital admissions, ICU admissions and mortality**

- As a percentage of real COVID-19 cases, not just the reported
- Important to differentiate population in age and underlying conditions

- **Capacity: how much of this impact (hospital and ICU admissions) can we handle?**

- What is our ICU capacity and to what level can we scale up?
- Focus on ICU as the typical first bottleneck (and the main reason for the "flatten the curve" discussion)

- **Time (ending)**: when do you achieve "**herd immunity**", when will there be a **vaccine** or drug, is there a "natural break" for the virus, e.g. in summer months?

# COVID-19 Factbook- understanding the real risk of mortality, hospital and ICU admission

## COVID-19 related news-reported deaths numbers can appear confusing

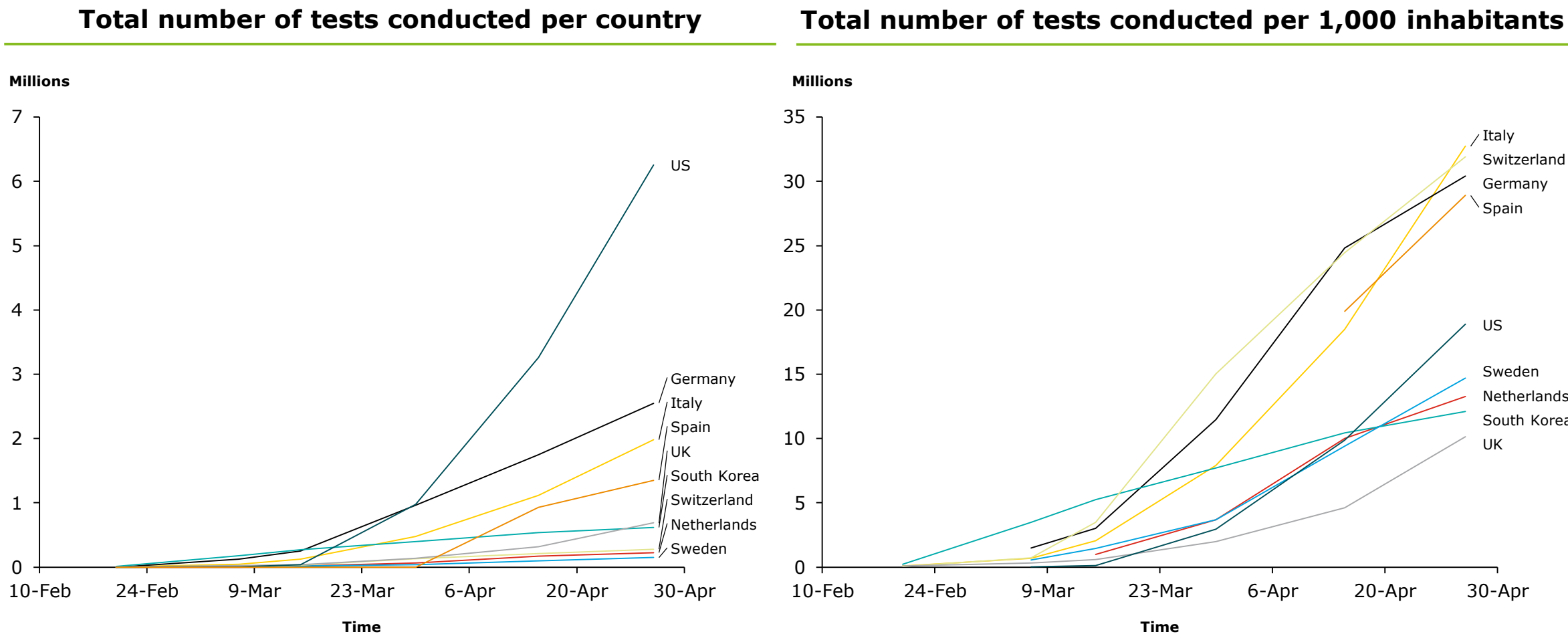


- Insight in the **real risk** of COVID-19 **hospital and ICU admission** and **mortality** is crucial to determine the **cost/ benefit of different interventions**
- However, there is still much **uncertainty** and **confusion** on this real impact
- The **COVID-19 pandemic** dated back to December 2019 originated in Wuhan, China, has currently affected **212** countries and over **3.5 million** cases, **248K** deaths world-wide as of 4<sup>th</sup> May, 2020 (so official mortality ~7%)
- Original **WHO estimate of mortality (Case Fatality Rate)** was **3,4%** of cases
