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The Potential Health Care Costs And Resource Use Associated With COVID-19 In The United States

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Abstract

With the coronavirus disease 2019 (COVID-19) pandemic, one of the major concerns is the direct medical cost and resource use burden imposed on the US health care system. We developed a Monte Carlo simulation model that represented the US population and what could happen to each person who got infected. We estimated resource use and direct medical costs per symptomatic infection and at the national level, with various "attack rates" (infection rates), to understand the potential economic benefits of reducing the burden of the disease. A single symptomatic COVID-19 case could incur a median direct medical cost of $3,045 during the course of the infection alone. If 80 percent of the US population were to get infected, the result could be a median of 44.6 million hospitalizations, 10.7 million intensive care unit (ICU) admissions, 6.5 million patients requiring a ventilator, 249.5 million hospital bed days, and $654.0 billion in direct medical costs over the course of the pandemic. If 20 percent of the US population were to get infected, there could be a median of 11.2 million hospitalizations, 2.7 million ICU admissions, 1.6 million patients requiring a ventilator, 62.3 million hospital bed days, and $163.4 billion in direct medical costs over the course of the pandemic.

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With the coronavirus disease 2019 (COVID-19) pandemic, one of the major concerns is the burden COVID-19 will impose on the US health care system. Elected officials, health professionals, and health care systems have raised concerns that the demand will exceed existing capacity, and they have requested additional resources and financial support.[1–3] One of the goals of social distancing measures is to reduce the percentage of the population that gets infected to avoid overburdening the health care system.[4,5] Conversely, others have advocated for the use of "herd immunity" strategies that allow certain proportions of the population to become infected (for example, at least 60–70 percent), until the virus can no longer spread.

All of this calls urgently for greater understanding of the potential health care costs and demand for resources due to COVID-19 in the US when different percentages of the population become infected with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Computational models have helped quantify the potential impact of and guide decision making for epidemics and outbreaks in the past, such as the 2009 H1N1 pandemic,[6–16] the ongoing Ebola outbreak that emerged in 2018,[17] and the 2015–16 Zika outbreak[18,19]. Therefore, we developed a computational model to represent what could happen to each patient infected with SARS-CoV-2 and quantify potential resource use and direct medical costs(that is, costs directly attributable to health care resource use for interventions and care that are specific to COVID-19, the illnesscausedbySARS-CoV-2, and would typically be paid for by third-party payers) in the US under various conditions.

Study Data And Methods

MODEL STRUCTURE

Using Microsoft Excel with the Crystal Ball add-in, we developed a Monte Carlo simulation model that represented the entire US population and what could happen to each patient who ended up getting infected with SARS-CoV-2. At the beginning of each simulation run, we determined what percentage of the population ended up getting infected (that is, the attack rate), with the age distribution of cases matching the reported age distribution of COVID-19 cases. Each infected person then travels through a probability tree of different possible sequential clinical outcomes. First, the person has a probability of being asymptomatic throughout the entire course of the infection. If instead the person is symptomatic, we assumed that the person starts with a mild infection and then has probabilities of either seeking ambulatory care or calling their physician (that is, having a telephone consultation). Next, the person has a probability of progressing to severe disease and requiring hospitalization. If the person is not hospitalized and has only a mild illness, they self-treat with over-the-counter medications (for example, acetaminophen or ibuprofen). If hospitalized, the person then has a probability of having either severe pneumonia or severe non-pneumonia symptoms. After hospital admission, the patient has a probability of being admitted to the intensive care unit (ICU). The patient then has a probability of having either sepsis or acute respiratory distress syndrome (ARDS) with or without sepsis. If the patient has ARDS, they require the use of a ventilator. The hospitalized patient also has a probability of dying, and if surviving, the patient could require additional care after hospital discharge (for example, ARDS or sepsis care).

