

# Using a Novel COVID-19 Calculator to Measure Positive U.S. Socio-Economic Impact of a COVID-19 Pre-Screening Solution (AI/ML)

Richard Swartzbaugh, M.P.A., J.D.<sup>1</sup> Amil Khanzada, B.S.C.S.<sup>2</sup> Praveen Govindan, Ph.D.<sup>3</sup> Mert Pilanci, Ph.D.<sup>4</sup>  
Ayomide Owoyemi, M.D.<sup>5</sup> Les Atlas, Ph.D.<sup>6</sup> Hugo Estrada, B.S.I.E., MSc., E.A.<sup>7</sup> Richard Nall, M.S.O.L.<sup>8</sup>  
Michael Lotito, J.D., Rich Falcone, J.D., Jennifer Ranjani J. Ph.D.

CuraeSoft Corporation,<sup>9</sup> University of California, Berkeley,<sup>10</sup> Indian Institute of Technology, Madras,<sup>11</sup> Stanford University,<sup>12</sup>  
University of Illinois at Chicago,<sup>13</sup> University of Washington,<sup>14</sup> Iwe Consultores,<sup>15</sup> The Brand Garden.<sup>16</sup>

*Abstract* — The COVID-19 pandemic has been a scourge upon humanity, claiming the lives of more than 5.1 million people worldwide;<sup>1</sup> the global economy contracted by 3.5% in 2020.<sup>2</sup> This paper presents a COVID-19 calculator, synthesizing existing published calculators and data points, to measure the positive U.S. socio-economic impact of a COVID-19 AI/ML pre-screening solution (algorithm & application).

*Index Terms* — COVID-19, Cough, Self-supervised Learning, Support Vector Machine, Convolutional Neural Networks, Product Market Fit (PMF), Return on Investment (ROI), Public Good, Artificial Intelligence (AI), Machine Learning (ML).

## I. INTRODUCTION

In recent history, the singular event that most profoundly impacted the entire globe has been the COVID-19 pandemic. To date, COVID-19 has claimed the lives of over 800,000 individuals in the United States and 5 million worldwide [1]. The highly infectious nature of COVID-19 has filled up hospital beds in record numbers, surpassing hospital capacity and causing immense strain on healthcare systems worldwide [2]. While vaccination efforts globally are underway, distribution efforts have been impeded in low- and middle-income countries.

Additionally, the emergence of new viral variants like the Omicron variant has decreased the effectiveness of current vaccines in the prevention of COVID-19 spread [3].

The US economy has shown significant recovery so far; however, it has not recovered back to pre-pandemic levels, the certainty of improvement in this recovery is affected by these newly emerging COVID-19 variants [8]. A recent surge in COVID, partially due to emerging variants, also affected job creation as fewer jobs than expected were added in December 2021 [9].

Considering these socio-economic impacts of disease outbreaks like COVID-19, it is important to assess and predict socio-economic impacts and effects of mitigation and management approaches to help reduce outbreaks.

As detailed below in the discussion below, we've used costs associated with Hospital Acquired Infections (HAI) and the savings realized by preventing spread as a relevant comparable, as COVID-19 is also an Airborne Transmissible Disease.

Our novel model COVID-19 calculator measures the U.S. socio-economic impact of a COVID-19 AI/ML pre-screening algorithm, and potential savings through early detection, facilitating the return to pre-COVID normalcy. Calculation assumptions are based on a 1% or 0.1% degree of positive change. By using one's own data and assumptions, and this model calculator, each user can customize the calculator based on values, weights, variables, and assumptions the user deems relevant for their local contexts or countries.