- Current reporting in most European countries (dividing reported deaths by reported cases) suggests mortality (CFR) above **5%** or even above **10%**
- However, this is a vast **overestimation of mortality**, due to a high number of **underreported** (milder) cases. This is mainly driven by the **low number of tests** available in specific countries, so tests are focused on groups with **worst symptoms and highest risk** of mortality
- The same overestimation principle applies to the percentage of **hospital admissions** and **ICU admissions** due to underestimation of actual cases, especially in younger groups
- Based on countries who do **more intensive testing**, and especially recent **"random samples"**, we can get to a better estimate of the **Infection Fatality Rate**, which includes not only the reported but also unreported cases
- Based on this logic we cannot only **estimate true mortality risk per age group**, but also **risk of hospital and ICU admission**

Source: Worldometers.info (4th May 2020), Deloitte analyses

# Mortality – Testing sizes per country

Below shows the total number of COVID-19 tests conducted per country

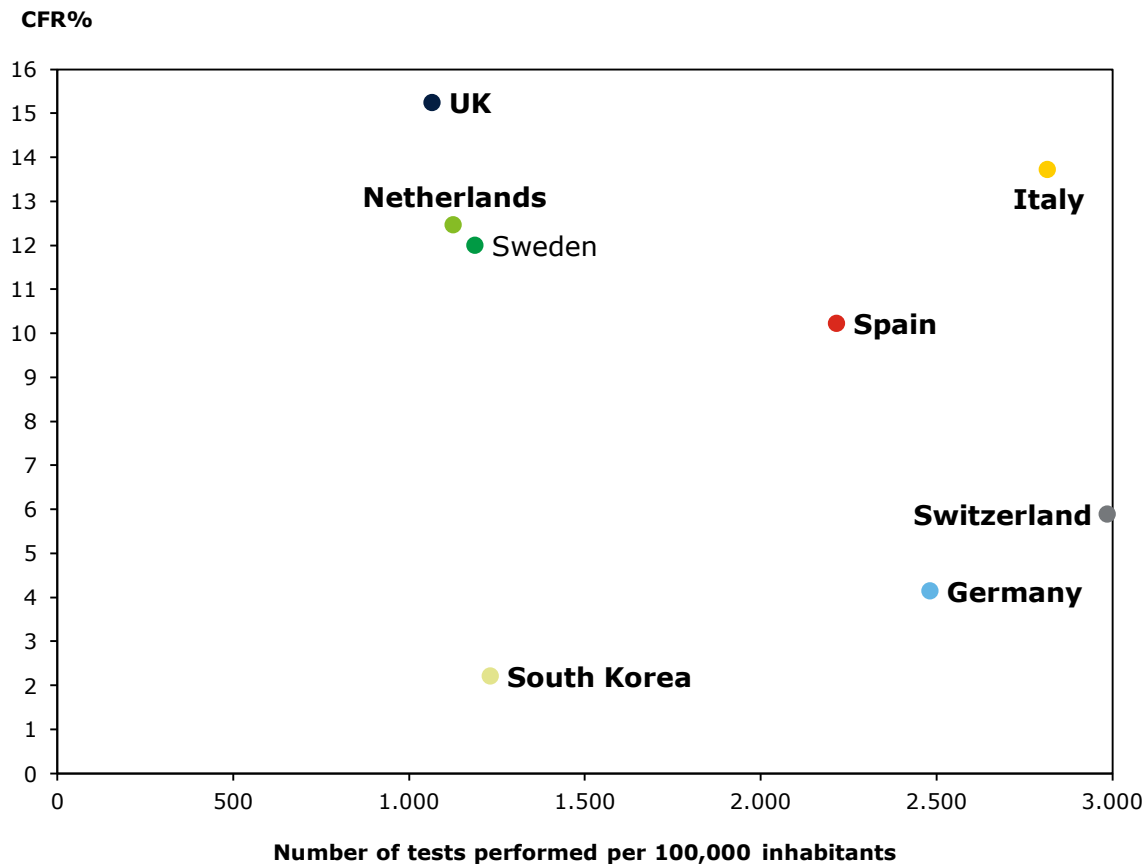


Source: Ourworldindata.org extracted on 30th April

# Mortality – CFR and its correlation with testing

Countries with more testing and tests more evenly distributed over population show significantly lower CFR