For each of the aforementioned steps and possible outcomes, the person accrues different associated direct medical costs. If a person has only a mild illness, these costs include those for either ambulatory care or a telephone consult and for over-the-counter medications. If a person is hospitalized, the costs include those for either ambulatory care or a telephone consult and for hospitalization and, in some circumstances, postdischarge care. The hospitalized patient incurs the cost of hospitalization associated with the highest ward level of care they receive (for example, a patient admitted to the ICU in curs the costs for the ICU-related diagnosis of sepsis or ARDS, but not those for a general ward stay) and the cost for their most severe clinical outcome (for example, a patient with ARDS incurs the cost for ARDS treatment, including ventilator use, regardless of sepsis). The discharged patient accrues outcome-specific postdischarge costs for associated health care use for one year.[20,21] If this patient has ARDS, they incur the reported median direct medical cost per patient, which includes additional hospitalizations, skilled nursing facility stays, rehabilitation stays, and outpatient visits (including specialist, primary care provider, and occupational therapist visits). If the patient has sepsis, they incur the median cost paid to providers for all-cause emergency department visits, outpatient visits, inpatient stays, and pharmacy costs for a patient who survives severe sepsis.[20]

DATA SOURCES

Online appendix exhibit 1 shows the model input parameters, values, and data sources and is divided into costs, probabilities, and population.[22] All inputs were age-specific (when available) and came from the scientific literature or nationally representative data sources, which are listed in the appendix.[22] The cost section of appendix exhibit 1[22] includes the costs associated with an ambulatory visit, a telephone consult, total cost of over-the-counter medications(based on age-specific dosing), age- and outcome-specific hospitalization costs, and outcome-specific postdischarge costs. Hospitalization costs came from the Healthcare Cost and Utilization Project[23] and include the cost for the entire hospital stay, excluding professional (for example, physician) fees. In the absence of data on COVID-19-specific hospitalization costs, the hospitalization cost of pneumonia due to *Streptococcus pneumoniae* served as a proxy for the cost of a COVID-19 hospitalization with severe pneumonia symptoms, as these patients present with similar symptoms and would require a similar level of care. Similarly, influenza due to an unidentified virus with other manifestations served as a proxy for hospitalization with non-severe pneumonia symptoms. We performed a literature search (searching PubMed and Google Scholar) to identify articles that reported direct medical costs for a year after hospital discharge for patients with a diagnosis of ARDS and sepsis, excluding the index hospitalization. We report all costs in 2020 values, using a 3 percent discount rate.

The probabilities section of appendix exhibit 1 reports the probabilities of the various outcomes as a person travels through the SARS-CoV-2 probability tree.[22] These include the probabilities of developing symptoms, seeking ambulatory care, being hospitalized, and subsequently being admitted to the ICU, as well as the probabilities of having the different clinical outcomes (for example, pneumonia or ARDS) and of dying. The probability of being symptomatic came from a recent study that conducted daily time-series laboratory testing of cases on board the *Diamond Princess* cruise ship.[24] In the absence of COVID-19-

specific data, the probability of seeking ambulatory care for influenza served as a proxy for seeking such care for COVID-19.[25] Age-specific COVID-19 probabilities for hospitalization and ICU admission came from a recent report from the Centers for Disease Control and Prevention and are specific to the US context as of March 16, 2020.[26] We used these data to calculate relevant COVID-19 probabilities because at the time we conducted this study, they were the only up-to-date and age-specific data available for the US context. Other COVID-19-specific data came from peer-reviewed literature and included all studies that reported inputs available at the time of the search (that is, studies published before March 10, 2020). Other inputs included the number of people in the US population, based on the Census Bureau's 2018 population estimate.[27]

SCENARIOS AND SENSITIVITY ANALYSES

For each scenario, we ran Monte Carlo simulations consisting of 1,000 trials that varied each parameter throughout its range (appendix exhibit 1).[22] Scenarios consisted of varying the attack rate from 20 percent to 80 percent. Given that new data on SARS-CoV-2 continue to emerge, as well as the variability and uncertainty in currently available data, we performed sensitivity analyses, varying several key parameters to determine their impact on our results. Specifically, we varied the type of initial care received (having a telephone consultation with their physician to having either a doctor's visit or telephone consultation), the probability of having severe disease that requires hospitalization (decreasing the reported values by a relative 20–50 percent and increasing the reported values by a relative 20 percent), the probability of being admitted to the ICU (varying the reported values by a relative plus or minus 20 percent), and the probability of death given hospitalization (decreasing the currently reported values by a relative 95 percent). We also reduced postdischarge costs to 50 percent of the reported values, so that they were comparable to values reported for other high-income countries.[28]