Sound has been used as one of the health indicators by clinicians and researchers., which often require skilled clinicians to interpret. Studies reveal that respiratory syndromes such as pneumonia, pulmonary diseases, and asthma [10] [11] [12] can be diagnosed effectively using cough samples. Recently researchers

---

<sup>1</sup> <https://ourworldindata.org/coronavirus-data>

<sup>2</sup> The impact of the pandemic on world GDP growth is massive. The COVID-19 global recession is the deepest since the end of World War II (Figure 1). The global economy contracted by 3.5 percent in 2020 according to the April 2021 World Economic Outlook Report published by the IMF, a 7 percent loss relative to the 3.4 percent growth forecast back in October 2019. <https://www.brookings.edu/research/social-and-economic-impact-of-covid-19/>

have explored the possibility of using sound instead of imaging techniques like MRI, sonography, as they offer a cheap alternative. In [13], a crowd-sourced dataset comprising sounds from 7000 users was collected using both Android and web applications. Out of the 7000, only 200 users were tested positive for COVID-19. They aimed to use simple machine learning models like support vector machines (SVM) to discriminate the cough from users with COVID-19 from healthy users and users with asthma. In [14], a non-invasive, real-time framework adapted from the brain model by the MIT Center for Brain Minds and Machine designed for diagnosing Alzheimer's is used to pre-screen cough to identify COVID-19 by leveraging orthogonal audio biomarkers. In this study, 96 cough samples from users with bronchitis and 136 with pertussis are collected in addition to 2660 COVID positive and 2660 healthy cough samples.

Recurrent Neural networks are gaining popularity in speech recognition and audio analysis. Studies using the long short-term memory (LSTM) network models reveal that comparing cough and breath, voice is inefficient [15]. 240 recordings from healthy individuals and 60 samples from COVID-19 patients collected from several hospitals in UAE are used in this study. Mouawad et al. exploited the non-linear phenomenon in voice and speech signals to capture the repetition pattern using time-series recurrence plots [16]. They have used the data collected in partnership with Carnegie Mellon University and Voca.ai to train the machine learning models.

The DiCOVA challenge was initiated to accelerate researchers in COVID-19 diagnosis, and it uses respiratory acoustics [17]. Two datasets derived from the crowd-sourced Coswara data [18] are used in the DiCOVA challenge. The first dataset focuses only on cough sounds, and the second dataset contains a collection of audio recordings, including counting numbers, phonation of sustained vowels, and breath. AI models like logistic regression (LR), multi-layer perceptron (MLP), and random forest (RF) are analyzed on the cough, breath, vowel sounds, and speech samples. A group of researchers from the University of Cambridge combined the 11 most common symptoms with 384 features obtained from 16 frame-level descriptors using linear kernel SVM [19].

Pahar et al. from Stellenbosch University, South Africa, evaluated the popular machine learning approaches like SVM, k-nearest neighbor (kNN), LR, MLP, ResNet50, and LSTM, on the Coswara dataset and

the SARS COVID-19 South Africa (Sarcos) dataset [20] collected from all the six continents.

Erdoğan et al. [21] used 595 positive and 592 negative COVID-19 cough samples from the Virufy dataset [22]. They concluded that the performance of features based on deep learning is inferior, compared to traditional methods, due to limited data availability.

In [23], experiments are conducted to identify the most informative acoustic features as a baseline instead of the handcrafted features or Mel frequency Cepstral Coefficients. It is also demonstrated that robust features can be learned using the wavelet scattering transform amidst the noise in the data. 92.38%, among the 1103 participants, were declared negative, with the remaining 7.62% declared COVID-19 positive.

In [24], four classes of cough samples are used in this study, they are users tested COVID-19 (346), COVID-19 negative (346), healthy users with cough (101), and users without COVID but has pertussis cough (20). A collection of 813 samples from the University of Lleida, University of Cambridge, Virufy, and Pertussis datasets, are used. Compared to the latest machine learning methods, random forest performed better on the time-frequency features.

From this study, we can conclude that researchers worldwide are actively working towards a cost-effective AI/ML solution to pre-screen the infection from the cough samples collected from the user's smartphone. However, the efficiency of these ML solutions is highly dependent on the balanced nature of the datasets and often in popular datasets healthy samples often outnumber the COVID-19 positive samples.

Preliminary data and analysis supports positive U.S. socio-economic impact of a COVID-19 pre-screening solution utilizing Artificial Intelligence / Machine Learning (AI/ML).

## II. DISCUSSION

In considering this Article, a number of existing published articles, research, and calculators were reviewed:

A. *APIC - Association for Professionals in Infection Control & Epidemiology (APIC) Algorithm & Data Set [4]*

APIC is the leading professional association for infection preventionists (IPs) with more than 15,000 members. APIC's mission is to advance the

science and practice of infection prevention and control.

