



Estimated Disease Burden of COVID-19

Updated May 19, 2021 [Print](#)

To better reflect the burden of COVID-19 – the full impact of the disease — CDC provides estimates of COVID-19 infections, symptomatic illnesses, and hospitalizations using a statistical model to adjust for cases that national surveillance networks are unable to capture for [a number of reasons](#). These estimates and the methodology used to calculate them are published in *Clinical Infectious Diseases* and available [online](#) . These estimates will be updated periodically.

Estimated COVID-19 Infections, Symptomatic Illnesses, and Hospitalizations—United States

CDC estimates that from February 2020–March 2021:

1 in 1.8 (95% UI* 1.7 – 2.1) COVID-19 hospitalizations were reported

1 in 3.9 (95% UI* 3.5 – 4.4) COVID-19 symptomatic illnesses were reported

1 in 4.3 (95% UI* 3.7 – 5.0) total COVID-19 infections were reported

These estimates suggest that during that period, there were approximately:

114.6 Million
Estimated Total Infections

97.1 Million
Estimated Symptomatic Illnesses

5.6 Million
Estimated Hospitalizations

Last Updated†: April 14, 2021

* Since the previous update, CDC has received additional data about the proportion of persons with symptomatic illness who seek medical attention or COVID-19 testing services, one of the sources of under-detection accounted for in these estimates. These updated data indicated higher levels of health-seeking behavior than data included in our previous estimates. The higher values of health-seeking behavior result in lower estimates of infections, symptomatic illnesses, and hospitalizations than previously reported. CDC will continue to update these preliminary estimates as additional data become available and improve our understanding of the detection and reporting of COVID-19..

Table 1: Preliminary Estimated COVID-19 Cumulative Incidence, by age group — United States, February 2020–March 2021

| | Infections | Symptomatic Illness | Hospitalizations |
|--|------------|---------------------|------------------|
|--|------------|---------------------|------------------|

| Age group | Infections | | Symptomatic Illness | | Hospitalizations | |
|-----------|-------------|--------------------------|---------------------|--------------------------|------------------|-----------------------|
| | Estimate | 95% UI* | Estimate | 95% UI* | Estimate | 95% UI* |
| 0-4 yrs | 4,466,773 | 3,640,856 – 5,603,223 | 3,811,216 | 3,238,789 – 4,568,978 | 50,030 | 40,862 – 61,134 |
| 5-17 yrs | 22,203,414 | 18,063,283 – 27,877,959 | 18,929,814 | 16,037,674 – 22,755,339 | 141,611 | 111,674 – 178,368 |
| 18-49 yrs | 55,616,991 | 46,355,840 – 67,031,661 | 47,402,926 | 41,781,099 – 54,104,814 | 1,338,235 | 1,133,895 – 1,590,638 |
| 50-64 yrs | 19,685,301 | 16,501,914 – 23,681,510 | 16,778,695 | 14,831,745 – 19,123,545 | 1,430,340 | 1,258,736 – 1,638,294 |
| 65+ yrs | 12,415,830 | 10,015,501 – 15,611,446 | 10,067,924 | 8,968,261 – 11,420,067 | 2,633,850 | 2,317,399 – 3,025,795 |
| All ages | 114,621,082 | 98,542,526 – 134,346,271 | 97,076,349 | 86,775,390 – 109,502,229 | 5,594,610 | 4,994,582 – 6,335,691 |