LIMITATIONS

Our study had several limitations. All models, by definition, are simplifications of real life and cannot account for every possible outcome.[29] Our model inputs drew from various sources, and new data on SARS-CoV-2 continue to emerge. For example, our clinical probabilities were derived from data based on testing regimens that captured live infections and might not be representative of all infections in the US population. Therefore, these probabilities may be lower than what studies report, given that these data may be subject to selection bias because of the lack of seroprevalence studies. We also used existing data for hospitalization costs that are not necessarily specific to COVID-19. For example, the cost of ARDS decreased with age (since mortality increases with age,[30] older patients had shorter hospital stays and therefore lower hospitalization costs),[31] which might not necessarily be the case for COVID-19. As another example, the studies that measured postdischarge costs for ARDS and sepsis included all health care costs, not just those specific to ARDS and sepsis. Thus, we explored a large range of values in sensitivity analyses, which helped determine the impact of uncertainty and variability in the available data. The purpose of this study was not to evaluate the value of specific interventions such as social distancing, but to determine the direct impact of the pathogen. Therefore, costs of various epidemic responses were not included.

Study Results

DIRECT MEDICAL COSTS PER CASE

A single symptomatic SARS-CoV-2 infection would have a median direct medical cost of $3,045 when we included only costs that accrue during the course of the infection (exhibit 1) (this estimate is based on a case of COVID-19 traveling through the probability tree). When we added costs that might be incurred after the infection, such as outpatient visits and rehospitalization, the cost per case increased to $3,994 (exhibit 1). When we decreased postdischarge costs by 50 percent, a single case would have a median cost of $3,517 (95% uncertainty interval: $3,355, $3,695; data not shown). A person who has mild symptoms (that is, someone who does not require hospitalization) and who has either an in-person doctor visit or a telephone consultation would incur a median cost of $57–$96, depending on age (exhibit 1). If a person uses only a telephone consultation, the median cost decreases to $32 (95% UI: $19, $56) for someone age 0–17 and to $17 (95% UI: $16, $67) for someone age 18 or older (data not shown).

A single hospitalized case would cost a median of $14,366 when only costs during the course of the infection are included (exhibit 1). The costs begin to decline for a person age 65 or older because of their lower hospitalization costs and probabilities for accruing these costs (for example, a person age 85 or older has a lower probability of ICU admission and lower ICU hospitalization costs than a person age 45–64). Decreasing postdischarge costs by 50 percent decreased the age-specific cost per case by a relative 0–14 percent, with the largest decrease for a person age 65–84 (median: $17,682; data not shown).

For any given symptomatic case, decreasing the probability of hospitalization by a relative 50 percent of the reported values decreased the cost to a median of $1,529 (95% UI: $1,450, $1,608; data not shown). Decreasing the probability of being admitted to the ICU by a relative 20 percent decreased the cost to a median of $2,895 (95% UI: $2,746, $3,066), while for a single hospitalized case it decreased the cost to a median of $13,708 (95% UI: $12,838, $14,515; data not shown). For any given hospitalized case, increasing the probability of being admitted to the ICU by a relative 20 percent increased the cost to a median of $14,991 (95% UI: $14,236, $15,812), while decreasing the probability of death had little impact on costs—including those that may be incurred after discharge (median: $18,629; 95% UI: $17,643, $19,666; data not shown).

HEALTH CARE RESOURCE USE AND COST SCENARIOS

We next explore health care resource use and costs when various percentages of the US population get infected with SARS-CoV-2. Exhibit 2 shows the number of cases and their resource use (for example, hospital bed days and ventilator days) in the US by attack rate.

► 80 PERCENT ATTACK RATE:

In a scenario that used the currently reported values for key parameters, an 80 percent attack rate would result in a median of 215.0 million symptomatic COVID-19 cases in the US, with 44.6 million hospitalizations.

Exhibits 3 and 4 show the median direct medical costs of COVID-19 in the US incurred during the course of the infection alone and including the costs in the year following hospital discharge, respectively, when different percentages of the population get infected with SARS-CoV-2. An 80 percent attack rate would result in a median cost of $654.0 billion (exhibit 3) (95% UI: $615.8 billion, $692.8 billion; data not shown), or $859.6 billion (exhibit 4)(95%UI:$809.5billion, $911.7 billion; data not shown) if costs for a year after discharge were added to costs during the infection. If postdischarge costs were 50 percent lower, median costs would be reduced from $859.6 billion to $756.1 billion (95% UI: $712.5, $802.6 billion; data not shown). When we decreased the probability of severe disease leading to hospitalization by a relative 50 percent of the values reported in the literature, the costs incurred during the course of the infection decreased by a relative 49.7 percent, to $328.9 billion (data not shown). Decreasing the reported value for the probability of death by a relative 95 percent had no impact on cost when we included costs that might be incurred after discharge (median: $859.6 billion; 95% UI: $813.7 billion, $909.1 billion; data not shown).