The APIC Cost of Healthcare-Associated Infections Model is designed to demonstrate the costs associated with infections and the savings realized by preventing them. It also provides tables and graphs that describe the financial impact of infections at your healthcare institution. By using your own data, you can customize this report for your respective facility. If you don't have your own data, APIC has provided data from national studies to estimate economic endpoints. Use of your healthcare organization's data will reflect the financial impact of infections to your institution.

- B. *TMIT – APIC (Texas Medical Institute of Technology (TMIT) - Association for Professionals in Infection Control & Epidemiology (APIC)) [4]*

The TMIT-APIC Healthcare-Associated Infections Cost Calculator was developed in collaboration with the Texas Medical Institute of Technology (TMIT) and APIC. It provides an alternate method to determine the cost of healthcare-associated infections from the APIC cost calculator.

- C. *Edweek [5]*

This interactive tool developed by Education Week and the Learning Policy Institute is used to calculate project socio-economic impact for the U.S.

- D. *St. Louis Fed Article [6]*

The Bureau of Labor Statistics (BLS) uses surveys to gather data on the prices of goods and services purchased across the U.S., weights these prices by how much they contribute to the typical basket of expenditures, and then aggregates to form the consumer price index (CPI). Inflation is then measured as the rate of growth of the CPI over a specific period.

Alberto Cavallo, an economics professor at Harvard Business School, constructed expenditure weights for each month of 2020 using data from the Opportunity Insights Economic Tracker at Harvard University and Brown University as compiled by Raj Chetty and other economists.

Cavallo's weights are, no doubt, imprecise but seem reasonable. For example, we know that consumer expenditures at restaurants fell sharply in 2020. It therefore seems likely that expenditures on Food at

Home (Food Away from Home) likely increased (decreased) in 2020 and hence the true expenditure weights should be higher (lower) than normal for these categories. In fact, these weights are estimated to have increased (decreased) by 3.76 (3.07) percentage points during the month of April 2020, when stay-at-home orders were most severe for much of the country.

Having the estimated expenditure weights for 2020, we can then compare the official CPI-based inflation with an unofficial COVID CPI-based inflation that is easily accessible at Cavallo's website.

- E. *Medscape [7]*

The COVID-19 Prognostic Tool estimates mortality rates in patients with COVID-19 and is adapted from Centers for Disease Control and Prevention (CDC) materials.

### III. METHODS

At present, we are not aware of any validated COVID-19 calculator that aggregates COVID value creation and have thus constructed this working model. The strength of our working model is that it leverages a number of existing models, and existing data points, and allows the user to customize the calculator based on values, weights, variables, and assumptions they deem relevant.

Our novel model COVID-19 calculator measures U.S. socio-economic impact of COVID-19 AI/ML pre-screening algorithm, and potential savings through early detection, facilitating the return to pre-COVID normalcy. Users may utilize criteria & assumptions they are comfortable with. For purposes of this illustration, assumptions are based on 1% or 0.1% degree of positive change. By using your own data and assumptions, and this model calculator, each user can customize the calculator based on values, weights, variables, and assumptions the user deems relevant.

In Figure 1 (next page), we have summarized the steps involved for a sample calculation using the proposed calculator. The users can replace the sample calculations with actual data to determine the actual impact. We have provided the link to the calculator with sample calculations for better understanding.

**Sample Action Steps to Customize the COVID-19 Calculator to Measure Positive U.S. Socio-Economic Impact of a COVID-19 Pre-Screening Solution (AI/ML)**

**Sample Action Steps to Use This Calculator**

**-> To customize, the user should use their own data and assumptions, and this model calculator, and customize the calculator based on values, weights, variables, and assumptions the user deems relevant**

**Debits:**

- (a) assume # of Year cost(s) to bring the solution for the U.S. market [e.g., \$75,000,000.00] or other value from the user?
- (b) additional future potential \$ through a public / private partnership for the U.S. market [e.g., \$ TBD] or other value from the user?
- Additional criteria from the user ?
- Additional criteria from the user ?

