

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

**Date: 2/14/22**

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 2/14/22 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.**

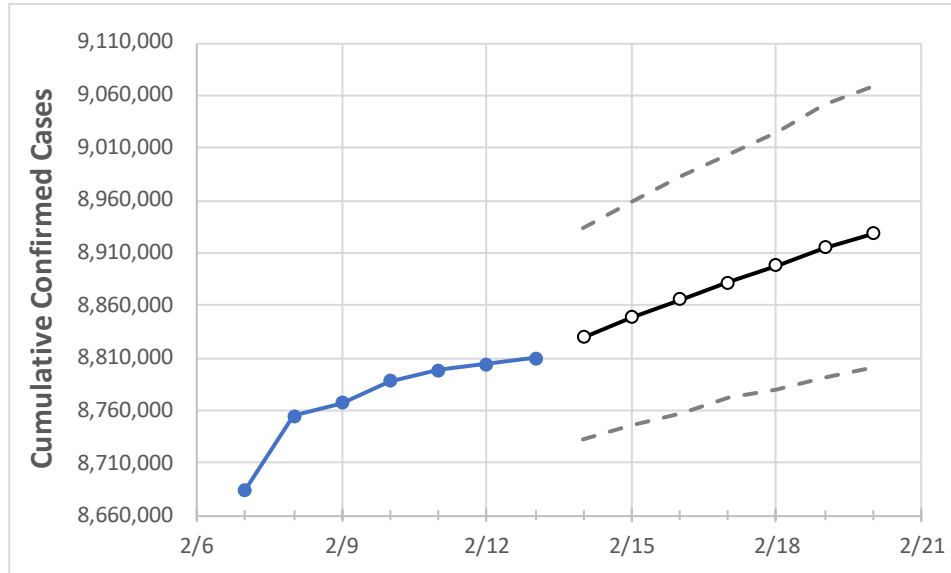
### **IEM's Modeling Lead**

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:						
	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20
California	8,788,257	8,798,006	8,804,417	8,809,229	8,829,630	8,848,366	8,865,319	8,881,494	8,898,319	8,914,818	8,928,044

*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:						
	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20
Alameda	256,963	256,964	256,965	256,965	257,527	258,119	258,641	259,201	259,631	260,229	260,600
Contra Costa	193,326	193,327	193,328	193,328	193,734	194,168	194,525	194,882	195,241	195,598	195,921
Fresno	240,505	240,507	240,509	240,509	241,173	241,750	242,248	242,856	243,348	243,905	244,399
Kern	225,509	226,717	226,717	226,717	227,500	228,225	228,944	229,675	230,359	231,065	231,677
Lake	10,669	10,669	10,669	10,669	10,754	10,842	10,921	11,008	11,095	11,177	11,272
Los Angeles	2,746,866	2,752,398	2,757,058	2,761,870	2,766,779	2,770,680	2,775,034	2,778,933	2,782,487	2,786,274	2,789,340
Marin	35,484	35,484	35,484	35,484	35,573	35,661	35,742	35,813	35,893	35,981	36,048
Monterey	87,758	87,761	87,763	87,763	88,494	89,264	89,926	90,680	91,236	92,098	92,847
Orange	574,435	574,622	574,622	574,622	575,953	577,166	578,546	579,538	580,756	581,926	582,850
Placer	67,809	67,810	67,810	67,810	67,955	68,113	68,231	68,374	68,513	68,639	68,772
Riverside	602,738	602,739	602,740	602,740	603,802	604,800	605,696	606,680	607,527	608,551	609,330
Sacramento	292,825	292,827	292,829	292,829	293,528	294,141	294,716	295,305	295,904	296,467	296,929
San Bernardino	572,697	572,703	572,709	572,709	573,558	574,348	575,124	575,924	576,719	577,409	578,080
San Diego	764,556	766,947	766,947	766,947	769,114	770,728	772,427	774,211	775,614	777,362	778,791
San Francisco	127,849	127,850	127,850	127,850	128,404	129,020	129,551	130,138	130,624	131,109	131,731
San Joaquin	170,660	170,661	170,662	170,662	171,018	171,374	171,681	171,986	172,273	172,589	172,838
San Luis Obispo	53,898	53,899	53,899	53,899	54,051	54,215	54,360	54,507	54,652	54,802	54,936
San Mateo	122,691	122,691	122,691	122,691	124,224	125,370	126,917	127,887	129,268	130,757	132,081
Santa Barbara	87,923	87,923	87,923	87,923	88,290	88,655	89,013	89,349	89,687	90,028	90,360
Santa Clara	310,961	310,963	310,964	310,964	311,830	312,540	313,441	314,262	314,930	315,688	316,321
Santa Cruz	46,488	46,488	46,488	46,488	46,734	46,943	47,198	47,414	47,630	47,877	48,054
Solano	83,084	83,096	83,108	83,108	83,560	84,027	84,503	84,948	85,411	85,899	86,298
Sonoma	81,683	81,684	81,684	81,684	81,881	82,074	82,254	82,450	82,601	82,781	82,952
Ventura	178,009	178,010	178,010	178,010	178,280	178,577	178,826	179,094	179,323	179,557	179,743

