

IEM's AI Modeling: Short-term COVID-19 Projections

Date: 2/23/22

Leveraging over 15 years of support to HHS for medical consequence modeling and our proprietary artificial intelligence (AI) models, IEM believes that our Coronavirus model outputs can be used to assist localities and their medical facilities to better prepare for an increase in hospitalizations, to better plan for and locate drive-through testing facilities, and to determine where increased levels of transmission may be occurring.

We have been refining our AI model over the past month and are confident in its ability to provide accurate 7-day projections that can be used for operational and logistical planning.

AI-based Model Background

IEM is currently using an AI model to fit data from various sources and project new cases of COVID-19. We do not assume the average number of secondary infections (R-value) stays the same over time. IEM's AI model finds the best R-value over time to evaluate how it changes over the course of the outbreak. The IEM modeling team is running ~11 million simulations to fit each state's data and using the best fit for the R-value to project new cases over the next 7 days. The AI models are executed on a daily basis to evaluate the changing dynamics of the COVID-19 pandemic. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 2/23/22 9 a.m.

Please provide any feedback or send any questions that you might have to us. We are continually updating and improving the model, so your feedback is critical.

Also, if you have more current or refined data for your State, Commonwealth or Territory that you would like IEM to factor in, please let us know.

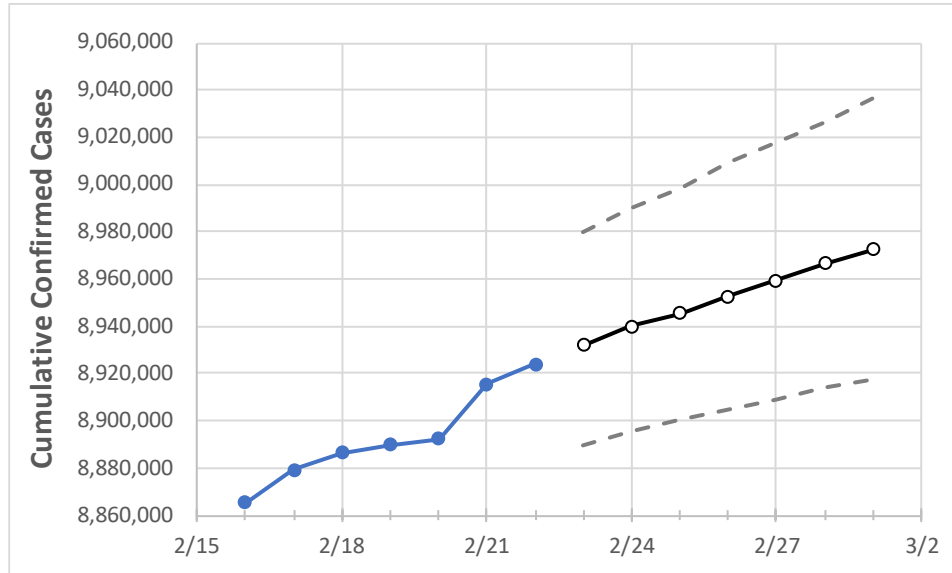
IEM's Modeling Lead

Dr. Prasith "Sid" Baccam is a **Computational Epidemiologist expert** at IEM with more than **20 years of experience in medical consequence modeling and simulation of disease outbreaks** and medical consequences following hypothetical attacks with biological agents or emerging infectious diseases. He develops key simulation models and decision support tools at IEM, specializing in public health, disaster response, and medical countermeasures (MCM) to enhance data-driven decision making and improve modeling assumptions.

Upon receiving his **Ph.D. in Applied Mathematics and Immunobiology** at Iowa State University, Dr. Baccam worked as a Postdoctoral Research Associate at Los Alamos National Laboratory where he focused on researching viral and immunological modeling. After his stint at Los Alamos, Dr. Baccam has served as Task Lead in multiple public health projects have allowed him to develop expertise as a mathematical biologist and a leader on high-performance modeling and simulation teams.

He has worked with state and local public health officials as well as Federal agencies, including **HHS**, the Centers for Disease Control and Prevention (**CDC**), and the Department of Homeland Security (**DHS**). Dr. Baccam has published numerous papers on public health response models and implications on policy and has been invited to participate in workshops and symposiums held by the Institute of Medicine (now the National Academy of Health). His modeling results have been briefed to the **Executive Office of the President** and informed two presidential policy actions.