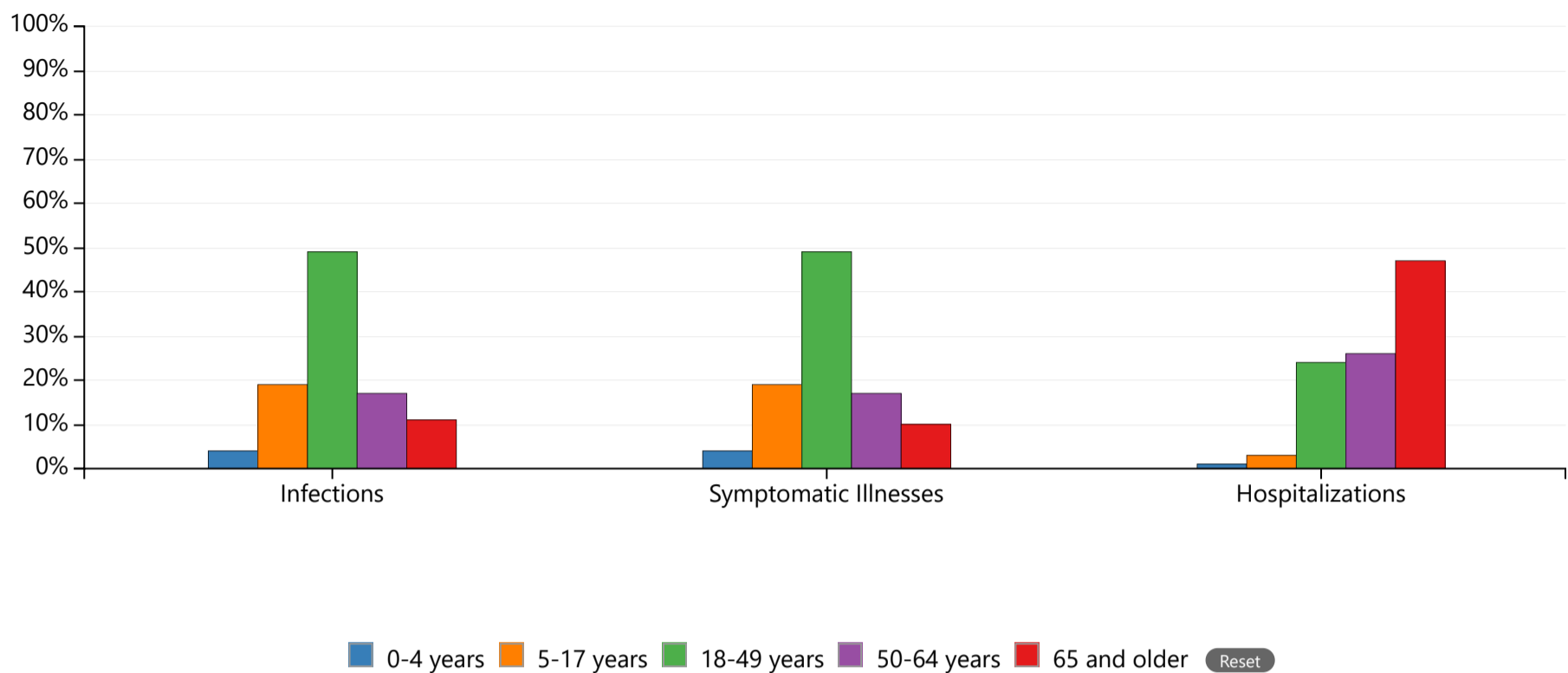
* Adjusted estimates and rates are presented in two parts: an uncertainty interval [UI] and a point estimate. The uncertainty interval provides a range in which the true number or rate of COVID-19 infections, symptomatic illnesses, or hospitalization would be expected to fall if the same study was repeated many times, and it gives an idea of the precision of the point estimate. A 95% uncertainty interval means that if the study were repeated 100 times, then 95 out of 100 times the uncertainty interval would contain the true point estimate. Conversely, in only 5 times out of a 100 would the uncertainty interval not contain the true point estimate.

Table 2: Estimated rates of COVID-19 disease outcomes, per 100,000, by age group — United States, February 2020–March 2021

| Age group | Infection rate per 100,000 | | Symptomatic Illness rate per 100,000 | | Hospitalization rate per 100,000 | |
|-----------|----------------------------|-----------------|--------------------------------------|-----------------|----------------------------------|---------------|
| | Estimate | 95% UI* | Estimate | 95% UI* | Estimate | 95% UI* |
| 0-4 yrs | 22,817 | 18,598 – 28,622 | 19,468 | 16,544 – 23,339 | 256 | 209 – 312 |
| 5-17 yrs | 41,532 | 33,788 – 52,146 | 35,408 | 29,999 – 42,564 | 265 | 209 – 334 |
| 18-49 yrs | 40,581 | 33,824 – 48,910 | 34,588 | 30,486 – 39,478 | 976 | 827 – 1,161 |
| 50-64 yrs | 31,293 | 26,233 – 37,646 | 26,673 | 23,578 – 30,400 | 2,274 | 2,001 – 2,604 |
| 65+ yrs | 22,967 | 18,527 – 28,879 | 18,624 | 16,590 – 21,125 | 4,872 | 4,287 – 5,597 |
| All ages | 35,047 | 30,130 – 41,078 | 29,682 | 26,533 – 33,482 | 1,711 | 1,527 – 1,937 |

* Adjusted estimates and rates are presented in two parts: an uncertainty interval [UI] and a point estimate. The uncertainty interval provides a range in which the true number or rate of COVID-19 infections, symptomatic illnesses, or hospitalization would be expected to fall if the same study was repeated many times, and it gives an idea of the precision of the point estimate. A 95% uncertainty interval means that if the study were repeated 100 times, then 95 out of 100 times the uncertainty interval would contain the true point estimate. Conversely, in only 5 times out of a 100 would the uncertainty interval not contain the true point estimate.

Percentage of COVID-19 infections, symptomatic illness, and hospitalizations by age group



Data Table

| | Infections | Symptomatic Illnesses | Hospitalizations |
|---------------------|------------|-----------------------|------------------|
| 0-4 years | 4% | 4% | 1% |
| 5-17 years | 19% | 19% | 3% |
| 18-49 years | 49% | 49% | 24% |
| 50-64 years | 17% | 17% | 26% |
| 65 and older | 11% | 10% | 47% |

Scroll for additional info

[Download Table Data \(csv\)](#)

What can be learned from estimates of COVID-19 infections, illnesses, and hospitalizations in the United States

Estimating unreported cases helps to quantify the impact and severity of the COVID-19 pandemic on the healthcare system and society. Additionally, these estimates can inform how to direct and allocate hospital resources; assist in planning for prevention and control measures, including vaccination; predict the future burden of COVID-19; and evaluate the potential impact of interventions.