► 50 PERCENT ATTACK RATE:

A 50 percent attack rate would result in 134.4 million symptomatic COVID-19 cases in the US (exhibit 2). This would result in a median of $408.8 billion (exhibit 3) (95% UI: $385.4 billion, $433.5 billion; data not shown) in direct medical costs during the course of the infection and a median of $536.7 billion (exhibit 4)(95%UI:$507.6billion, $570.8 billion; data not shown) when postdischarge costs were included. Reducing the postdischarge costs by 50 percent decreased the median direct medical coststo$472.5 billion (95% UI: $447.0 billion, $501.3 billion; data not shown).

► 20 PERCENT ATTACK RATE:

With an attack rate of 20 percent, there would be 53.8 million symptomatic COVID-19 cases in the US (exhibit 2), which would cost $163.4 billion (exhibit 3) (95% UI: $154.5 billion, $173.1 billion; data not shown) in direct medical costs incurred during the course of the infection. Adding costs for a year after discharge would result in a median cost of $214.5 billion (exhibit 4)(95% UI: $202.4 billion, $227.9 billion; data not shown). Decreasing postdischarge costs by 50 percent would lower that amount to a median of $188.6 billion (95% UI: $178.8 billion, $199.8 billion; data not shown). Decreasing the currently reported values for the probability of death by a relative 95 percent had little impact on direct medical costs (median: $214.9 billion (95% UI: $202.8 billion, $227.2 billion; data not shown).

Discussion

Our results show that even when only the costs during the acute infection (and not the costs of follow-up care after the infection) are considered, the direct medical cost of a symptomatic COVID-19 case tends to be substantially higher than those for other common infectious diseases. For example, the cost, on average, is over four times that of a symptomatic influenza case ($696 in medical costs in 2020 values)[25] and approximately 5.5 times that of a pertussis case ($412–$555 in 2020 values).[32] The cost of a hospitalized case in infants was greater for COVID-19 than that for respiratory syncytial virus ($7,804 in 2020 values),[33] but for older adults, the cost per hospitalized case of those two conditions was similar ($20,463 in 2020 values).[34] The direct medical costs are higher than those for other common infectious diseases because a patientwithCOVID-19can have a higher probability of hospitalization and mortality compared to someone who has seasonal influenza[25] or is infected with other pathogens. While the COVID-19-specific probabilities are based on emerging data, our results were robust to varying the probabilities of ICU admission and death. Additionally, a potential lingering medical cost after the acute infection has run its course is the cost of caring for people who have survived major complications such as ARDS and sepsis. Existing studies have shown that the cost of such care can be considerable,[20,21] often requiring follow-up care and potentially rehospitalization because long-lasting damage has been done—which makes the person susceptible to other problems, such as other infections. These costs added approximately $4,000 to the cost of a single case, particularly when the patient was hospitalized.

The significant differences in medical costs by attack rate show the value of any strategies that can keep the attack rate as low as possible and, conversely, the potential cost of any “herd immunity” strategies that allow people to get infected. As can be seen, the difference between 80 percent and 50 percent of the population getting infected is 80.6 million symptomatic cases, 16.7 million hospitalizations, and $245.4 billion in direct medical costs incurred during the course of the infection, which is 11.7 percent versus 18.7 percent of the 2017 total national health expenditures ($3.5 trillion).[35] Similarly, thedifferencebetween80percentand20percent of the population being infected is 161.2 million symptomatic cases, 33.4 million hospitalizations, and $490.6 billion in direct medical costs.

Currently, the primary strategy to keep the attack rate lower is social distancing, which includes people maintaining physical space between themselves and others and avoiding group gatherings and crowds. Any discussion regarding the cost or burden of social distancing should include the costs on the other side of the equation, such as health care costs—which are the costs that such approaches are potentially reducing. The alternative to, or in many ways the opposite of, social distancing is herd immunity, which has been considered in the United Kingdom.[36] Herd immunity strategies would involve having certain proportions of the population be exposed to the virus until it no longer spreads. However, it must be kept in mind that this strategy is not without its cost.