**Credits:**

- + (c) Reduction in covid-related healthcare expenses for the U.S. market [e.g., assume a solution can contribute to a .1% reduction at covid-related healthcare expenses - \$50B loss per month, assume 12 months = \$600B, which means \$600M; assume conversion of loss = ten cents per dollar = \$60,000,000.00] or other value from the user?
- + (d) Increase in GDP for the U.S. market (e.g., assume a solution can contribute to an increase in GDP of the U.S. of 1/10th of 1% of GDP [2021 forecasted US GDP \$21T. 0.04 attributed to COVID (\$840B). 1/10th of 1% = \$840M] or other value from the user ?
- + (e) assume 1% reduction of COVID related deaths in the U.S. [e.g., U.S. 790,000 deaths, assume 1% reduction conversion is 7,930 lives per year = 23,790 lives / 3 years] or other value from the user ?
- + (f) assume .1% savings of 22 million U.S. jobs lost = 22,000 jobs saved / year [e.g., U.S. = 66,000 jobs / 3 years] or other value from the user?
- + (g) Reduction in U.S. PCR testing [users may add Antigen testing cost as well if they prefer] or other value from the user?
- + (h) Reduction in U.S. school-related expenses & delayed learning or other value from the user ?
- + (i) Reduction in COVID-related U.S. inflation [e.g., .1% of 50 basis points] or other value from the user ?
- + (j) Measurable progress of U.S. returning to pre-COVID normalcy
- + Additional criteria from the user ?
- + Additional criteria from the user ?

**Fig. 1 Sample Calculator - to be Customized by User**

Click on the below link

<https://docs.google.com/spreadsheets/d/1kgKk9Hflj6Q0EDnrVcknIYAjvscLcl35rnPn3j7OYko/edit#gid=1231624889>

## V. CONCLUSION

The pace at which each country recovers from COVID shock varies from one another due to several factors such as increased domestic spending power, decreased consumption of contact-intensive services, labor shortages, etc. The surge due to variants from time to time adds up to other factors causing inflation. Hence, it is important to evaluate or predict the socio-economic impact of disease outbreaks like COVID-19.

Several organizations and researchers have designed calculators to determine the cost incurred with the diseases and the associated savings by preventing them. Mostly, these calculators are industry-specific like the APIC cost calculator determines the impact on healthcare institutions and the Edweek calculator on the schools.

Recently, few AI/ML researchers have started exploring the usage of coughs collected from smartphones to pre-screen associated diseases like COVID-19, Asthma, Pertussis, etc. In this paper, we have designed a COVID-19 calculator that measures the socio-economic impact involved in the development of an AI/ML pre-screening solution and the associated savings through early detection. We have considered 1% or 0.1% degree of positive change in the calculations. We have enabled the users of this calculator to use their own data and assumptions to customize by assigning values, variables, weights, and assumptions the user deems fit.

## VI. ACKNOWLEDGEMENTS

We are very grateful to:

- Mark Parinas, CEO, CuraeSoft Corporation, for his thoughtful guidance on the socio-economic implications of our research, and his heartfelt commitment to the public good.
- The Covid Detection Foundation (dba Virufy) for their AI/ML efforts in support of our research.
- M. Pilanci is supported by the National Science Foundation (NSF), and the U.S. Army Research Office.


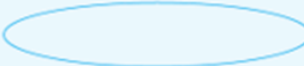
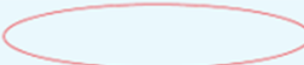
## VII. FAIR USE

Subject to general limitations, some copyrighted material(s), such as the included figures, are deemed fair use(s) based on this paper's intentions to stimulate creativity for the enrichment of the general public, comment, criticism, research, news reporting, teaching, and scholarship. Cited work(s) are the property of the author(s) / copyright holders.

