



# Clinical Informatics Innovations in the COVID Era

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# *New England Journal of Medicine, January 24, 2020*

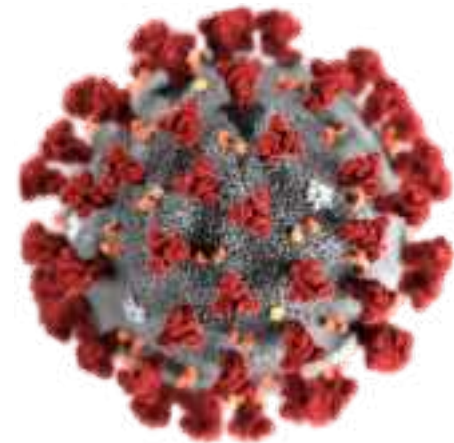
## BRIEF REPORT

### A Novel Coronavirus from Patients with Pneumonia in China, 2019

Na Zhu, Ph.D., Dingyu Zhang, M.D., Wenling Wang, Ph.D., Xingwang Li, M.D., Bo Yang, M.S., Jingdong Song, Ph.D., Xiang Zhao, Ph.D., Baoying Huang, Ph.D., Welfeng Shi, Ph.D., Roujian Lu, M.D., Peihua Niu, Ph.D., Faxian Zhan, Ph.D., Xuejun Ma, Ph.D., Dayan Wang, Ph.D., Wenbo Xu, M.D., Guizhen Wu, M.D., George F. Gao, D.Phil., and Wenjie Tan, M.D., Ph.D., for the China Novel Coronavirus Investigating and Research Team

#### SUMMARY

In December 2019, a cluster of patients with pneumonia of unknown cause was linked to a seafood wholesale market in Wuhan, China. A previously unknown betacoronavirus was discovered through the use of unbiased sequencing in samples from patients with pneumonia. Human airway epithelial cells were used to isolate a novel coronavirus, named 2019-nCoV, which formed a clade within the subgenus sarbecovirus, Orthocoronavirinae subfamily. Different from both MERS-CoV and SARS-CoV, 2019-nCoV is the seventh member of the family of coronaviruses that infect humans. Enhanced surveillance and further investigation are ongoing. (Funded by the National Key Research and Development Program of China and the National Major Project for Control and Prevention of Infectious Disease in China.)



# February 2020 in San Diego



# UC San Diego Health

- Only academic medical center in San Diego county
  - Medical center – 9000+ employees + 800 beds
  - 3 professional schools – 1600+ faculty
- Epic client since 2003

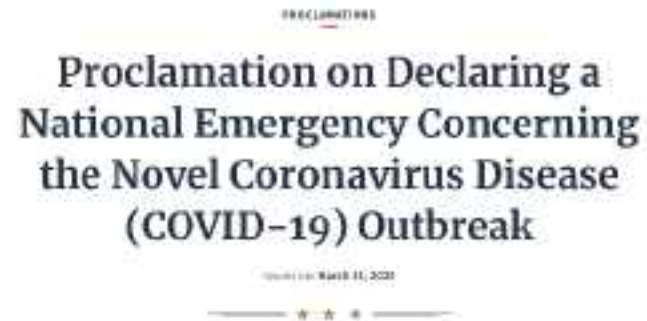


# March 2020

## March 11, 2020



## March 13, 2020





March 24, 2020, *JAMIA*

*Journal of the American Medical Informatics Association*, 27(6), 2020, 853–859

doi: 10.1093/jamia/ocaa037

Advance Access Publication Date: 27 April 2020

Research and Applications



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## Research and Applications

# Rapid response to COVID-19: health informatics support for outbreak management in an academic health system

J. Jeffery Reeves <sup>1</sup>, Hannah M. Hollandsworth<sup>1</sup>, Francesca J. Torriani<sup>2</sup>, Randy Taplitz<sup>2</sup>, Shira Abeles<sup>2</sup>, Ming Tai-Seale<sup>3</sup>, Marlene Millen<sup>4</sup>, Brian J. Clay<sup>4</sup>, and Christopher A. Longhurst <sup>4</sup>

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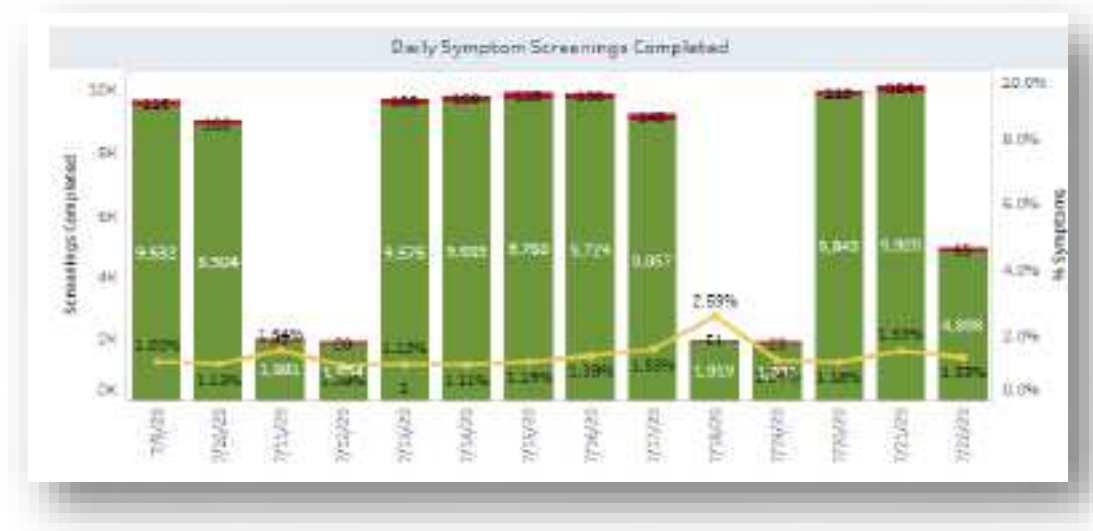
# Health IT Needs Identified

<b>Electronic Health Record Tools for Managing a Pandemic</b>
<b>Screening Protocols</b>
Triage of Patient Phone Calls
Required Registration/Check-In Screening Questions for All Patients
<b>System Level EHR Templates</b>
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Smart tablets in patient rooms w/ video capabilities