Our study also provides an idea of the magnitude of resources needed to take care of COVID-19 cases. Various state and local leaders have been calling for assistance, such as more hospital beds and ventilators to bolster existing capacity. Companies such as General Motors are repurposing factories to make emergency ventilators, stadiums are being converted into makeshift hospitals to increase capacity, tents to treat cases are popping up, and Navy ships are aiding in the care of non-COVID-19 patients.[37–40] Even a quick look at the numbers shows that the current capacity of the health care system is falling well below what is needed. For example, there are approximately 96,596 ICU beds and 62,000 full-featured mechanical ventilators in US,[41]which are orders of magnitude lower than what would be needed even with a 20 percent attack rate. The number of available ICU beds would, of course, depend on the timing of COVID-19 patient admissions.

Our study focused on direct medical costs and therefore did not include the potentially substantial nonmedical costs that may be associated with COVID-19, such as productivity losses due to absenteeism and premature mortality, as well as declines in economic activity (for example, decreased production, equity losses, and business closures). In fact, our results may even underestimate direct medical costs, given our interest in remaining conservative in calculating costs. For example, we did not include additional costs that could be incurred if COVID-19 and its impact on health care usage exacerbated other medical conditions (for example, respiratory illnesses can worsen other chronic health conditions).[42] Our analysis drew from costs accrued during situations that were not public health emergencies and did not account for the possibility that costs could change during a pandemic. In actuality, the scarcity of critical supplies could drive up costs, as suppliers may increase prices or charge higher premiums (for example, hospitals are paying up to fifteen times the usual price of personal protective equipment and medical supplies).[43,44] Moreover, our analysis did not include indirect medical costs or effects such as decreased revenue because of reductions in elective procedures,[45] or potential cost increases resulting from worse disease outcomes due to postponement of preventive care and diagnosis. Additionally, recruiting health care professionals to focus on COVID-19 could lead to shortages in professionals for other patients.[46] Thus, health care systems that lack extra capacity could experience increases in operating costs.

Conclusion

Our study suggests that over the course of the pandemic, COVID-19 in the US could result in direct medical costs incurred during the course of the infection from $163.4 billion if 20 percent of the population gets infected to $654.0 billion if 80 percent of the population gets infected. Even when only the costs during the acute infection and not those of follow-up care after infection are considered, the direct medical costs of a symptomatic COVID-19 case tend to be substantially higher than costs for other common infectious diseases. The significant difference in costs by attack rate across the US population shows the value of strategies that keep that rate as low as possible and, conversely, the potential cost of any herd immunity strategies that allow people to get infected. Our study also highlights the magnitude of resources needed to take care of COVID-19 cases.

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NOTES

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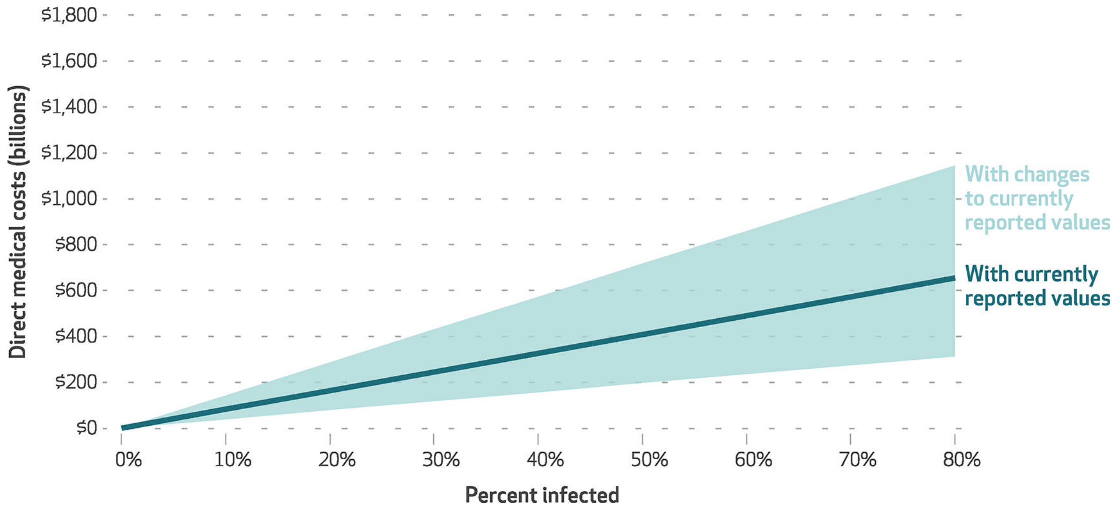