## Testing in relation to CFR







## Observations and conclusions

- Netherlands conducts **too few tests** and also skewed to the **high risk older age groups**
- Switzerland and Germany conduct more tests and have lower CFR
- Although Italy and Spain conduct more tests, the samples are strongly over-represented in the older age groups (see next slide)
- If we assume that the positive cases were normally distributed amongst different age groups, the CFR differences would be much smaller, detailed data see the following slides

# Mortality – CFR across countries per age group (I/II)

Overall country CFR strongly driven by deaths in 70+ segment

Overview of deaths split by age groups





		0-9	10-19	20~29	30-39	40~49	50-59	60~69	70-79	80+	Total
 <b>Italy<sup>1</sup></b>	Total reported cases	1,304	2,146	8,963	13,137	22,767	32,524	25,707	27,615	42,862	177,025
	Reported deaths in the age group	2	0	7	48	203	861	2,576	6,882	12,609	23,188
	CFR in the age group	<b>0.15%</b>	<b>0.00%</b>	<b>0.08%</b>	<b>0.37%</b>	<b>0.89%</b>	<b>2.65%</b>	<b>10.02%</b>	<b>24.92%</b>	<b>29.42%</b>	<b>13.10%</b>
	Average weighted CFR (cases)	<b>0.00%</b>	<b>0.00%</b>	<b>0.00%</b>	<b>0.03%</b>	<b>0.11%</b>	<b>0.49%</b>	<b>1.46%</b>	<b>3.89%</b>	<b>7.12%</b>	<b>13.10%</b>
 <b>NL</b>	Total reported cases	82	410	3,454	3,386	4,447	7,257	5,235	5,684	9,350	39,305
	Reported deaths in the age group	0	1	3	9	21	116	406	1,358	2,880	4,794
	CFR in the age group	<b>0.00%</b>	<b>0.24%</b>	<b>0.09%</b>	<b>0.27%</b>	<b>0.47%</b>	<b>1.60%</b>	<b>7.76%</b>	<b>23.89%</b>	<b>30.80%</b>	<b>12.20%</b>
	Average weighted CFR (cases)	<b>0.00%</b>	<b>0.00%</b>	<b>0.01%</b>	<b>0.02%</b>	<b>0.05%</b>	<b>0.30%</b>	<b>1.03%</b>	<b>3.46%</b>	<b>7.33%</b>	<b>12.20%</b>
 <b>Spain<sup>2</sup></b>	Total reported cases	694	1,258	11,540	19,558	30,572	37,555	30,930	29,979	48,320	210,406
	Reported deaths in the age group	2	5	22	55	174	523	1,445	4,119	10,172	16,517
	CFR in the age group	<b>0.29%</b>	<b>0.40%</b>	<b>0.19%</b>	<b>0.28%</b>	<b>0.57%</b>	<b>1.39%</b>	<b>4.67%</b>	<b>13.74%</b>	<b>21.05%</b>	<b>7.85%</b>
	Average weighted CFR (cases)	<b>0.00%</b>	<b>0.00%</b>	<b>0.01%</b>	<b>0.03%</b>	<b>0.08%</b>	<b>0.25%</b>	<b>0.69%</b>	<b>1.96%</b>	<b>4.83%</b>	<b>7.85%</b>
 <b>Germany<sup>3</sup></b>	Total reported cases	2,658	6,528	22,317	22,317	22,317	32,190	15,140	15,140	17,730	156,337
	Reported deaths in the age group	1	1	6	12	44	186	526	1,368	3,763	5,907
	CFR in the age group	<b>0.04%</b>	<b>0.02%</b>	<b>0.03%</b>	<b>0.05%</b>	<b>0.20%</b>	<b>0.58%</b>	<b>3.47%</b>	<b>9.04%</b>	<b>21.22%</b>	<b>3.78%</b>
	Average weighted CFR (cases)	<b>0.00%</b>	<b>0.00%</b>	<b>0.00%</b>	<b>0.01%</b>	<b>0.03%</b>	<b>0.12%</b>	<b>0.34%</b>	<b>0.88%</b>	<b>2.41%</b>	<b>3.78%</b>