# UC San Diego Screening Tool Supports Testing for Symptomatic Employees and Students

- Mandated by San Diego County to screen all students and employees on-site; UC San Diego “strongly encourages” for all regional employees working off-site
- All students and employees who screen positive for new symptoms or exposure are referred to UC San Diego Health for COVID testing *at no cost*

<https://blink.ucsd.edu/HR/services/covid-19/symptom-screening/>





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# Return to Learn @ UC San Diego



# Journal of American College Health, Nov 2020

JOURNAL OF AMERICAN COLLEGE HEALTH  
<https://doi.org/10.1080/10744848.2020.1843468>



OPEN ACCESS

Check for updates

## CASE REPORT

### Bringing student health and Well-Being onto a health system EHR: the benefits of integration in the COVID-19 era

J. Jeffery Reeves, MD<sup>a</sup>, Christopher A. Longhurst, MD, MS<sup>b</sup>, Stacie J. San Miguel, MD<sup>c</sup>, Reina Juarez, PhD<sup>d</sup>, Joseph Behymer, MD<sup>e</sup>, Kevin M. Ramotar, PsyD<sup>f</sup>, Patricia Maysent, MPH, MBA<sup>g</sup>, Angela L. Scioscia, MD<sup>h</sup>, and Marlene Millen, MD<sup>i</sup>

<sup>a</sup>Department of Surgery, University of California, San Diego, La Jolla, California, USA; <sup>b</sup>Department of Medicine, Division of Biomedical Informatics, University of California, San Diego, La Jolla, California, USA; <sup>c</sup>Student Health Services, University of California, San Diego, La Jolla, California, USA; <sup>d</sup>Counseling and Psychological Services, University of California, San Diego, La Jolla, California, USA; <sup>e</sup>University of California, San Diego Health, Office of the CEO, La Jolla, California, USA; <sup>f</sup>Student Health and Well-Being, University of California, San Diego, La Jolla, California, USA

#### ABSTRACT

**Objective:** To detail the implementation, benefits and challenges of onboarding campus-based health services onto a health system's electronic health record.

**Participants:** UC San Diego Student Health and Well-Being offers medical services to over 39,000 students. UC San Diego Health is an academic medical center.

**Methods:** 20 workstreams and 9 electronic modules, systems, or interfaces were converted to new electronic systems.

**Results:** 36,023 student-patient medical records were created. EHR-integration increased security while creating visibility to 19,700 shared patient visits and records from 236 health systems across the country over 6 months. Benefits for the COVID-19 response included access to screening tools, decision support, telehealth, patient alerting system, reporting and analytics, COVID-19 dashboard, and increased testing capabilities.

**Conclusions:** Integration of an interoperable EHR between neighboring campus-based health services and an affiliated academic medical center can streamline case management, improve quality and safety, and increase access to valuable health resources in times of need. Pertinent examples during the COVID-19 pandemic included uninterrupted and safe provision of clinical services through access to existing telehealth platforms and increased testing capacity.