## REFERENCES

- [1] "WHO Coronavirus (COVID-19) Dashboard," <https://covid19.who.int/>, accessed on Mon, January 03, 2022. [Online] <https://covid19.who.int>
- [2] R. K. W. Abraar Karan, "Healthcare System Stress Due to Covid-19: Evading an Evolving Crisis," *Journal of Hospital Medicine*, 2021.
- [3] E. Mahase, "Covid-19: Do vaccines work against omicron-and other questions answered." *BMJ*, vol. 375, pg. 3062, Dec 2021.
- [4] [Online]<https://apic.org/Resources/Cost-calculators>
- [5] [Online]<https://www.edweek.org/policy-politics/calculator-how-much-will-covid-19-cost-schools>
- [6] M. McCracken, A. Amburgey, "How COVID-19 May Be Affecting Inflation," on the Economy Blog by the Federal Reserve Bank of St. Louis, Feb, 2021. [Online]<https://www.stlouisfed.org/on-the-economy/2021/february/covid19-affecting-inflation>
- [7] [Online]<https://reference.medscape.com/calculator/731/covid-19-prognostic-tool>
- [8] G. M. Milesi-Ferretti, "A Most Unusual Recovery: How the US rebound from COVID differs from rest of G7, Brookings, Dec 2021. [Online]<https://www.brookings.edu/blog/up-front/2021/12/08/a-most-unusual-recovery-how-the-us-rebound-from-covid-differs-from-rest-of-g7/>
- [9] U.S. Bureau of Statistics, "State Employment and Unemployment Summary" in the Economic News Release, Dec 2021 [Online]<https://www.bls.gov/news.release/laus.nr0.htm>
- [10] Thorpe, W., M. Kurver, G. King, and C. Salome. 2001. "Acoustic Analysis of Cough". In *The Seventh Australian and New Zealand Intelligent Information Systems Conference, 2001*, 391–94.
- [11] Song, I. 2015. "Diagnosis of Pneumonia from Sounds Collected Using Low Cost Cell Phones". In *2015 International Joint Conference on Neural Networks (IJCNN)*, 1–8.
- [12] Infante, C., D. Chamberlain, R. Fletcher, Y. Thorat, and R. Kodgule. 2017. "Use of Cough Sounds for Diagnosis and Screening of Pulmonary Disease". In *2017 IEEE Global Humanitarian Technology Conference (GHTC)*, 1–10.

- [13] Brown, C, J Chauhan, A Grammenos, J Han, A Hasthanasombat, D Spathis, T Xia, P Cicuta, and C Mascolo. 2020. "Exploring Automatic Diagnosis of COVID-19 from Crowdsourced Respiratory Sound Data". In *Proceedings of the 26th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining*, 3474–84. KDD '20. New York, NY, USA: Association for Computing Machinery.
- [14] Laguarda, J, F Hueto, and B Subirana. 2020. "COVID-19 Artificial Intelligence Diagnosis Using Only Cough Recordings". *IEEE Open Journal of Engineering in Medicine and Biology* 1: 275–81.
- [15] Hassan, A, I Shahin, and M B Alsabek. 2020. "COVID-19 Detection System Using Recurrent Neural Networks". In *2020 International Conference on Communications, Computing, Cybersecurity, and Informatics (CCCI)*, 1–5.
- [16] Mouawad, P, T Dubnov, and S Dubnov. 2021. "Robust Detection of COVID-19 in Cough Sounds: Using Recurrence Dynamics and Variable Markov Model.". *SN Comput Sci* 2: 34.
- [17] Muguli, Ananya, Lancelot Pinto, Nirmala R., Neeraj Sharma, Prashant Krishnan, Prasanta Kumar Ghosh, Rohit Kumar, et al. 2021. "DiCOVA Challenge: Dataset, Task, and Baseline System for COVID-19 Diagnosis Using Acoustics".
- [18] Neeraj Sharma, "Coswara – A Database of Breathing, Cough, and Voice Sounds for COVID-19 Diagnosis". *arxiv* (2020)
- [19] Han, J, C Brown, J Chauhan, A Grammenos, A Hasthanasombat, D Spathis, T Xia, P Cicuta, and C Mascolo. 2021. "Exploring Automatic COVID-19 Diagnosis via Voice and Symptoms from Crowdsourced Data". In *ICASSP 2021 - 2021 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 8328–32.
- [20] Pahar, M, M Klopper, R Warren, and T Niesler. 2021. "COVID-19 Cough Classification Using Machine Learning and Global Smartphone Recordings". *Computers in Biology and Medicine* 135: 104572.
- [21] Erdoğlan, Y E, and A Narin. 2021. "COVID-19 Detection with Traditional and Deep Features on Cough Acoustic Signals". *Computers in Biology and Medicine* 136: 104765.
- [22] [Online] <https://github.com/virufy>
- [23] Despotovic, V, M Ismael, M Cornil, R M Call, and G Fagherazzi. 2021. "Detection of COVID-19 from Voice, Cough and Breathing Patterns: Dataset and Preliminary Results". *Computers in Biology and Medicine* 138: 104944.
- [24] Tena, A, F Clarià, and F Solsona. 2022. "Automated Detection of COVID-19 Cough". *Biomedical Signal Processing and Control* 71: 103175.