Note: <sup>1</sup> Italy based on 23<sup>rd</sup> April <sup>2</sup>Spain data based on 30<sup>th</sup> April, available information only <sup>3</sup>Germany data based on 28<sup>th</sup> April, approximated  
Source: Worldometers.info, localchef.IT, Ministry of Health Spain, RIVM, Statista, Deloitte analyses on 30<sup>th</sup> April

# Mortality – CFR across countries per age group (II/II)

If we would weigh age group CFR not against reported cases but population distribution CFRs over countries would be lower and with less variation

Overview of deaths split by age groups

		0-9	10-19	20~29	30-39	40~49	50-59	60~69	70-79	80+	Total
 <b>Italy<sup>1</sup></b>	Population in the age group	5,090,482	5,768,874	6,201,270	7,074,218	9,242,654	9,352,231	7,337,210	5,962,533	4,330,074	60,359,546
	% of distribution	8.43%	9.56%	10.27%	11.72%	15.31%	15.49%	12.16%	9.88%	7.17%	100%
	CFR in the age group	<b>0.15%</b>	<b>0.00%</b>	<b>0.08%</b>	<b>0.37%</b>	<b>0.89%</b>	<b>2.65%</b>	<b>10.02%</b>	<b>24.92%</b>	<b>29.42%</b>	<b>13.10%</b>
	<b>Average weighted CFR (population)</b>	<b>0.01%</b>	<b>0.00%</b>	<b>0.01%</b>	<b>0.04%</b>	<b>0.14%</b>	<b>0.41%</b>	<b>1.22%</b>	<b>2.46%</b>	<b>2.11%</b>	<b>6.40%</b>
 <b>NL</b>	Population in the age group	1,783,519	2,008,187	2,201,748	2,108,424	2,260,507	2,507,642	2,089,414	1,522,559	798,436	17,280,435
	% of distribution	10.32%	11.62%	12.74%	12.20%	13.08%	14.51%	12.09%	8.81%	4.62%	100%
	CFR in the age group	<b>0.00%</b>	<b>0.24%</b>	<b>0.09%</b>	<b>0.27%</b>	<b>0.47%</b>	<b>1.60%</b>	<b>7.76%</b>	<b>23.89%</b>	<b>30.80%</b>	<b>12.20%</b>
	<b>Average weighted CFR (population)</b>	<b>0.00%</b>	<b>0.03%</b>	<b>0.01%</b>	<b>0.03%</b>	<b>0.06%</b>	<b>0.23%</b>	<b>0.94%</b>	<b>2.10%</b>	<b>1.42%</b>	<b>4.83%</b>
 <b>Spain<sup>2</sup></b>	Population in the age group	4,552,734	4,978,227	4,953,071	6,419,019	8,022,889	7,114,154	5,364,870	3,929,205	1,402,607	46,736,776
	% of distribution	9.74%	10.65%	10.60%	13.73%	17.17%	15.22%	11.48%	8.41%	3.00%	100%
	CFR in the age group	<b>0.29%</b>	<b>0.40%</b>	<b>0.19%</b>	<b>0.28%</b>	<b>0.57%</b>	<b>1.39%</b>	<b>4.67%</b>	<b>13.74%</b>	<b>21.05%</b>	<b>7.85%</b>
	<b>Average weighted CFR (population)</b>	<b>0.02%</b>	<b>0.04%</b>	<b>0.02%</b>	<b>0.04%</b>	<b>0.10%</b>	<b>0.21%</b>	<b>0.54%</b>	<b>1.16%</b>	<b>0.63%</b>	<b>2.73%</b>
 <b>Germany<sup>3</sup></b>	Population in the age group	7,588,635	7,705,657	9,800,607	10,646,445	10,426,257	13,474,166	10,302,411	7,685,929	5,389,106	83,019,213
	% of distribution	9.14%	9.28%	11.81%	12.82%	12.56%	16.23%	12.41%	9.26%	6.49%	100.00%
	CFR in the age group	<b>0.04%</b>	<b>0.02%</b>	<b>0.03%</b>	<b>0.05%</b>	<b>0.20%</b>	<b>0.58%</b>	<b>3.47%</b>	<b>9.04%</b>	<b>21.22%</b>	<b>3.78%</b>
	<b>Average weighted CFR (population)</b>	<b>0.00%</b>	<b>0.00%</b>	<b>0.00%</b>	<b>0.01%</b>	<b>0.02%</b>	<b>0.09%</b>	<b>0.43%</b>	<b>0.84%</b>	<b>1.38%</b>	<b>2.78%</b>