#### ARTICLE HISTORY

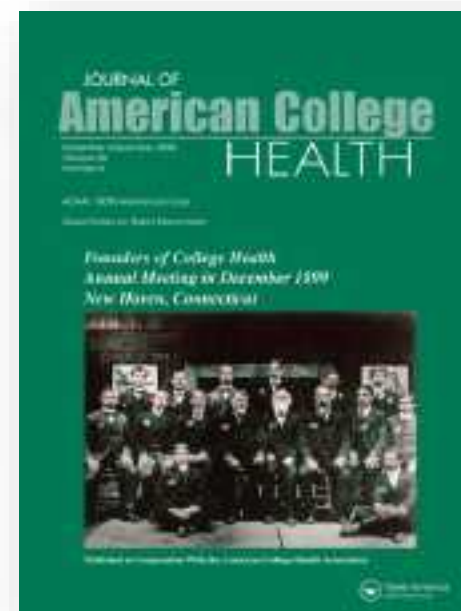
Received 6 July 2020

Revised 8 September 2020

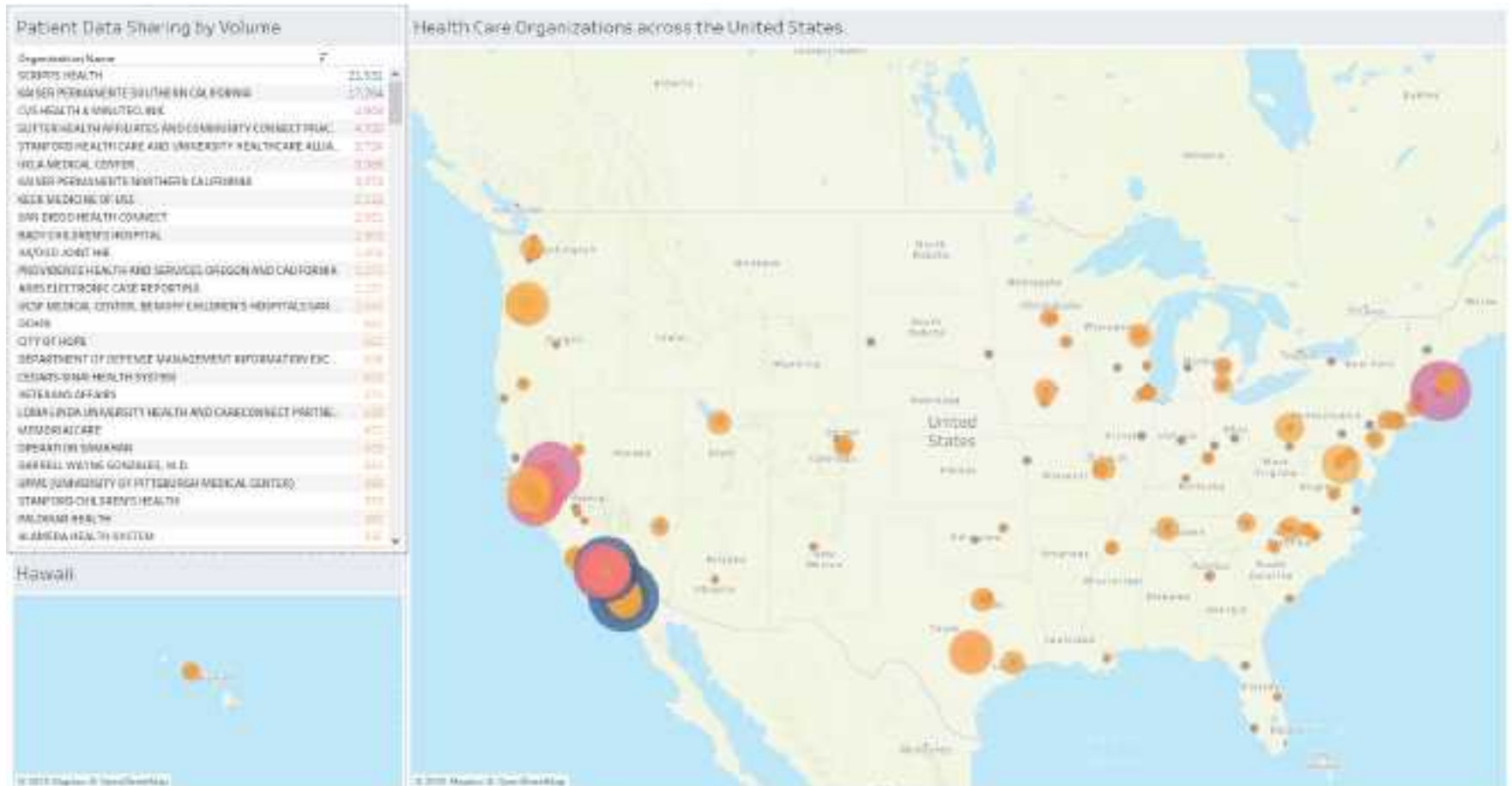
Accepted 18 October 2020

#### KEYWORDS

Clinical informatics;  
electronic health record;  
data sharing; student  
health; telehealth

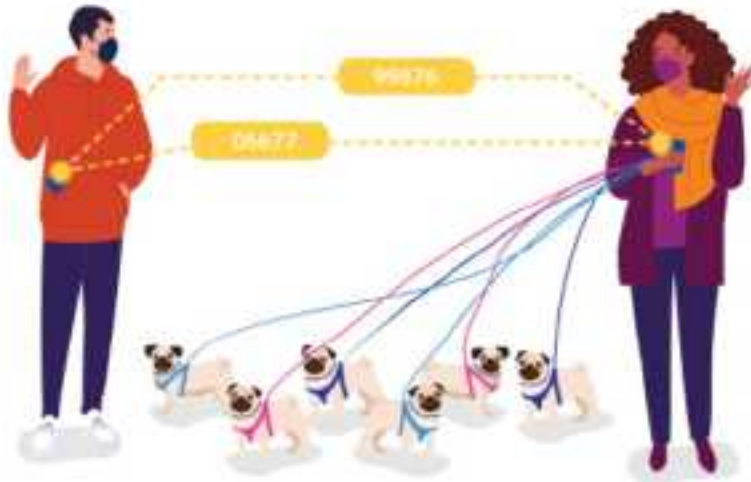


# Records shared between student health and USA





# How Exposure Notification Works



- Bob and Alice don't know each other
- They both have CA Notify exposure notifications enabled on their phones
- They have a conversation for 15 minutes within 6 feet of each other
- Their phones exchange anonymous keys via Bluetooth

CA Notify does not collect:



your  
name



contact  
information



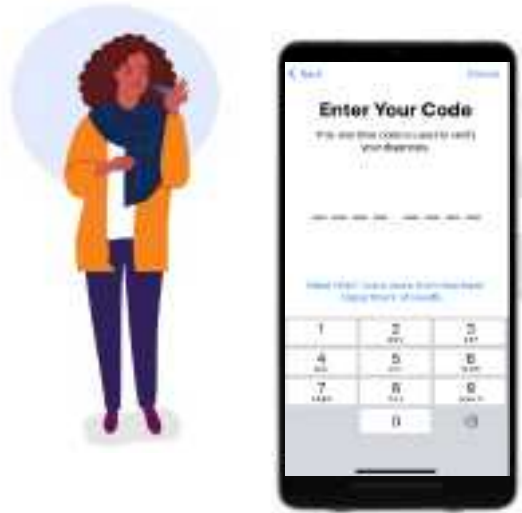
location or  
movement



identity of  
people you meet



# How Exposure Notification Works



- Later Alice tests COVID-19 positive; her test result is reported to CDPH so she receives an automated text message with a link to launch exposure notifications
- She voluntarily moves forward to send alerts to other CA Notify users she might have exposed



- Bob receives an alert on his phone that he may have been near someone who tested positive for COVID-19.
- He is directed to a website for information on quarantining and testing.

# Timeline of Exposure Notification in CA

- **May/June** – advocacy with various stakeholders for ENS in California
- **July/August** – collaborate with UC government relations on proposed state bills
- **September** – UCSD/UCSF pilot announced (9/10) and launched at UCSD with student move-in (9/23) and UCSF (9/30)
- **October** – early outcome data @ UCSD showed >75% on-campus adoption, confirmed privacy and benefit of early notification for quarantine and testing
- **November** – UC pilot expansion announced (11/5) and launched (11/16) at UCB, UCD, UCSB, UCR, and UCLA (managed by UCSD)
- **December** – statewide expansion announced 12/7 as partnership with UC San Diego Health, and launched 12/10. Over 7M users in the first week!