	Example	Your Organization
HAI incidence per 1,000 patient days <sup>1</sup>	9.3	
	X	X
Mean attributable costs of HAIs <sup>2</sup>	\$13,973-\$15,275	\$13,973-\$15,275
Estimated cost to facility per 1,000 patient days	= \$129,949-\$142,057	
	X	X
Potential decreases in HAI cases <sup>3</sup>	Up to 83%	Up to 83%
Potential savings	= \$107,858-\$117,907	

Note: The potential decrease cited in HAI cases reflects that there is a range of prevention outcomes, based on the nature and compliance to a multimodal approach. Peer-reviewed, published studies have demonstrated success in controlling outbreaks involving Norovirus and VRE and significant decreases (up to 83%) involving CDI. This range has been reinforced by Harbarth.<sup>4</sup>

1. Klevens RM, Edwards JR, Richards CL, Horan T, Gaynes R, Pollock D, Cardo D. Estimating Health Care-Associated Infections and Deaths in US Hospitals, 2002. *Public Health Rep.* 2007;122:160-166.
2. Stone PW, Larson E, Kawar LN. A systematic audit of economic evidence linking nosocomial infections and infection control interventions: 1990-2000. *Am J Infect Control* 2002;30:145-152. Roberts RR, Scott RD II, Cordell R, Solomon SL, Steele L, Kampe LM, Trick WE, Weinstein RA. The use of economic modeling to determine the hospital costs associated with nosocomial infections. *Clinical Infectious Diseases.* 2003;36:1424-32.
3. Johnston et al., Outbreak Management and Implications of a Nosocomial Outbreak. *Clinical Infectious Diseases.* 45:534. Eckstein et al., Reduction of

- Clostridium difficile* and vancomycin-resistant *Enterococcus* contamination of environmental surfaces after an intervention to improve cleaning methods. *BMC Infectious Diseases.* 2007;7:61. McMullen KM, Zack J, Coopersmith CM, Kollef M, Dubberke E, and Warren DK. Use of hypochlorite solution to decrease rates of *Clostridium difficile*-associated diarrhea. *Infect Control Hosp Epidemiol.* 2007;28:205-7. Mayfield JL, Leet T, Miller J, Murdy LM. Environmental Control to Reduce Transmission of *Clostridium difficile.* *Clin Dis.* 2000;31:995-1000.
4. Harbarth S, Sax H, Gastmeier P. The preventable proportion of nosocomial infections: an overview of published reports. *J Hosp Infect.* 2003;54:258-266.

Fig. 2 Sample Calculation from the APIC calculator [4]



# Cost of HAI Calculator

## :::: Determine Hospital Size Category ::::

REGION	TEACHING <sup>5</sup>	HOSPITAL BEDS		
Northeast <sup>1</sup>	Non-teaching	1-124	125-199	200+
	Teaching	1-249	250-424	425+
Midwest <sup>2</sup>	Non-teaching	1-74	75-174	175+
	Teaching	1-249	250-374	375+
South <sup>3</sup>	Non-teaching	1-99	100-199	200+
	Teaching	1-249	250-449	450+
West <sup>4</sup>	Non-teaching	1-99	100-174	175+
	Teaching	1-199	200-324	325+

↑            ↑            ↑  
 SMALL      MEDIUM    LARGE

### SET HOSPITAL SIZE

Size

Example: For a Midwestern Urban Teaching hospital with 76 beds, select "Small"

<sup>1</sup> Northeast includes ME, NH, VT, MA, RI, CT, NY, NJ, and PA.