Why CDC Estimates COVID-19 Infections, Illnesses, and Hospitalizations

The cumulative incidence of COVID-19 is an estimate of the number of people who may have been infected, sick, or hospitalized as a result of a COVID-19 infection from February to September 30, 2020. In the United States, confirmed COVID-19 cases are nationally reported, but these cases likely represent only a fraction of the true number of cases that have occurred in the population. COVID-19 infections, symptomatic illnesses, and hospitalizations may be under detected and go unreported for a variety of reasons:

- Some people infected with SARS-CoV-2 may never show symptoms (asymptomatic infection), so their infection will likely go undetected.

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- Not everyone who is sick will seek medical care and/or be tested; and patients may not be tested for COVID-19 while hospitalized.
- Even if a sick outpatient or hospitalized patient is tested, an infection with COVID-19 may not be accurately captured if:
 - the test was not completed correctly, or within the appropriate timeframe for capturing infection;
 - the test result was falsely negative for a COVID-19 infection due to the sensitivity of the test;
 - the test result was falsely negative for a COVID-19 infection due to the quality or quantity of the specimen collected;
 - or the confirmed COVID-19 case was never reported to the local and state public health agency and then to CDC.




Because current surveillance systems do not capture all cases of COVID-19 occurring in the United States, CDC provides these estimates to better reflect the larger burden of COVID-19. CDC uses these types of estimates to inform policy decisions and public messages.

How CDC Estimates COVID-19 Infections, Symptomatic Illnesses and Hospitalizations

COVID-19 infections, symptomatic illnesses, and hospitalizations are estimated using a statistical model applied to confirmed cases of COVID-19, adjusted for missing age and hospitalization status. Several data sources and surveillance systems are used to identify and characterize potential sources of under-detection, which include:

COVID-19

has been reported in the literature, a range of 75-98% sensitivity is used to account for false negative test results.

- **SARS-CoV-2 test ordered and completed in a timely manner.** Not all outpatients who seek care for acute respiratory illness (ARI) and inpatients hospitalized with ARI were tested for COVID-19, and not all ordered tests were correctly completed in a timely manner. Two data sources were used to approximate how many outpatients with ARI were not tested for COVID-19:
 - IBM Watson Explorys Electronic Health Record database, a data repository of electronic health records from more than 39 health partners, 400 acute care facilities, and 400,000 unique providers; and
 - [COVID Near You](#) (CNY), a website application launched by Harvard University in March 2020 where participants can submit information on self-reported symptoms, efforts to obtain health care, and COVID-19 testing.
- **Symptomatic patient may or may not seek care or testing services.** Not all sick patients will seek care and/or be tested for COVID-19, and therefore are not included in national case reports. To approximate the number of symptomatic people who never sought medical care, researchers used data from [COVID Near You](#) (CNY) and [Flu Near You](#) (FNY) sites on health care seeking behaviors. While COVID Near You launched in March 2020, FNY has been collecting self-reported influenza participatory data since 2011.
- **Case is asymptomatic.** Some people infected with SARS-CoV-2 may never show symptoms (asymptomatic infection) so are very likely to go undetected. The percentage of asymptomatic infections is reported in the literature and varies by age group. In those 0-64 years old a range of 5-24% is used, and for those 65 years and older, a range of 5-32% is used.

The statistical model used to adjust hospitalized and non-hospitalized case counts for the above sources of under-detection is based on methods that have been previously used to estimate the disease burden of influenza, detailed [elsewhere](#).

Limitations

These estimates of COVID-19 infections, symptomatic illnesses, and hospitalizations are subject to several limitations.

In the early stages of the COVID-19 pandemic, as is generally the case with the emergence of a novel virus like SARS-CoV-2, data on testing, detection, and case reporting, which are necessary for estimating the true burden of a disease were lacking or not available. More specifically, in some heavily affected areas of the United States, the size of the COVID-19 outbreak quickly exceeded the capacity of health systems to complete detailed reporting on cases that included information like the age of the patient and whether or not they were hospitalized. This led to case reports sent to CDC that were missing vital patient information. CDC had to estimate the age and hospitalization status of patients with missing data based on cases with known information on age and hospitalization status. To inform how to make estimates of disease burden for COVID-19, we relied on our experiences estimating influenza disease burden. CDC has been monitoring testing practices for influenza (flu) among hospitalized patients since 2010 to make estimates of [annual disease burden of flu](#) in the United States. Nearly a decade of flu data collection and analysis has shown respiratory disease testing varies in different parts of the country, by care settings, for different age groups, and at differing levels of disease severity. The data available so far on COVID-19 testing practices are limited across these variables. Once more complete data across these variables are available, COVID-19 burden estimates will be updated.

As additional data become available on the sensitivity of the SARS-CoV-2 tests, these data will also help refine COVID-19 infection, illness, and hospitalization estimates.