California State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1

California 8,889,738 8,892,368 8,915,379 8,923,984 8,931,965 8,939,895 8,945,616 8,952,852 8,959,451 8,966,623 8,972,350

Note: The State's projection shows a "best estimate" curve (the solid line with circles) and the dotted lines are the upper and lower estimates around that best estimate. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

California Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Alameda	259,971	260,323	260,674	260,675	260,995	261,337	261,617	261,883	262,174	262,432	262,699
Contra Costa	195,762	195,988	196,214	196,214	196,428	196,629	196,845	197,032	197,193	197,413	197,553
Fresno	245,463	245,795	246,127	246,130	246,433	246,729	247,001	247,264	247,515	247,776	248,007
Kern	232,279	232,686	233,094	233,501	234,064	234,657	235,169	235,689	236,212	236,711	237,226
Lake	11,112	11,150	11,187	11,187	11,218	11,249	11,278	11,303	11,331	11,359	11,385
Los Angeles	2,780,323	2,782,953	2,784,276	2,785,449	2,787,639	2,789,728	2,791,650	2,793,512	2,795,319	2,796,935	2,798,541
Marin	34,625	34,657	34,689	34,689	34,721	34,752	34,780	34,806	34,830	34,855	34,879
Monterey	89,694	89,841	89,988	89,989	90,177	90,338	90,505	90,669	90,808	90,989	91,120
Orange	578,706	578,969	579,231	579,493	579,827	580,129	580,442	580,717	580,941	581,196	581,435
Placer	68,663	68,741	68,818	68,818	68,883	68,943	69,002	69,059	69,109	69,162	69,212
Riverside	609,780	610,261	610,742	610,745	611,301	611,859	612,354	612,839	613,271	613,705	614,072
Sacramento	296,904	297,281	297,658	297,660	297,981	298,294	298,594	298,857	299,144	299,389	299,636
San Bernardino	577,324	577,701	578,079	578,093	578,555	578,968	579,269	579,646	579,978	580,348	580,658
San Diego	777,818	778,506	779,193	779,880	780,784	781,619	782,347	783,100	783,841	784,583	785,214
San Francisco	130,112	130,279	130,446	130,446	130,660	130,850	131,027	131,200	131,372	131,551	131,680
San Joaquin	172,399	172,637	172,875	172,876	173,055	173,215	173,343	173,500	173,650	173,795	173,910
San Luis Obispo	54,594	54,684	54,774	54,775	54,850	54,915	54,984	55,044	55,110	55,170	55,227
San Mateo	123,783	123,935	124,088	124,088	124,230	124,365	124,497	124,621	124,733	124,854	124,956
Santa Barbara	88,951	89,111	89,270	89,270	89,376	89,472	89,554	89,627	89,723	89,800	89,864
Santa Clara	316,006	316,451	316,896	316,899	317,342	317,707	318,102	318,449	318,859	319,145	319,471
Santa Cruz	47,557	47,659	47,761	47,761	47,866	47,965	48,050	48,139	48,240	48,311	48,389
Solano	84,577	84,825	85,073	85,097	85,249	85,384	85,513	85,637	85,761	85,888	85,997
Sonoma	83,001	83,131	83,260	83,260	83,396	83,518	83,642	83,742	83,854	83,946	84,056
Ventura	179,699	179,851	180,003	180,004	180,132	180,258	180,385	180,490	180,610	180,730	180,813

Some recipients of our daily COVID-19 short-term (7 day) projections have requested projections of demand for: hospital bed, intensive care unit (ICU) beds, and mechanical ventilation. We realize that different states and localities will have different characteristics for hospital demand of COVID-19 cases, and we are presenting the best assumptions we could find for those medical demands based on scientific literature and health data reporting. Specifically:

- **Beds:** For hospitalization, we use a range of 10% and 20% of cases require hospitalization based on CDC's report ([MMWR, March 18, 2020](#)) and state reports of COVID-19 cases.
- **ICU:** The CDC report found that 24% of hospitalized cases require ICU care.
- **Ventilators:** Based on clinical data from China and state reports, we assume that 50% of ICU cases require a ventilator.

If you have other estimates for these assumptions, please share them with us as we work to refine our modeling, assumptions, and data on a daily basis.

The medical demands shown in the table assume 20% of **cumulative** confirmed cases require hospitalization. To get the medical demand for the assumption that 10% of confirmed cases require hospitalization, simply divide the demand by 2.