<sup>2</sup> Midwest includes OH, IN, IL, MI, WI, MN, IA, MO, ND, SD, NE, and KS.

<sup>3</sup> South includes DE, MD, DC, VA, WV, NC, SC, GA, FL, KY, TN, AL, MS, AR, LA, OK, and TX.

<sup>4</sup> West includes MT, ID, WY, CO, NM, AZ, UT, NV, WA, OR, CA, AK, and HI.

<sup>5</sup> If your hospital has an AMA-approved residency program, is a member of the Council of Teaching Hospitals (COH), or has a ratio of full-time equivalent interns and residents to beds of .25 or higher, then use Teaching. Otherwise, use Non-teaching.

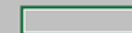


Fig 3. Sample Calculation from the APIC - TMIT calculator [4]



## Calculate: How Much Will COVID-19 Cost Schools?

Follow the steps below to estimate the total impact of increased costs and revenue losses due to the coronavirus pandemic. Total amount appears at the bottom of this form.

To interact with the data worksheet, move the scroll bars left and right to adjust the factors in each scenario. Calculations based on your input appear in the pale blue boxes.

### STEP 1 / Select your state

Use the dropdown below to look at national or state data

### STEP 2 / Accounting for increased costs

Percent of students without high-speed internet at home\*  
(Data populates from your state selection in step 1)

Calculated cost

\$221,140,824

Increase in the number of days to provide free/reduced-price lunch and breakfast

Calculated cost

\$62,447,497

Increase number of school days added to 2020 school year

Percent of students this will impact

Calculated cost

\$834,737,526

Estimated total additional costs

\$1,118,325,847

Fig 4. Sample Calculation from the Education Week Calculator [5]

