

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

Date: 3/22/22

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 3/22/22 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.**

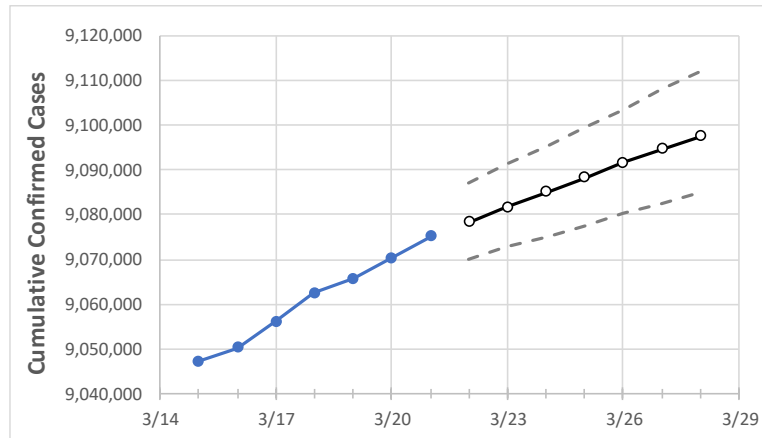
### IEM's Modeling Lead

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:						
	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28
California	9,062,442	9,065,637	9,070,322	9,075,006	9,078,384	9,081,752	9,085,143	9,088,295	9,091,614	9,094,643	9,097,622

*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:						
	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28
Alameda	267,654	267,773	267,892	268,011	268,105	268,194	268,287	268,373	268,455	268,542	268,621
Contra Costa	200,341	200,422	200,502	200,583	200,663	200,737	200,806	200,874	200,944	201,015	201,077
Fresno	250,990	251,101	251,211	251,322	251,417	251,509	251,599	251,686	251,771	251,851	251,925
Kern	241,875	241,922	241,968	242,015	242,098	242,176	242,250	242,322	242,385	242,453	242,508
Lake	11,538	11,542	11,545	11,549	11,553	11,558	11,562	11,565	11,569	11,573	11,576
Los Angeles	2,820,159	2,823,354	2,824,389	2,825,423	2,826,601	2,827,779	2,828,930	2,830,070	2,831,241	2,832,431	2,833,537
Marin	35,366	35,389	35,412	35,435	35,456	35,475	35,495	35,515	35,534	35,554	35,573
Monterey	91,965	91,993	92,020	92,048	92,085	92,122	92,155	92,191	92,224	92,262	92,290
Orange	585,098	585,416	585,735	586,053	586,274	586,494	586,700	586,925	587,146	587,362	587,569
Placer	69,813	69,827	69,841	69,855	69,873	69,890	69,905	69,919	69,936	69,950	69,965
Riverside	617,085	617,298	617,512	617,725	617,852	617,982	618,105	618,213	618,338	618,457	618,563
Sacramento	301,676	301,830	301,984	302,138	302,226	302,310	302,395	302,482	302,561	302,637	302,713
San Bernardino	584,249	584,344	584,439	584,534	584,638	584,751	584,853	584,957	585,053	585,154	585,244
San Diego	797,794	798,290	798,787	799,283	799,788	800,264	800,746	801,193	801,672	802,121	802,569
San Francisco	131,902	131,992	132,083	132,173	132,214	132,258	132,291	132,335	132,369	132,411	132,441
San Joaquin	174,884	174,938	174,992	175,046	175,080	175,111	175,139	175,168	175,197	175,224	175,250
San Luis Obispo	55,908	55,922	55,937	55,951	55,970	55,989	56,007	56,024	56,041	56,056	56,073
San Mateo	126,788	126,828	126,867	126,907	126,956	127,005	127,047	127,092	127,135	127,177	127,215
Santa Barbara	90,152	90,177	90,203	90,228	90,240	90,252	90,263	90,274	90,283	90,294	90,304
Santa Clara	322,203	322,368	322,532	322,697	322,823	322,948	323,064	323,182	323,298	323,418	323,522
Santa Cruz	49,126	49,147	49,167	49,188	49,210	49,234	49,256	49,277	49,296	49,317	49,335
Solano	86,865	86,883	86,900	86,918	86,948	86,977	87,004	87,032	87,057	87,083	87,107
Sonoma	85,250	85,292	85,335	85,377	85,406	85,432	85,462	85,487	85,516	85,539	85,566
Ventura	181,627	181,672	181,716	181,761	181,805	181,852	181,891	181,927	181,973	182,014	182,052