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:											
	2/10	2/11	2/12	2/13	2/15				2/17				2/19			
Alameda	256,963	256,964	256,965	256,965	258,119	(51,624)	[12,390]	{6,195}	259,201	(51,840)	[12,442]	{6,221}	260,229	(52,046)	[12,491]	{6,246}
Contra Costa	193,326	193,327	193,328	193,328	194,168	(38,834)	[9,320]	{4,660}	194,882	(38,976)	[9,354]	{4,677}	195,598	(39,120)	[9,389]	{4,694}
Fresno	240,505	240,507	240,509	240,509	241,750	(48,350)	[11,604]	{5,802}	242,856	(48,571)	[11,657]	{5,829}	243,905	(48,781)	[11,707]	{5,854}
Kern	225,509	226,717	226,717	226,717	228,225	(45,645)	[10,955]	{5,477}	229,675	(45,935)	[11,024]	{5,512}	231,065	(46,213)	[11,091]	{5,546}
Lake	10,669	10,669	10,669	10,669	10,842	(2,168)	[520]	{260}	11,008	(2,202)	[528]	{264}	11,177	(2,235)	[537]	{268}
Los Angeles	2,746,866	2,752,398	2,757,058	2,761,870	2,770,680	(554,136)	[132,993]	{66,496}	2,778,933	(555,787)	[133,389]	{66,694}	2,786,274	(557,255)	[133,741]	{66,871}
Marin	35,484	35,484	35,484	35,484	35,661	(7,132)	[1,712]	{856}	35,813	(7,163)	[1,719]	{860}	35,981	(7,196)	[1,727]	{864}
Monterey	87,758	87,761	87,763	87,763	89,264	(17,853)	[4,285]	{2,142}	90,680	(18,136)	[4,353]	{2,176}	92,098	(18,420)	[4,421]	{2,210}
Orange	574,435	574,622	574,622	574,622	577,166	(115,433)	[27,704]	{13,852}	579,538	(115,908)	[27,818]	{13,909}	581,926	(116,385)	[27,932]	{13,966}
Placer	67,809	67,810	67,810	67,810	68,113	(13,623)	[3,269]	{1,635}	68,374	(13,675)	[3,282]	{1,641}	68,639	(13,728)	[3,295]	{1,647}
Riverside	602,738	602,739	602,740	602,740	604,800	(120,960)	[29,030]	{14,515}	606,680	(121,336)	[29,121]	{14,560}	608,551	(121,710)	[29,210]	{14,605}
Sacramento	292,825	292,827	292,829	292,829	294,141	(58,828)	[14,119]	{7,059}	295,305	(59,061)	[14,175]	{7,087}	296,467	(59,293)	[14,230]	{7,115}
San Bernardino	572,697	572,703	572,709	572,709	574,348	(114,870)	[27,569]	{13,784}	575,924	(115,185)	[27,644]	{13,822}	577,409	(115,482)	[27,716]	{13,858}
San Diego	764,556	766,947	766,947	766,947	770,728	(154,146)	[36,995]	{18,497}	774,211	(154,842)	[37,162]	{18,581}	777,362	(155,472)	[37,313]	{18,657}
San Francisco	127,849	127,850	127,850	127,850	129,020	(25,804)	[6,193]	{3,096}	130,138	(26,028)	[6,247]	{3,123}	131,109	(26,222)	[6,293]	{3,147}
San Joaquin	170,660	170,661	170,662	170,662	171,374	(34,275)	[8,226]	{4,113}	171,986	(34,397)	[8,255]	{4,128}	172,589	(34,518)	[8,284]	{4,142}
San Luis Obispo	53,898	53,899	53,899	53,899	54,215	(10,843)	[2,602]	{1,301}	54,507	(10,901)	[2,616]	{1,308}	54,802	(10,960)	[2,630]	{1,315}
San Mateo	122,691	122,691	122,691	122,691	125,370	(25,074)	[6,018]	{3,009}	127,887	(25,577)	[6,139]	{3,069}	130,757	(26,151)	[6,276]	{3,138}
Santa Barbara	87,923	87,923	87,923	87,923	88,655	(17,731)	[4,255]	{2,128}	89,349	(17,870)	[4,289]	{2,144}	90,028	(18,006)	[4,321]	{2,161}
Santa Clara	310,961	310,963	310,964	310,964	312,540	(62,508)	[15,002]	{7,501}	314,262	(62,852)	[15,085]	{7,542}	315,688	(63,138)	[15,153]	{7,577}
Santa Cruz	46,488	46,488	46,488	46,488	46,943	(9,389)	[2,253]	{1,127}	47,414	(9,483)	[2,276]	{1,138}	47,877	(9,575)	[2,298]	{1,149}
Solano	83,084	83,096	83,108	83,108	84,027	(16,805)	[4,033]	{2,017}	84,948	(16,990)	[4,077]	{2,039}	85,899	(17,180)	[4,123]	{2,062}
Sonoma	81,683	81,684	81,684	81,684	82,074	(16,415)	[3,940]	{1,970}	82,450	(16,490)	[3,958]	{1,979}	82,781	(16,556)	[3,973]	{1,987}
Ventura	178,009	178,010	178,010	178,010	178,577	(35,715)	[8,572]	{4,286}	179,094	(35,819)	[8,597]	{4,298}	179,557	(35,911)	[8,619]	{4,309}

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.