---

### STEP 3 / **Factoring losses in revenue**

Percentage of revenue cuts, 2019-20 school year

Projected loss

\$15,592,734,908

Percentage of revenue cuts, 2020-21 school year

Projected loss

\$15,592,734,908

---

Projected revenue loss for both years

\$31,185,469,816

---

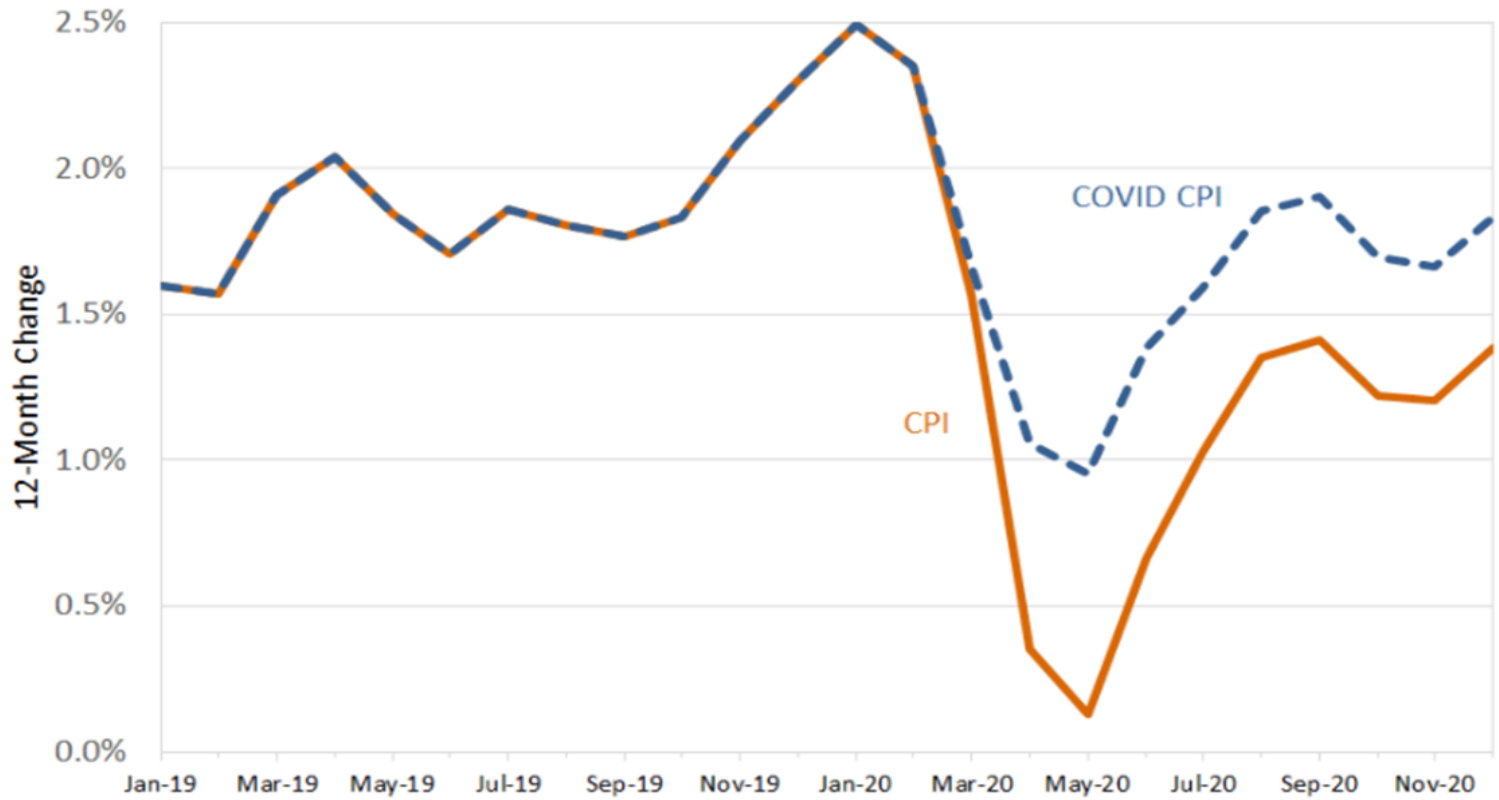
### STEP 4 / **The bottom line**

Total increased cost & revenue loss

\$32,303,795,663

Fig 4. Sample Calculation from the Education Week Calculator [5] (contd.)

## The Pandemic's Influence on U.S. Inflation



NOTES: CPI is the official consumer price index for all items. COVID CPI is a similar index, but its expenditure weights are adjusted to reflect monthly changes in estimated consumer spending patterns.

SOURCE: Alberto Cavallo ([projects.iq.harvard.edu/covid-cpi](https://projects.iq.harvard.edu/covid-cpi)).

Federal Reserve Bank of St. Louis

Fig. 5. The Pandemic's Influence on the U.S. Inflation [6]

### COVID-19 Prognostic Tool

Estimate mortality rates in patients with COVID-19. Adapted from CDC materials.

Si US

Calculator	References/About
<ul style="list-style-type: none"><li>✓ 1. Age? 55-59 &gt;</li><li>✓ 2. Cardiovascular Disease? No &gt;</li><li>✓ 3. Diabetes? No &gt;</li><li>✓ 4. Chronic Respiratory Disease? No &gt;</li><li>✓ 5. Hypertension? No &gt;</li><li>✓ 6. Cancer? No &gt;</li><li>✓ 7. Prior Stroke? No &gt;</li><li>✓ 8. Heart Disease? No &gt;</li><li>✓ 9. Chronic Kidney Disease? No &gt;</li></ul>	<h4>Results</h4> <p><b>Age Specific Fatality Rate (Chinese Data)</b> 1.3%</p> <p><b>Age Specific Fatality Rate (U.S. Data)</b> 1%-3%</p> <p><b>Comorbidity Information (Chinese Data)</b> Patients in China with no reported underlying medical conditions had an overall case fatality of 0.9%</p> <p><b>Note</b> There is no model for a single mortality risk that takes into account multiple variables. Accounting for differences in age and prevalence of underlying condition, mortality associated with COVID-19 in the United States was similar to China.</p> <p>Created by QxMD</p>

Fig. 6. COVID-19 Prognostic Tool [7]