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:											
	3/18	3/19	3/20	3/21	3/23				3/25				3/27			
Alameda	267,654	267,773	267,892	268,011	268,194	(53,639)	[12,873]	{6,437}	268,373	(53,675)	[12,882]	{6,441}	268,542	(53,708)	[12,890]	{6,445}
Contra Costa	200,341	200,422	200,502	200,583	200,737	(40,147)	[9,635]	{4,818}	200,874	(40,175)	[9,642]	{4,821}	201,015	(40,203)	[9,649]	{4,824}
Fresno	250,990	251,101	251,211	251,322	251,509	(50,302)	[12,072]	{6,036}	251,686	(50,337)	[12,081]	{6,040}	251,851	(50,370)	[12,089]	{6,044}
Kern	241,875	241,922	241,968	242,015	242,176	(48,435)	[11,624]	{5,812}	242,322	(48,464)	[11,631]	{5,816}	242,453	(48,491)	[11,638]	{5,819}
Lake	11,538	11,542	11,545	11,549	11,558	(2,312)	[555]	{277}	11,565	(2,313)	[555]	{278}	11,573	(2,315)	[556]	{278}
Los Angeles	2,820,159	2,823,354	2,824,389	2,825,423	2,827,779	(565,556)	[135,733]	{67,867}	2,830,070	(566,014)	[135,843]	{67,922}	2,832,431	(566,486)	[135,957]	{67,978}
Marin	35,366	35,389	35,412	35,435	35,475	(7,095)	[1,703]	{851}	35,515	(7,103)	[1,705]	{852}	35,554	(7,111)	[1,707]	{853}
Monterey	91,965	91,993	92,020	92,048	92,122	(18,424)	[4,422]	{2,211}	92,191	(18,438)	[4,425]	{2,213}	92,262	(18,452)	[4,429]	{2,214}
Orange	585,098	585,416	585,735	586,053	586,494	(117,299)	[28,152]	{14,076}	586,925	(117,385)	[28,172]	{14,086}	587,362	(117,472)	[28,193]	{14,097}
Placer	69,813	69,827	69,841	69,855	69,890	(13,978)	[3,355]	{1,677}	69,919	(13,984)	[3,356]	{1,678}	69,950	(13,990)	[3,358]	{1,679}
Riverside	617,085	617,298	617,512	617,725	617,982	(123,596)	[29,663]	{14,832}	618,213	(123,643)	[29,674]	{14,837}	618,457	(123,691)	[29,686]	{14,843}
Sacramento	301,676	301,830	301,984	302,138	302,310	(60,462)	[14,511]	{7,255}	302,482	(60,496)	[14,519]	{7,260}	302,637	(60,527)	[14,527]	{7,263}
San Bernardino	584,249	584,344	584,439	584,534	584,751	(116,950)	[28,068]	{14,034}	584,957	(116,991)	[28,078]	{14,039}	585,154	(117,031)	[28,087]	{14,044}
San Diego	797,794	798,290	798,787	799,283	800,264	(160,053)	[38,413]	{19,206}	801,193	(160,239)	[38,457]	{19,229}	802,121	(160,424)	[38,502]	{19,251}
San Francisco	131,902	131,992	132,083	132,173	132,258	(26,452)	[6,348]	{3,174}	132,335	(26,467)	[6,352]	{3,176}	132,411	(26,482)	[6,356]	{3,178}
San Joaquin	174,884	174,938	174,992	175,046	175,111	(35,022)	[8,405]	{4,203}	175,168	(35,034)	[8,408]	{4,204}	175,224	(35,045)	[8,411]	{4,205}
San Luis Obispo	55,908	55,922	55,937	55,951	55,989	(11,198)	[2,687]	{1,344}	56,024	(11,205)	[2,689]	{1,345}	56,056	(11,211)	[2,691]	{1,345}
San Mateo	126,788	126,828	126,867	126,907	127,005	(25,401)	[6,096]	{3,048}	127,092	(25,418)	[6,100]	{3,050}	127,177	(25,435)	[6,104]	{3,052}
Santa Barbara	90,152	90,177	90,203	90,228	90,252	(18,050)	[4,332]	{2,166}	90,274	(18,055)	[4,333]	{2,167}	90,294	(18,059)	[4,334]	{2,167}
Santa Clara	322,203	322,368	322,532	322,697	322,948	(64,590)	[15,501]	{7,751}	323,182	(64,636)	[15,513]	{7,756}	323,418	(64,684)	[15,524]	{7,762}
Santa Cruz	49,126	49,147	49,167	49,188	49,234	(9,847)	[2,363]	{1,182}	49,277	(9,855)	[2,365]	{1,183}	49,317	(9,863)	[2,367]	{1,184}
Solano	86,865	86,883	86,900	86,918	86,977	(17,395)	[4,175]	{2,087}	87,032	(17,406)	[4,178]	{2,089}	87,083	(17,417)	[4,180]	{2,090}
Sonoma	85,250	85,292	85,335	85,377	85,432	(17,086)	[4,101]	{2,050}	85,487	(17,097)	[4,103]	{2,052}	85,539	(17,108)	[4,106]	{2,053}
Ventura	181,627	181,672	181,716	181,761	181,852	(36,370)	[8,729]	{4,364}	181,927	(36,385)	[8,733]	{4,366}	182,014	(36,403)	[8,737]	{4,368}

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.