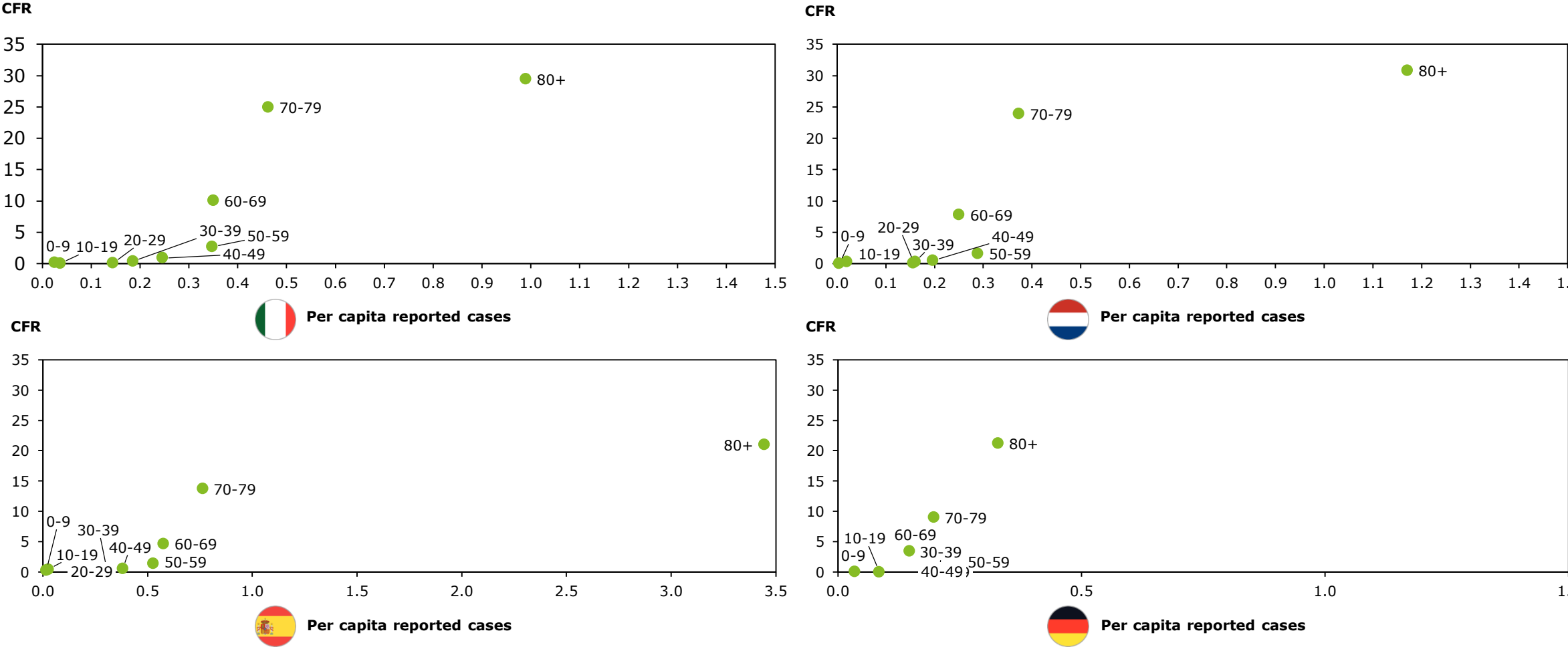
Note: <sup>1</sup> Italy based on 23<sup>rd</sup> April <sup>2</sup>Spain data based on 30<sup>th</sup> April, available information only <sup>3</sup>Germany data based on 28<sup>th</sup> April, approximated  
Source: Worldometers.info, localchef.IT, Ministry of Health Spain, RIVM, Statista, Deloitte analyses on 30<sup>th</sup> April



