

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

Date: 5/14/21

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 5/14/21 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.**

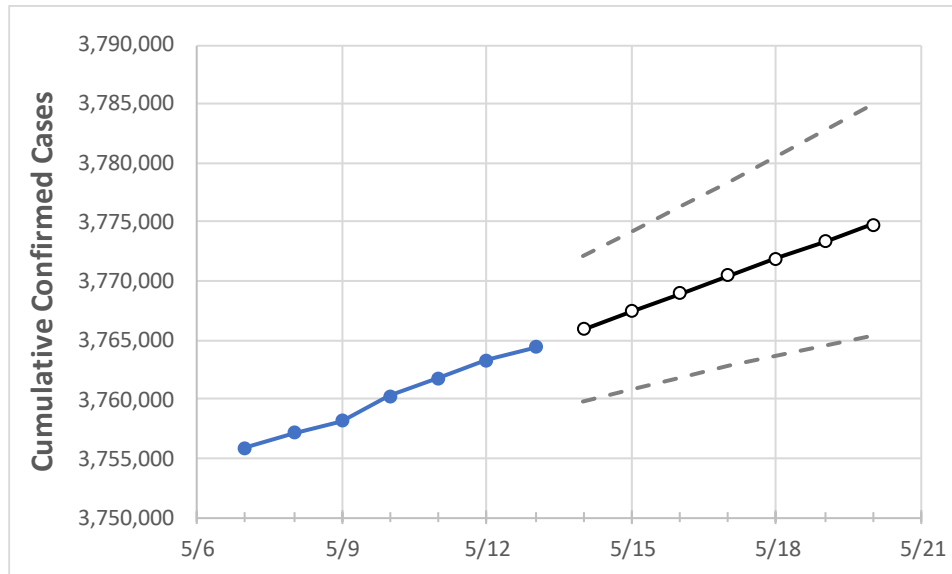
### IEM's Modeling Lead

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:						
	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20
California	3,760,303	3,761,779	3,763,281	3,764,405	3,765,925	3,767,465	3,768,973	3,770,492	3,771,914	3,773,349	3,774,777

*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:						
	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20
Alameda	87,637	87,733	87,877	87,940	88,009	88,077	88,144	88,210	88,277	88,340	88,401
Contra Costa	68,638	68,689	68,741	68,741	68,799	68,856	68,912	68,967	69,022	69,076	69,131
Fresno	101,729	101,755	101,792	101,838	101,881	101,924	101,968	102,012	102,054	102,096	102,138
Kern	109,052	109,101	109,139	109,177	109,221	109,264	109,305	109,347	109,388	109,429	109,470
Lake	3,471	3,472	3,473	3,476	3,479	3,481	3,484	3,486	3,489	3,492	3,494
Los Angeles	1,235,828	1,235,999	1,236,256	1,236,456	1,236,668	1,236,871	1,237,075	1,237,265	1,237,457	1,237,642	1,237,818
Marin	14,040	14,054	14,056	14,056	14,063	14,071	14,079	14,087	14,094	14,103	14,110
Monterey	43,595	43,601	43,613	43,613	43,627	43,641	43,655	43,669	43,683	43,697	43,712
Orange	270,800	270,883	270,940	270,983	271,039	271,094	271,148	271,199	271,248	271,295	271,342
Placer	22,610	22,635	22,665	22,679	22,707	22,736	22,766	22,795	22,823	22,852	22,880
Riverside	299,173	299,376	299,455	299,455	299,530	299,604	299,676	299,752	299,824	299,898	299,971
Sacramento	104,491	104,610	104,720	104,840	104,970	105,102	105,230	105,369	105,498	105,633	105,777
San Bernardino	296,655	296,700	296,782	296,782	296,841	296,899	296,954	297,009	297,064	297,117	297,168
San Diego	278,182	278,307	278,401	278,591	278,783	278,979	279,178	279,377	279,581	279,781	279,986
San Francisco	36,669	36,683	36,707	36,720	36,739	36,758	36,776	36,794	36,812	36,830	36,847
San Joaquin	73,174	73,180	73,220	73,220	73,278	73,335	73,389	73,444	73,497	73,550	73,603
San Luis Obispo	21,293	21,307	21,308	21,308	21,315	21,322	21,329	21,336	21,342	21,348	21,354
San Mateo	41,903	41,926	41,985	42,038	42,078	42,117	42,157	42,199	42,241	42,282	42,324
Santa Barbara	34,323	34,328	34,337	34,337	34,347	34,356	34,365	34,374	34,382	34,389	34,397
Santa Clara	118,932	118,974	119,010	119,064	119,110	119,153	119,195	119,238	119,277	119,316	119,353
Santa Cruz	16,238	16,246	16,249	16,264	16,284	16,303	16,323	16,342	16,362	16,381	16,400
Solano	32,864	32,880	32,912	32,953	32,988	33,023	33,057	33,091	33,125	33,158	33,190
Sonoma	30,002	30,012	30,026	30,035	30,048	30,061	30,073	30,086	30,098	30,110	30,122
Ventura	80,905	80,949	80,978	81,001	81,028	81,056	81,084	81,112	81,139	81,167	81,195