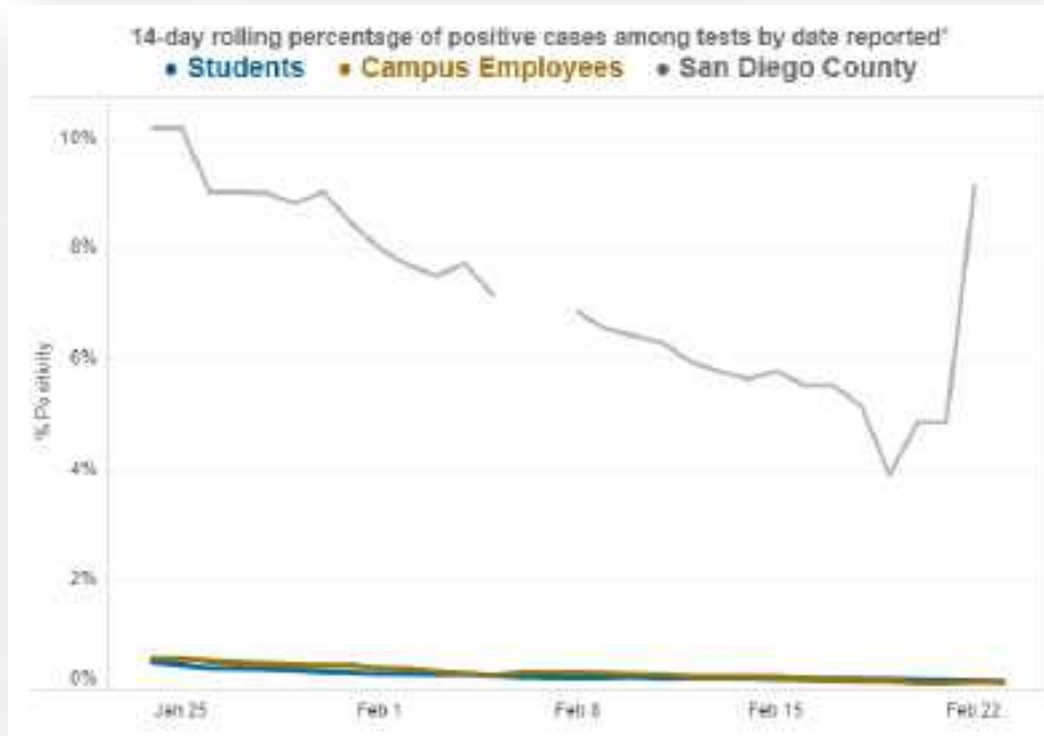


<http://canotify.ca.gov>

A promotional graphic for the California Can Notify campaign. The top half has a blue background. On the right, a light blue map of California is overlaid with a network of orange dots and lines, representing connectivity. Five circular icons with orange backgrounds and white borders are placed around the map, each containing a stylized illustration of a person wearing a face mask. On the left, the text 'California can stop the spread' is written in white. Below it, in smaller white text, is 'Add your phone today to California's exposure notification system'. At the bottom of the blue section are two black buttons: 'Available on iPhone' with the Apple logo and 'GET IT ON Google Play' with the Google Play logo. The bottom half of the graphic has a white background. It starts with the text 'Powered by' in blue. Below this are four logos arranged horizontally: 'UC San Diego Health', the 'CDPH' logo (California Department of Public Health), the 'CALIFORNIA ALL' logo (a circular seal), and the 'California DEPARTMENT OF TECHNOLOGY' logo (a square icon with a globe).

# Key Findings from UC San Diego Pilot

1. It works! Multiple students and employees are appropriately quarantined and tested as a result of early exposure notification



<https://returntolearn.ucsd.edu/dashboard/>

# Key Findings from UC San Diego Pilot

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2. This technology is not a silver bullet, but is part of a larger pandemic defense effort



<https://returntolearn.ucsd.edu/return-to-campus/safety-requirements/>



# Key Findings from UC San Diego Pilot

1. It works! Multiple students and employees are appropriately quarantined and tested as a result of early exposure notification
2. This technology is not a silver bullet, but is part of a larger pandemic defense effort
3. The technology is viewed as a health tool. Efficacy in limiting spread is proportional to adoption in a population, and messaging from a healthcare provider was particularly effective at converting users



# California as of April 25, 2021

## CA Notify Adoption

Estimated Total CA Notify Activations

10,300,281

iOS

1

Android

2

9,416,689

883,592

26% Total

per CA Population

3

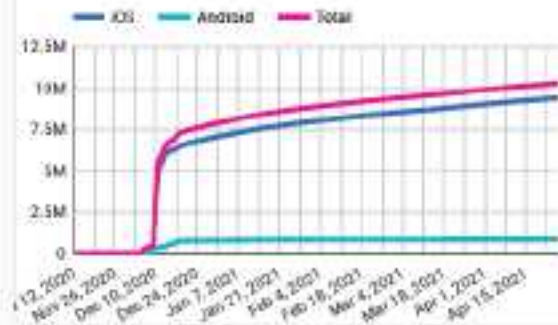
40% Median Value

per Smartphone user

4

### Estimated CA Notify Adoption Trend

1,2



## CA Notify Performance (7 Days' Average)

Codes Claimed

29%

↑ 2.99%

% COVID(+) CA Notify Users Who Claimed Codes

5

Codes Used

12%

↓ -0.40%

% COVID(+) CA Notify Users Who Used Codes

6

EN Alerts per Code Used

4.1

↓ -0.15

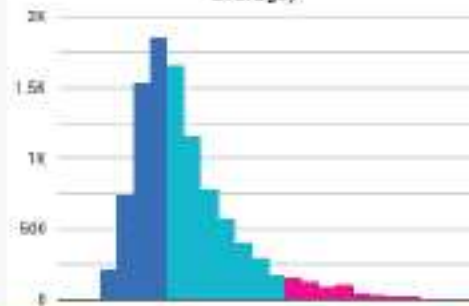
Average EN Webpage Visits for Every Used Code

7

The % on the right side of the small arrow represents the changes when compared to the prior 7-days' average. Rounded to nearest percent.

### Distribution of Days from Symptom Onset to Code Used (past 28 days, on a rolling average)

8



Days 0 to 3

43%

Days 4 to 10

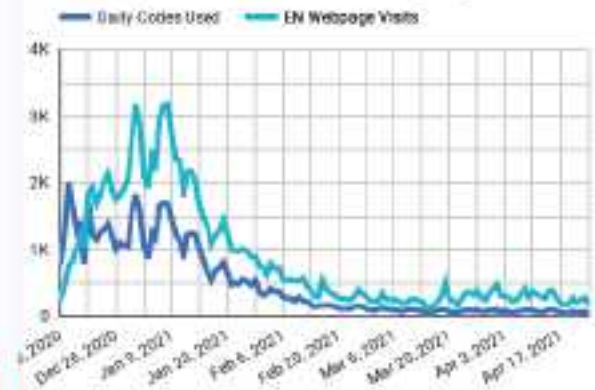
50%

Days 11 to 14

6%

### Daily Codes Used vs. EN Webpage Visits

9,10



65,050

Total Codes Used

9

114,728

Total EN Webpage Visits

10

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# COVID-19 Daily Readiness Dashboard (March 2020)



# Becker's Hospital Review, Aug 2020

## How COVID-19 dashboard is fueling engagement across UCSD Health

Jackie Drees - Monday, August 3rd, 2020 Print | Email



As CIO of UC San Diego Health, Chris Longhurst, MD, is familiar with the occasional complaint that comes after sending IT announcements to the organization's 20,000 employees. During this pandemic, however, disgruntled emails have been replaced by praise from staff on UCSD Health's coronavirus dashboard, a real-time digital snapshot of easy-to-understand hospital data.