# Mortality - Testing per age groups

In Italy, NL and Spain, older groups are tested more and have higher CFR, however Germany tests wider age groups hence shows lower CFR

Relation between per capita reported cases and CFR



Source: Deloitte analyses

# Mortality – IFR Samples

All the available IFR research suggests the number of real infections are much higher due to underreported cases, hence the real mortality (IFR) is much lower

**To understand infection fatality (IFR), research for (semi-) random sample testing of COVID-19 infections, which also includes non-symptomatic cases, have been gathered.**

A few of the studies carried out include the following and data can be seen on the right:

- 1) Netherlands-wide serum tests for antibodies in blood donations from Sanquin suggests older people are more prone to COVID-19 health complications  
**Limitation:** blood donors differ in health, demographics etc. and age groups <18 and >70 are excluded
- 2) Iceland-wide serum tests for antibodies in blood samples from company DeCode  
**Limitation:** private initiative, only semi-random (no real sample selection rules)
- 3) County-wide serum tests for antibodies in blood samples in Santa Clara County, US  
**Limitation:** Santa Clara has a very young average age, so real death rates might be higher; testing and care policies in US are regionally very different
- 4) US Cruise ship: A selection of test samples from cruise ships incl. non-symptomatic cases, there were more older people in the sample than younger groups  
**Limitation:** Data quality of the different samples fluctuates; situation on cruise ship does not reflect outside world; however, taking them together allows indications

In addition:

- In the Netherlands it was found that in total 13,884 healthcare workers have been infected with COVID-19 (population age 20-60), 9 have died (CFR ~0.06%)

	Sample size	Positive cases sample	Probability being positive	Overall population of the area	Estimated positive cases	Actual deaths - Total YTD from same day	Estimated IFR (%) – mortality
NL (Sanquin)	4,208	122	2.90%	17,282,163	<b>501,051</b>	2,246	<b>0.45%</b>
Austria (Study 1)	1,544	7	0.45%	8,859,000	<b>38,980</b>	184	<b>0.47%</b>
Austria (Study 2)	269	13	0.45%	8,859,000	<b>417,259</b>	606	<b>0.11%</b>
Iceland (DeCode)	22,334	154	4.71%	364,134	<b>2,511</b>	9	<b>0.36%</b>
Gangelt, Germany	919	138	15.02%	12,597	<b>1,892</b>	7	<b>0.37%</b>
Santa Clara, USA	3,330	111	3.33%	1,928,000	<b>64,106</b>	73	<b>0.11%</b>
Cruise Ship cases	6,207	1,994	32.13%	32,034	<b>10,291</b>	46	<b>0.45%</b>

*Note that IFR for different age groups gives more insights than the overall IFR (for details relate to Sanquin example)*