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:											
	5/10	5/11	5/12	5/13	5/15				5/17				5/19			
Alameda	87,637	87,733	87,877	87,940	88,077	(17,615)	[4,228]	{2,114}	88,210	(17,642)	[4,234]	{2,117}	88,340	(17,668)	[4,240]	{2,120}
Contra Costa	68,638	68,689	68,741	68,741	68,856	(13,771)	[3,305]	{1,653}	68,967	(13,793)	[3,310]	{1,655}	69,076	(13,815)	[3,316]	{1,658}
Fresno	101,729	101,755	101,792	101,838	101,924	(20,385)	[4,892]	{2,446}	102,012	(20,402)	[4,897]	{2,448}	102,096	(20,419)	[4,901]	{2,450}
Kern	109,052	109,101	109,139	109,177	109,264	(21,853)	[5,245]	{2,622}	109,347	(21,869)	[5,249]	{2,624}	109,429	(21,886)	[5,253]	{2,626}
Lake	3,471	3,472	3,473	3,476	3,481	(696)	[167]	{84}	3,486	(697)	[167]	{84}	3,492	(698)	[168]	{84}
Los Angeles	1,235,828	1,235,999	1,236,256	1,236,456	1,236,871	(247,374)	[59,370]	{29,685}	1,237,265	(247,453)	[59,389]	{29,694}	1,237,642	(247,528)	[59,407]	{29,703}
Marin	14,040	14,054	14,056	14,056	14,071	(2,814)	[675]	{338}	14,087	(2,817)	[676]	{338}	14,103	(2,821)	[677]	{338}
Monterey	43,595	43,601	43,613	43,613	43,641	(8,728)	[2,095]	{1,047}	43,669	(8,734)	[2,096]	{1,048}	43,697	(8,739)	[2,097]	{1,049}
Orange	270,800	270,883	270,940	270,983	271,094	(54,219)	[13,013]	{6,506}	271,199	(54,240)	[13,018]	{6,509}	271,295	(54,259)	[13,022]	{6,511}
Placer	22,610	22,635	22,665	22,679	22,736	(4,547)	[1,091]	{546}	22,795	(4,559)	[1,094]	{547}	22,852	(4,570)	[1,097]	{548}
Riverside	299,173	299,376	299,455	299,455	299,604	(59,921)	[14,381]	{7,190}	299,752	(59,950)	[14,388]	{7,194}	299,898	(59,980)	[14,395]	{7,198}
Sacramento	104,491	104,610	104,720	104,840	105,102	(21,020)	[5,045]	{2,522}	105,369	(21,074)	[5,058]	{2,529}	105,633	(21,127)	[5,070]	{2,535}
San Bernardino	296,655	296,700	296,782	296,782	296,899	(59,380)	[14,251]	{7,126}	297,009	(59,402)	[14,256]	{7,128}	297,117	(59,423)	[14,262]	{7,131}
San Diego	278,182	278,307	278,401	278,591	278,979	(55,796)	[13,391]	{6,695}	279,377	(55,875)	[13,410]	{6,705}	279,781	(55,956)	[13,429]	{6,715}
San Francisco	36,669	36,683	36,707	36,720	36,758	(7,352)	[1,764]	{882}	36,794	(7,359)	[1,766]	{883}	36,830	(7,366)	[1,768]	{884}
San Joaquin	73,174	73,180	73,220	73,220	73,335	(14,667)	[3,520]	{1,760}	73,444	(14,689)	[3,525]	{1,763}	73,550	(14,710)	[3,530]	{1,765}
San Luis Obispo	21,293	21,307	21,308	21,308	21,322	(4,264)	[1,023]	{512}	21,336	(4,267)	[1,024]	{512}	21,348	(4,270)	[1,025]	{512}
San Mateo	41,903	41,926	41,985	42,038	42,117	(8,423)	[2,022]	{1,011}	42,199	(8,440)	[2,026]	{1,013}	42,282	(8,456)	[2,030]	{1,015}
Santa Barbara	34,323	34,328	34,337	34,337	34,356	(6,871)	[1,649]	{825}	34,374	(6,875)	[1,650]	{825}	34,389	(6,878)	[1,651]	{825}
Santa Clara	118,932	118,974	119,010	119,064	119,153	(23,831)	[5,719]	{2,860}	119,238	(23,848)	[5,723]	{2,862}	119,316	(23,863)	[5,727]	{2,864}
Santa Cruz	16,238	16,246	16,249	16,264	16,303	(3,261)	[783]	{391}	16,342	(3,268)	[784]	{392}	16,381	(3,276)	[786]	{393}
Solano	32,864	32,880	32,912	32,953	33,023	(6,605)	[1,585]	{793}	33,091	(6,618)	[1,588]	{794}	33,158	(6,632)	[1,592]	{796}
Sonoma	30,002	30,012	30,026	30,035	30,061	(6,012)	[1,443]	{721}	30,086	(6,017)	[1,444]	{722}	30,110	(6,022)	[1,445]	{723}
Ventura	80,905	80,949	80,978	81,001	81,056	(16,211)	[3,891]	{1,945}	81,112	(16,222)	[3,893]	{1,947}	81,167	(16,233)	[3,896]	{1,948}

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