In early April, UC San Diego Health Sciences began sending out a comprehensive COVID-19 dashboard to all its employees. The project, led by Dr. Longhurst and his colleagues, at first was designed specifically to inform UCSD Health's executives and physicians. But after seeing its potential to boost transparency across the health system, **CEO Patty Maysent supported making it available to all Health Sciences employees**, according to Dr. Longhurst.

Making the dashboard accessible to all staff has helped "to support a real shift in thinking around data and making data-driven decisions," he told *Becker's Hospital Review*. "The situational awareness of what our health system needs on a day-to-day basis, whether it's PPE, emergency department visits, virtual visits or inpatients with COVID-19, is extraordinary, and available in one view. It's really beyond anything that we've had access to in the past."

The UC San Diego Health Information Services department sends the data dashboard out in a daily email to staff, giving them access to information ranging from the number of COVID-19 hospitalizations at the health system, available intensive care unit beds and lab test positivity rates. The key operational metrics are meant to help keep employees current on the evolving situation of the pandemic as well as UCSD Health's response. Staff are also advised not to distribute the information outside of the health system to protect sensitive data.



<https://www.beckershospitalreview.com/data-analytics/how-covid-19-dashboard-is-fueling-engagement-across-ucsd-health.html>



# COVID Daily Readiness Dashboard (April 26, 2021)

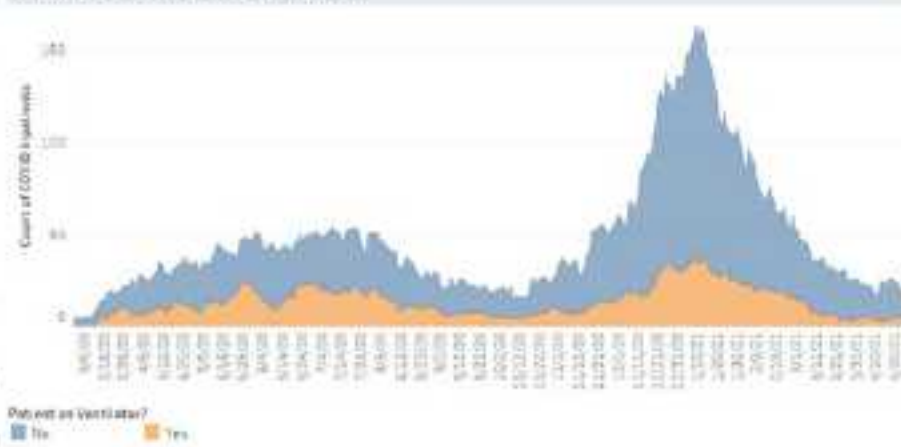
Positive Covid Tests: Health Employees

PCR Test since 12/23/2020



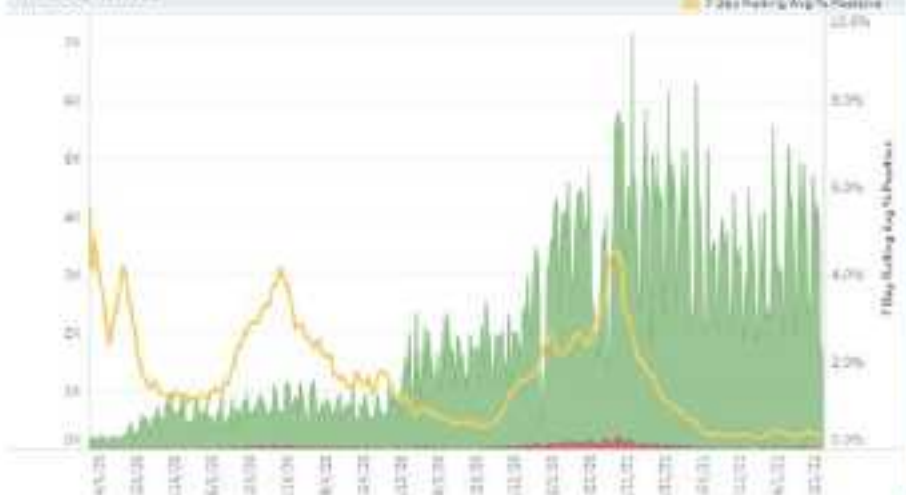
Daily Inhouse COVID Patients by Ventilator Status

Ventilator patients counted if present at any time of the day



UCSD All Tests Final Results

Aggregated by Result Date



COVID-19 Admits and Discharges by Day

All COVID-19 Referrals



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Deep Learning Localization of Pneumonia  
2019 Coronavirus (COVID-19) Outbreak

Itzhak Averbach, MD, MS, Scott Altshuler, MD, and Albert Haines, MD, PhD

For Windows radiographs, device imaging, processing, and viewing  
critical software, COVID-19 symptoms, or find  
it. Please, Amazon, 2020-10-20, 2020

### HOME PATIENT

The rising number of COVID-19 infections reported in Shanghai 2019 in Wuhan, China, spread rapidly, with confirmed cases in multiple countries. This first colony is a major health emergency (acute infections, with ~5% of COVID-19) hospitalized patients developing in acute pneumonia. Seventeen percent of hospitalized patients died. The disease is caused by a novel coronavirus, which often leads to long-term suppressing ability, thereby causing severe pulmonary inflammation. The 3% mortality rate associated with COVID-19 in China is less than that seen with previous coronavirus coronavirus outbreaks such as SARS (10% mortality) and MERS (35% mortality), at a 20-fold lower rate. The disease is caused by a novel coronavirus, which often leads to long-term suppressing ability, thereby causing severe pulmonary inflammation. The 3% mortality rate associated with COVID-19 in China is less than that seen with previous coronavirus coronavirus outbreaks such as SARS (10% mortality) and MERS (35% mortality), at a 20-fold lower rate. The disease is caused by a novel coronavirus, which often leads to long-term suppressing ability, thereby causing severe pulmonary inflammation. The 3% mortality rate associated with COVID-19 in China is less than that seen with previous coronavirus coronavirus outbreaks such as SARS (10% mortality) and MERS (35% mortality), at a 20-fold lower rate.