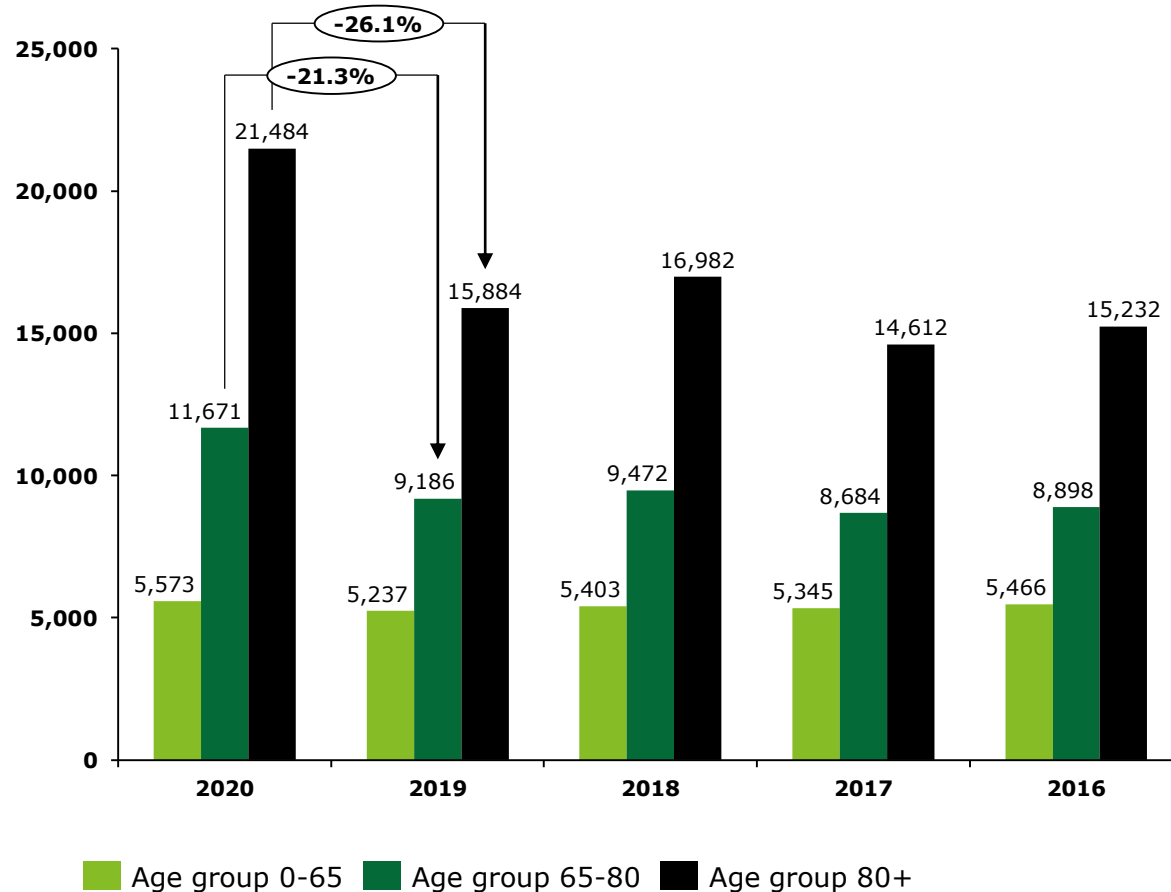
**Even though the studies have limitations, the overall conclusion tells us that the real mortality (IFR) is estimated and has to be much lower (~0.4%) than what the perception on death rate of general public suggests based on only the diagnosed cases (CFR). Younger age groups have less risks to die than older groups, hence for both CFR and IFR it is crucial to look at the numbers per age groups as there are significant differences among them.**

Source: Deloitte analyses

# Mortality – comparison over the last 5 years

In NL, compared with the last 5 years, 80+ age groups are hit the hardest in terms of deaths related to COVID-19, whilst age group <65 is barely affected