EXHIBIT 3. Median direct medical costs of COVID-19 in the US when including only costs during the course of the infection, by percent of population that gets infected with SARS-CoV-2

SOURCE Authors analysis. NOTES The line represents a situation that uses the currently reported values for key parameters (explained in the notes to exhibit 2) listed in appendix exhibit 1 (see note 22 in text). The band depicts the range of the median direct medial costs, where the lower bound of the shaded area represents a situation that decreases the reported values of key parameters to the lowest values tested, while the upper bound represents a situation that increases the reported values of key parameters to the highest values tested (see the notes to exhibit 2).

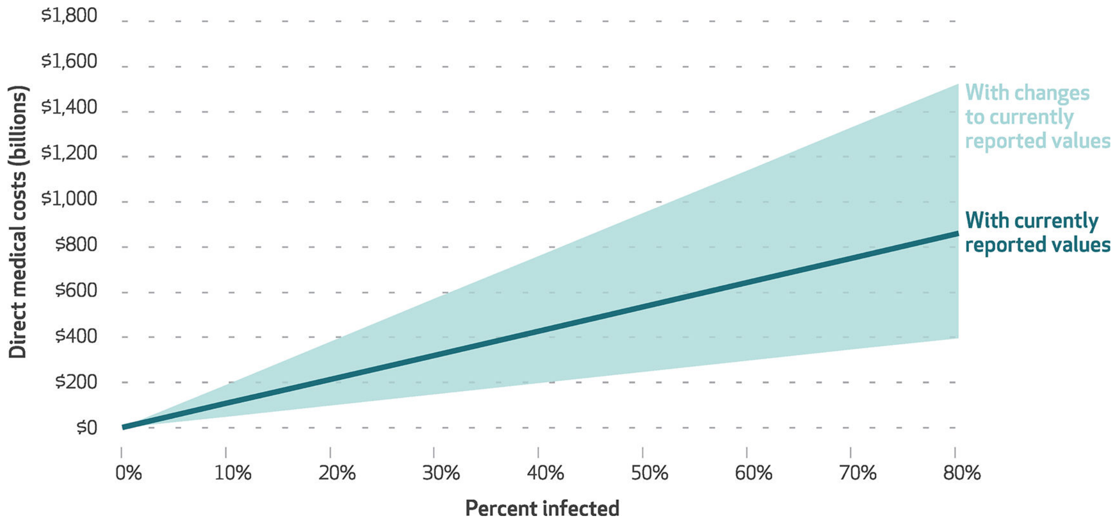

EXHIBIT 4. Median direct medical costs of COVID-19 in the US, including costs during the course of the infection and one year after hospital discharge, by percent of population that gets infected with SARS-CoV-2

SOURCE Authors analysis NOTES The line represents a situation that uses the currently reported values for key parameters (explained in the notes to exhibit 2) listed in appendix exhibit 1 (see note 22 in text). The band depicts the range of the median direct medial costs, where the lower bound of the shaded area represents a situation that decreases the reported values of key parameters to the lowest values tested, while the upper bound represents a situation that increases the reported values of key parameters to the highest values tested (see the notes to exhibit 2).

Exhibit 1

Median direct medical cost of a COVID-19 case in the US, by type

Type of case	Median cost ($)	95% uncertainty interval ($)
Including only costs during the course of the infection		
A person with symptomatic infection	3,045	2,873, 3,205
A person with only mild symptoms by age group, years		
0–17	91	60, 124
18–64	57	54, 67
65 or older	96	89, 103
A person with symptomatic infection requiring hospitalization		
Any patient	14,366	13,545, 15,129
A patient by age group, years		
0–17	11,367	9,070, 13,840
18–44	13,132	11,510, 14,741
45–64	15,943	14,419, 17,557
65–84	14,859	14,179, 15,538
85 or older	11,900	11,089, 12,835
Including costs during the course of the infection and one year after hospital discharge		
A person with symptomatic infection	3,994	3,799, 4,200
A person with symptomatic infection requiring hospitalization	18,579	17,524, 19,609

SOURCE Authors' analysis.