There has been a lot of work done in the area of image segmentation. One of the most popular methods is the region growing technique. This technique involves starting with a seed pixel and then growing a region around it by adding pixels that are similar in color or intensity. Another popular method is the watershed segmentation technique, which involves dividing the image into regions based on the local minima of a gradient magnitude image. Both of these techniques have their own strengths and weaknesses, and it is often necessary to combine them in order to achieve the best results. In this paper, we propose a new method for image segmentation that combines the strengths of both region growing and watershed segmentation. Our method involves using region growing to identify the main regions of the image, and then using watershed segmentation to refine these regions and remove any remaining noise. We have tested our method on a variety of images, and the results show that it is able to segment the images more accurately than either region growing or watershed segmentation alone. We also show that our method is able to handle images with complex backgrounds and textures, which is a common problem for many other segmentation methods. In conclusion, we believe that our method is a promising new approach to image segmentation, and we hope that it will be useful to other researchers in the field.

From the Department of Biology, University of California, San Diego, La Jolla, CA.

**8.3.** Nothing shall support that the NSF T-2 Intergovernmental Personnel Award Service (IPIAS) program used to perform the research provided by an IPIAS Awardee (IPIAS Awardee) is a federal government activity for the purposes of the American Foreign War Service, as the NSF T-2 follows.

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 http://www.degruyter.com

## METHODS

A total of 18 frontal chest radiographs from 3 patients treated in China and the United States were reviewed from 3 prior COVID-19 systematic and case-control publications [17]. Furthermore, figures with frontal chest radiographs were downloaded as PDFs from and visually inspected to only include the frontal radiographs. These images were used as inputs for our UN algorithm, implemented as a U-Net trained with 228 radiograph-annotated radiographs, which produces pneumonia probability maps (red), only on chest radiographs.

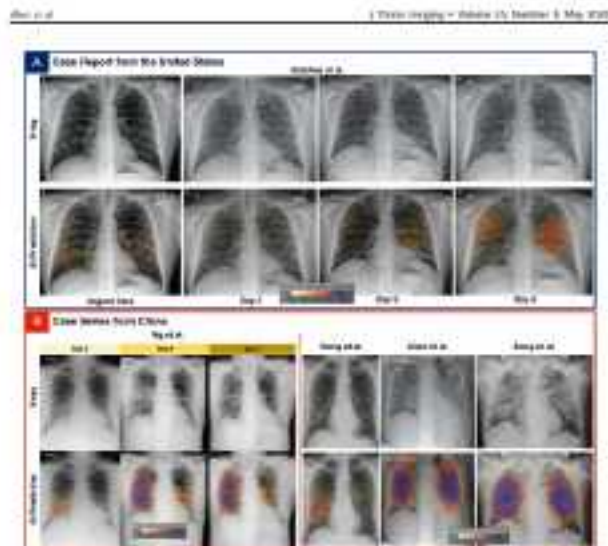
0022-0715/97/0000-0000\$05.00/0

Radiotherapy and the corresponding permanent probability were also estimated for each category in Figure 3. Figure 3 shows several chest radiographs of a CD44-19+ patient from the United States consistent with the existing symptom patterns and prognosis for several days. The algorithm predicted an increasingly localized state of pneumonia with increasing likelihood, as the finite corpus queries increased over time. It was very likely that each radiograph was analyzed by the algorithm independently without awareness of the deep context or relationship of previous films.

**Prevalence** In 10 cases 8 additional radiographs for the COVID-19 patients captured in Chinese hospitals spanning 4-time points between the group of 7 radiographs on the left side of the panel is from 1 patient over a 7-day span showing progression of a lower right lobe and perihilar alveolar opacities. The 1 radiograph on the right are from different patients. Two thoracic cases showing diffuse bilateral coarse opacities consistent with pneumonia, and another case showing a right hilar/oblique consolidation consistent with pneumonia. The chest radiographs in each panel are ordered chronologically from earliest location to latest and contain technical details that may be useful to readers and outline difficulties that may be seen in some of the images. Further

**COMMENT**

These results illustrate a relevant aspect of generalizability and consistency of the ILL approach that we formally proposed, suggesting that it may have utility for early diagnosis and longitudinal follow-up of suspected persons, including patients with COVID-19 symptoms. Although the trials are not an exhaustive proof of longitudinal performance, these results imply that some structural generalizability of the ILL, depending on context, is when it generally processed in the ILL2. This is despite considerable variation in the magnitude of error, image quality, and the number of subjects. The results of this preliminary study suggest that the ILL approach may be a promising solution. It is possible that the detection of the same person, illustrated on fig. 2, in case 5 is related to the



**FIGURE 1.** *U. luteolus* in *Hyalella* 2 specimens, *Hyalella* 15, cleared from multiple parasites (2786) 17 (one not even exposed by any dissection), 1 total count including one from a 4.6-pm-old male of *Hyalella* (one parasite not recovered), similarly, about 2000 parasites (not described) in the digestive tract of one *Hyalella*, which definitely had appeared on the 4.6, and continued to progress in the 17. A female and a male of *Hyalella* from 17 (the same) were also infected with *U. luteolus* (not described) and infected by the dissection. Several other specimens were obtained (not mentioned here) from this source (published by Holmboe et al., 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640

change represents effort as in the wage exchange between the migrant and hostland settings. A larger study will be necessary to assess the generalizability of this algorithm across industries. Nevertheless, these results support the idea that TR algorithms will become increasingly valuable as they become better integrated into the shared day-to-day workflow.