## Total number of deaths (cum. week 10 – week 17)



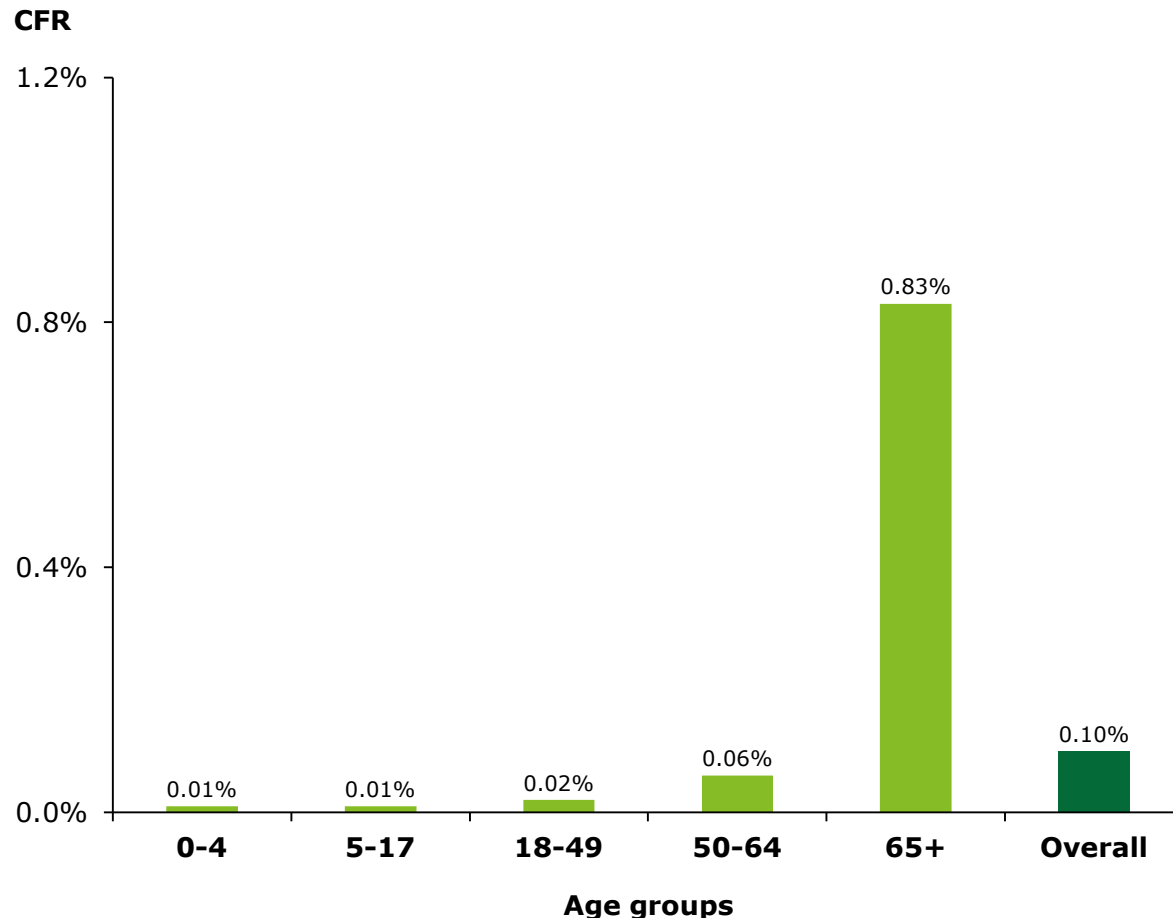
## Observations and conclusions

- Since the first death of COVID-19 in NL (week 10), we see that there has been a significant increase (26.1%) in the absolute death numbers for age group >80 during these 7 weeks
- For the age group 65-80, this increase has been mild and for the age group below 65, COVID-19 seems to not have affected the death rate at all
- Although it requires more research into how much exactly COVID-19 has contributed to the excess mortality (especially in age group 80+ and somewhat in age group 65-80), we can conclude that the significant increase for 80+ group is caused for a great deal by COVID-19
- If we would attribute 2/3 of the excess mortality versus 2019 to COVID, this would make the number of deaths in 80+ group ~30% higher than reported. That does not mean the mortality % in this age group is also 30% higher, it can also mean that there are more under reported cases than assumed

# Mortality – Influenza

Available official data shows ~8x higher CFR for age group 65+ than rest of population. Average CFR for age groups below 65 is <0.05%

## CFR for Influenza per age group in the US



## Observations and conclusions

- In 2019, 35 million people around the world contracted the flu, about 34,000 of those died (CFR~0.09%)
- The figure on the left shows that only 1 in 10,000 cases in children <4 dies, but the number increases exponentially with age
- Similar to COVID-19, Influenza flu affects the older age group (65+) more than the younger groups
- COVID-19 thus has a higher CFR and is more deadly compared to a flu, especially driven by the impact in the 60+ age group

Note: Assumption is that influenza CFR is similar to US in Europe

Source: Centers for Disease Control and Prevention (CDC); <https://www.businessinsider.nl/coronavirus-griep-verschil-overeenkomst-who/>