NOTE A person with only mild symptoms is defined as someone who has an in-person doctor visit or a telephone consultation and does not require hospitalization.

Exhibit 2

Median number of clinical outcomes and amounts of resource use in millions due to COVID-19 in the US, by percent of population that gets infected with SARS-CoV-2

	Symptomatic cases	Ambulatory care visits[a]	Hospitalizations	ICU admissions	Patients requiring a ventilator	General ward bed days	ICU bed days	Ventilator days
Using the currently reported values for key parameters [b]								
80% attack rate								
Number 95% UI	215.0 (208.7, 221.2)	89.3 (83.8, 95.0)	44.6 (43.3, 45.9)	10.7 (10.4, 11.0)	6.5 (6.3, 6.7)	156.9 (146.8, 169.4)	92.6 (88.8, 96.6)	52.2 (50.3, 54.1)
50% attack rate								
Number 95% UI	134.4 (130.6, 138.2)	89.3 (83.8, 95.0)	27.9 (27.1, 28.7)	6.7 (6.5, 6.9)	4.1 (4.0, 4.2)	98.3 (91.7, 104.8)	57.9 (55.5, 60.2)	32.6 (31.4, 33.8)
20% attack rate								
Number 95% UI	53.8 (52.2, 55.3)	89.3 (83.8, 95.0)	11.2 (10.8, 11.5)	2.7 (2.6, 2.7)	1.6 (1.6, 1.7)	39.2 (36.6, 41.9)	23.1 (22.2, 24.1)	13.0 (12.5, 13.5)
Using decreased values [c]								
80% attack rate								
Number 95% UI	214.9 (208.8, 221.3)	89.3 (83.8, 95.0)	22.3 (21.6, 22.9)	4.3 (4.2, 4.4)	2.6 (2.5, 2.7)	133.4 (125.4, 142.9)	37.0 (35.5, 38.5)	20.9 (20.1, 21.7)
50% attack rate								
Number 95% UI	134.4 (130.6, 138.2)	89.3 (83.8, 95.0)	13.9 (13.5, 14.3)	2.7 (2.6, 2.7)	1.6 (1.6, 1.7)	83.4 (78.1, 89.4)	23.2 (22.2, 24.1)	13.1 (12.6, 13.5)
20% attack rate								
Number 95% UI	53.8 (52.2, 55.3)	89.3 (83.8, 95.0)	5.6 (5.4, 5.7)	1.1 (1.0, 1.1)	0.7 (0.6, 0.7)	33.4 (31.3, 35.7)	9.3 (8.9, 9.6)	5.2 (5.0, 5.4)
Using increased values [d]								
80% attack rate								
Number 95% UI	215.0 (208.9, 221.2)	89.3 (83.8, 95.0)	53.5 (52.0, 55.0)	15.4 (14.9, 15.8)	9.4 (9.1, 9.7)	175.9 (164.1, 188.1)	133.2 (128.3, 138.9)	75.1 (72.2, 78.0)
50% attack rate								
Number 95% UI	134.4 (130.8, 138.3)	89.3 (83.8, 95.0)	33.5 (32.5, 34.4)	9.6 (9.4, 9.9)	5.9 (5.7, 6.0)	110.1 (103.0, 117.5)	83.4 (79.9, 87.2)	47.0 (45.4, 48.9)
20% attack rate								
Number 95% UI	53.8 (52.2, 55.3)	89.3 (83.8, 95.0)	13.4 (13.0, 13.7)	3.8 (3.7, 4.0)	2.3 (2.3, 2.4)	44.0 (41.2, 47.3)	33.4 (32.0, 34.8)	18.8 (18.1, 19.5)

SOURCE Authors' analysis.

NOTES General ward bed days plus intensive care unit (ICU) bed days equal total hospital bed days. UI is uncertainty interval.

[a]For patients who seek ambulatory care or call their physician.

[b] The currently reported values for the probabilities of severe disease requiring hospitalization, ICU admission, and death are in appendix exhibit 1 (see note 22 in text).

[c] Using the lower values of the key parameters tested: decreasing the probability of severe disease requiring hospitalization by a relative 50 percent, the probability of ICU admission by a relative 20 percent, and the probability of death by a relative 95 percent.

[d] Using the higher values of the key parameters tested: increasing the probability of severe disease requiring hospitalization and ICU admission by a relative 20 percent each.