Our application to the current COVID-19 outbreak provides a tangible example of how physicians and radiologists can work with artificial intelligence. This has the potential to augment the diagnostic abilities of physicians in the point of care, highlighting subtle abnormalities that may be missed by less-experienced physicians, and stage patients for improved outcomes. It also allows physicians to work the daily evaluation of the pulmonary vasculature more as a pattern recognition task before development of diffuse alveolar damage or acute respiratory distress syndrome. It

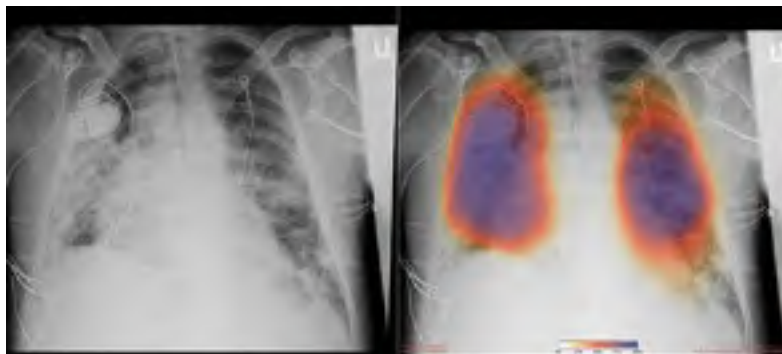
will respond such as COVID-19 pose a greater threat to the health care system, it may also provide a mechanism of sustained relief and other advanced interventions. Although further study is required to validate the effectiveness of this approach across multiple conditions, these results provide further evidence that this approach could be a potential tool for physicians and other health care providers to enhance acute and/or early diagnosis of patients.

## APPENDIX 1

1. Chen, Y., Zhou, M., Tang, Y., et al. Systemic acquired silencing disturbance of 99 cases of *HBV* and *HBsAg* expression in Fudan/Tsinghua hepatocarcinoma. *Cancer* (London, England) 2008; 97:861-7.
2. JTC. Chinese Society of Hepatology. HBV eradication strategy and the treatment of liver cancer. Accessed online 11/20/2016.

# Artificial Intelligence in Diagnostic Radiology

- Preliminary meeting March 13<sup>th</sup>
- Live in production March 28<sup>th</sup>
- Every CXR automatically processed in AWS and downloaded to the production PACS...within 60 seconds
- As of December 31<sup>st</sup> the system had processed 66,731 images





DOI: 10.1002/ajem.2.12297

BRIEF RESEARCH REPORT

Infectious Disease



WILEY

## Deployment of artificial intelligence for radiographic diagnosis

“Of the 5,125 total visits and 1,960 chest radiographs obtained in the ED during the study period, 1,855 were analyzed by the algorithm. Among these, emergency physicians were surveyed for their experiences on 202. Overall, **86% either strongly agreed or somewhat agreed that the intervention was easy to use in their workflow. 20% of respondents reported that the algorithm impacted clinical decision making.**”

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action with a novel artificial intelligence (AI) algorithm designed to enhance physician abilities to identify ground-glass opacities and consolidation on chest radiographs.

**Methods:** During the first wave of the pandemic, we deployed a previously developed and validated deep-learning AI algorithm for assisted interpretation of chest radiographs for use by physicians at an academic health system in Southern California. The algorithm overlays radiographs with “heat” maps that indicate pneumonia probability