California Medical Demand by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:											
	2/19	2/20	2/21	2/22	2/24			2/26			2/28					
Alameda	259,971	260,323	260,674	260,675	261,337	(52,267)	[12,544]	{6,272}	261,883	(52,377)	[12,570]	{6,285}	262,432	(52,486)	[12,597]	{6,298}
Contra Costa	195,762	195,988	196,214	196,214	196,629	(39,326)	[9,438]	{4,719}	197,032	(39,406)	[9,458]	{4,729}	197,413	(39,483)	[9,476]	{4,738}
Fresno	245,463	245,795	246,127	246,130	246,729	(49,346)	[11,843]	{5,921}	247,264	(49,453)	[11,869]	{5,934}	247,776	(49,555)	[11,893]	{5,947}
Kern	232,279	232,686	233,094	233,501	234,657	(46,931)	[11,264]	{5,632}	235,689	(47,138)	[11,313]	{5,657}	236,711	(47,342)	[11,362]	{5,681}
Lake	11,112	11,150	11,187	11,187	11,249	(2,250)	[540]	{270}	11,303	(2,261)	[543]	{271}	11,359	(2,272)	[545]	{273}
Los Angeles	2,780,323	2,782,953	2,784,276	2,785,449	2,789,728	(557,946)	[133,907]	{66,953}	2,793,512	(558,702)	[134,089]	{67,044}	2,796,935	(559,387)	[134,253]	{67,126}
Marin	34,625	34,657	34,689	34,689	34,752	(6,950)	[1,668]	{834}	34,806	(6,961)	[1,671]	{835}	34,855	(6,971)	[1,673]	{837}
Monterey	89,694	89,841	89,988	89,989	90,338	(18,068)	[4,336]	{2,168}	90,669	(18,134)	[4,352]	{2,176}	90,989	(18,198)	[4,367]	{2,184}
Orange	578,706	578,969	579,231	579,493	580,129	(116,026)	[27,846]	{13,923}	580,717	(116,143)	[27,874]	{13,937}	581,196	(116,239)	[27,897]	{13,949}
Placer	68,663	68,741	68,818	68,818	68,943	(13,789)	[3,309]	{1,655}	69,059	(13,812)	[3,315]	{1,657}	69,162	(13,832)	[3,320]	{1,660}
Riverside	609,780	610,261	610,742	610,745	611,859	(122,372)	[29,369]	{14,685}	612,839	(122,568)	[29,416]	{14,708}	613,705	(122,741)	[29,458]	{14,729}
Sacramento	296,904	297,281	297,658	297,660	298,294	(59,659)	[14,318]	{7,159}	298,857	(59,771)	[14,345]	{7,173}	299,389	(59,878)	[14,371]	{7,185}
San Bernardino	577,324	577,701	578,079	578,093	578,968	(115,794)	[27,790]	{13,895}	579,646	(115,929)	[27,823]	{13,911}	580,348	(116,070)	[27,857]	{13,928}
San Diego	777,818	778,506	779,193	779,880	781,619	(156,324)	[37,518]	{18,759}	783,100	(156,620)	[37,589]	{18,794}	784,583	(156,917)	[37,660]	{18,830}
San Francisco	130,112	130,279	130,446	130,446	130,850	(26,170)	[6,281]	{3,140}	131,200	(26,240)	[6,298]	{3,149}	131,551	(26,310)	[6,314]	{3,157}
San Joaquin	172,399	172,637	172,875	172,876	173,215	(34,643)	[8,314]	{4,157}	173,500	(34,700)	[8,328]	{4,164}	173,795	(34,759)	[8,342]	{4,171}
San Luis Obispo	54,594	54,684	54,774	54,775	54,915	(10,983)	[2,636]	{1,318}	55,044	(11,009)	[2,642]	{1,321}	55,170	(11,034)	[2,648]	{1,324}
San Mateo	123,783	123,935	124,088	124,088	124,365	(24,873)	[5,969]	{2,985}	124,621	(24,924)	[5,982]	{2,991}	124,854	(24,971)	[5,993]	{2,996}
Santa Barbara	88,951	89,111	89,270	89,270	89,472	(17,894)	[4,295]	{2,147}	89,627	(17,925)	[4,302]	{2,151}	89,800	(17,960)	[4,310]	{2,155}
Santa Clara	316,006	316,451	316,896	316,899	317,707	(63,541)	[15,250]	{7,625}	318,449	(63,690)	[15,286]	{7,643}	319,145	(63,829)	[15,319]	{7,659}
Santa Cruz	47,557	47,659	47,761	47,761	47,965	(9,593)	[2,302]	{1,151}	48,139	(9,628)	[2,311]	{1,155}	48,311	(9,662)	[2,319]	{1,159}
Solano	84,577	84,825	85,073	85,097	85,384	(17,077)	[4,098]	{2,049}	85,637	(17,127)	[4,111]	{2,055}	85,888	(17,178)	[4,123]	{2,061}
Sonoma	83,001	83,131	83,260	83,260	83,518	(16,704)	[4,009]	{2,004}	83,742	(16,748)	[4,020]	{2,010}	83,946	(16,789)	[4,029]	{2,015}
Ventura	179,699	179,851	180,003	180,004	180,258	(36,052)	[8,652]	{4,326}	180,490	(36,098)	[8,663]	{4,332}	180,730	(36,146)	[8,675]	{4,338}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.