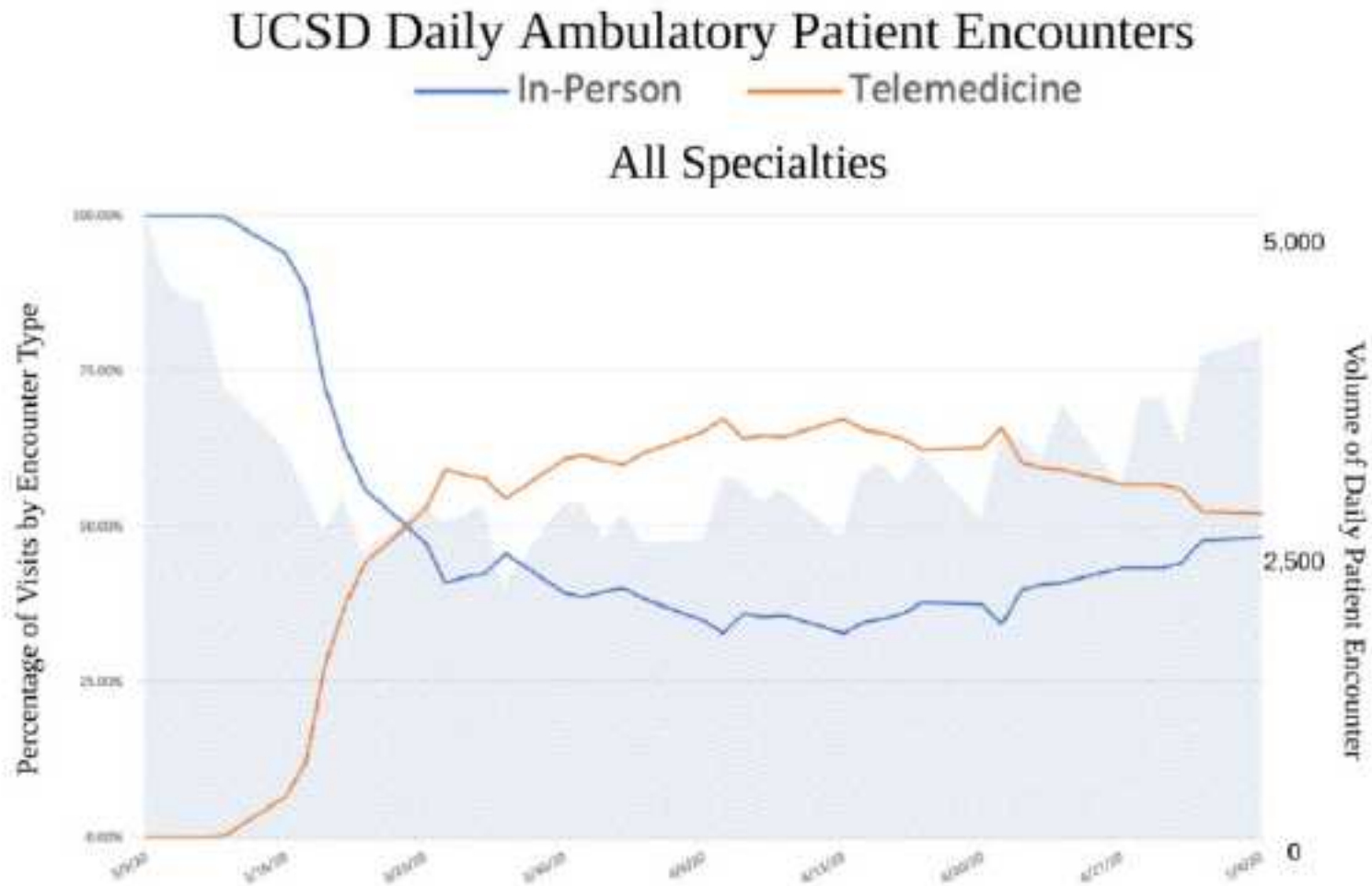


# Health IT Needs Identified

<b>Electronic Health Record Tools for Managing a Pandemic</b>
<b>Screening Protocols</b>
Triage of Patient Phone Calls
Required Registration/Check-In Screening Questions for All Patients
<b>System Level EHR-Templates</b>
Updated with Current Infection Control Specialist and Command Center Information
<b>Inpatient, Emergency Department and Ambulatory Order Panels</b>
Decision support for testing protocol
Embedded modifiable required isolation orders
Detailed personal protective equipment needs for providers
Detailed instructions for proper specimen collection
<b>Reporting and Analytics</b>
COVID-19 Operational Dashboard
Tracking of COVID-19 and Personal under Investigation (PUIO) in EHR embedded database
<b>Communication Channels</b>
EHR-integrated secure messaging
<b>Artificial Intelligence</b>
Real-time algorithm to assist in diagnostic imaging
<b>Patient Facing Technology</b>
Telemedicine – Video Visits for Outpatient Clinic Encounters
Smart tablets in patient rooms w/ video capabilities



# Rapid Expansion of Ambulatory Telehealth





## Medical Undistancing Through Telemedicine: A Model Enabling Rapid Telemedicine Deployment in an Academic Health Center During the COVID-19 Pandemic

Brett C. Meyer, MD, Lawrence S. Friedman, MD,  
Keith Payne, Lisa Moore, MPH, John Cressler, BA,  
Stacy Holberg, MBA, Brittany Partridge, MBA,  
Britney Prince, MPH, Marc Sylwestrzak, BS,  
Matthew Jenusaitis, MSE, MBA, Brendan Kremer, MHA,  
Christopher J. Kane, MD, Amy Sitapati, MD, Brian Cloy, MD,  
Marlene Millen, MD, and Christopher Longhurst, MD, MS

University of California, San Diego Enterprise Telehealth Program,  
San Diego, California, USA.

*Conclusion:* This article is designed to offer a “How To” potential best practice approach for others wishing to quickly implement a telemedicine program during the COVID-19 pandemic.

**Keywords:** telemedicine, academic, model, COVID, pandemic

### Introduction



Academic health centers (AHCs) offer highly specialized clinical care and technologically advanced





Viewpoint

## Telehealth in the COVID-19 Era: A Balancing Act to Avoid Harm

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### Abstract

The telehealth revolution in response to COVID-19 has increased essential health care access during an unprecedented public health crisis. However, virtual patient care can also limit the patient-provider relationship, quality of examination, efficiency of health care delivery, and overall quality of care. As we witness the most rapidly adopted medical trend in modern history, clinicians are beginning to comprehend the many possibilities of telehealth, but its limitations also need to be understood. As outcomes are studied and federal regulations reconsidered, it is important to be precise in the virtual patient encounter approach. Herein, we offer some simple guidelines that could assist health care providers and clinic schedulers in determining the appropriateness of a telehealth visit by considering visit types, patient characteristics, and chief complaint or disease states.



# **COVID Vaccination @ UC San Diego Health**



# Vaccination Superstation: Sharing Best Practices



# Vaccine Credential Initiative

**OPEN**

**SIMPLE**

**EQUITABLE**

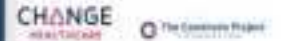
**PRIVACY-  
PRESERVING**

**COMMUNITY-SUPPORTED**

## Vaccination Credential Initiative

### About the Vaccination Credential Initiative

The Vaccination Credential Initiative (VCI) brings together healthcare organizations, technology firms, nonprofits, academia, and startups working to empower consumers to conveniently access, store, and share digital COVID-19 vaccination records.



... and more





## SARS-CoV-2 Infection after Vaccination in Health Care Workers in California

**TO THE EDITOR:** Data from phase 3 clinical trials of messenger RNA (mRNA) vaccines through November 2020 showed 94.1% efficacy for the prevention of symptomatic infection at 14 days after mRNA-1273 vaccine (Moderna) and 90.5% at 7 days after the second vaccine (Pfizer).<sup>2</sup> Since these results were published, a nationwide outbreak of SARS-CoV-2 variants with increased transmissibility emerged, the Food and Drug Administration granted emergency use authorization for two mRNA vaccines, and vaccination was initiated across the United States. Data from health care workers at UCSD and after vaccination, and the majority (71%) of these persons tested positive within the first 2 weeks after the first dose. After receiving both vaccinations, 15 health care workers tested positive; of these, 8 tested positive 1 to 7 days after the second dose. Only 8 health care workers tested positive 15 or more days after the second dose (Table 1). As of March 1, 2021, the cumulative incidence rate of SARS-CoV-2 infection among health care workers at UCSD who received the second vaccine was 0.05%. These findings suggest a low risk of testing positive for SARS-CoV-2 after vaccination was initiated across the United States.

**Table 1.** New SARS-CoV-2 Infections among Vaccinated Health Care Workers from December 16, 2020, through February 9, 2021.

Days after Vaccination	Vaccinated Persons		
	With New Infection (N=379)	Tested (N=14,604)*	Eligible for Testing (N=36,659)†
	number		number (percent)
<b>Dose 1</b>			
Days 1–7	145	5794	35,673 (97.3)
Days 8–14	125	7844	34,404 (93.8)
Days 15–21	57	7958	32,667 (89.1)
Day 22 or later, before dose 2	15	4286	32,327 (88.2)
<b>Dose 2</b>			
Days 1–7	22	5546	23,100 (63.0)
Days 8–14	8	4909	16,082 (43.9)
Day 15 or later	7	4167	14,990 (40.9)

# April 26, 2021

In sweeping move likely to be followed by campuses across the nation, the University of California and California State University systems are planning to require Covid-19 vaccinations by the start of the fall semester for all students, faculty and staff.



Two of the country's largest public university systems plan to require vaccinations for all...

[nytimes.com](https://www.nytimes.com)





# Questions?

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