

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

Date: 2/16/22

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 2/16/22 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.

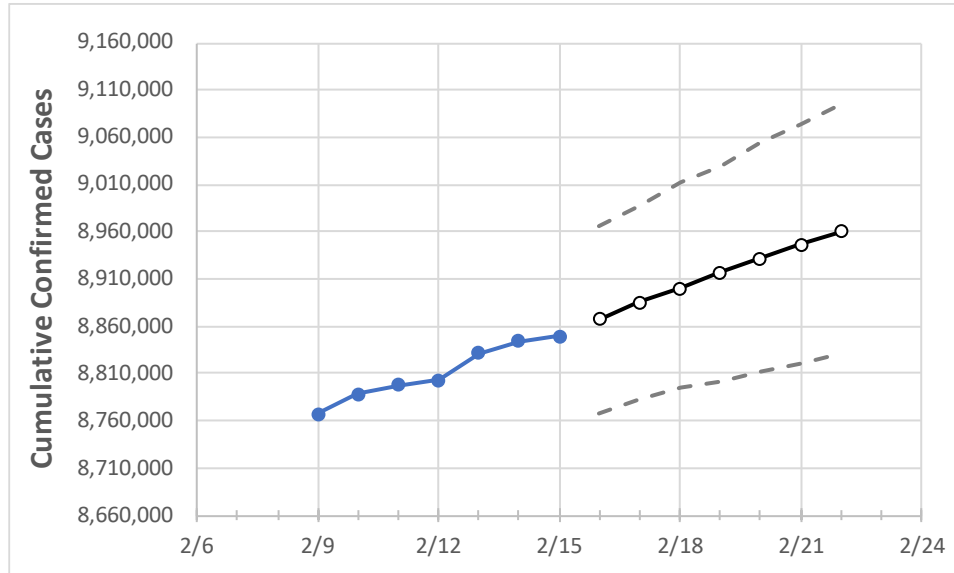
IEM's Modeling Lead

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:							
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	

California 8,802,666 8,831,723 8,844,213 8,849,745 8,867,720 8,884,911 8,900,094 8,916,997 8,931,803 8,946,872 8,960,270

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:						
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22
Alameda	257,992	258,507	259,141	259,143	259,720	260,305	260,770	261,311	261,724	262,238	262,687
Contra Costa	194,021	194,369	194,809	194,811	195,227	195,606	195,951	196,313	196,637	197,010	197,297
Fresno	241,690	242,282	242,956	242,960	243,631	244,215	244,765	245,288	245,937	246,443	246,956
Kern	227,196	227,674	228,153	229,034	229,728	230,414	231,044	231,686	232,297	232,915	233,468
Lake	10,746	10,785	10,833	10,833	10,895	10,963	11,022	11,081	11,146	11,214	11,267
Los Angeles	2,757,058	2,761,870	2,764,073	2,766,161	2,769,939	2,773,586	2,777,185	2,780,405	2,783,331	2,786,386	2,789,125
Marin	35,600	35,658	35,740	35,740	35,812	35,883	35,959	36,025	36,084	36,158	36,210
Monterey	88,060	88,211	88,323	88,328	88,996	89,466	90,089	90,531	91,078	91,678	92,032
Orange	575,166	575,709	576,253	577,043	578,219	579,135	580,260	581,157	582,018	583,231	583,852
Placer	68,065	68,193	68,296	68,297	68,458	68,589	68,728	68,834	68,977	69,103	69,216
Riverside	604,603	605,535	606,346	606,348	607,405	608,333	609,378	610,228	611,112	612,036	612,976
Sacramento	293,892	294,425	295,025	295,029	295,645	296,265	296,850	297,416	297,918	298,464	298,987
San Bernardino	573,904	574,507	575,213	575,225	576,038	576,799	577,552	578,264	578,927	579,601	580,299
San Diego	768,152	769,357	770,562	770,562	771,953	773,437	774,708	776,217	777,272	778,459	779,690
San Francisco	128,637	129,031	129,317	129,318	129,824	130,419	130,805	131,358	131,821	132,372	132,757
San Joaquin	171,189	171,454	171,789	171,791	172,124	172,432	172,713	173,019	173,309	173,576	173,828
San Luis Obispo	54,111	54,218	54,299	54,300	54,457	54,594	54,728	54,861	55,001	55,142	55,256
San Mateo	123,118	123,332	123,585	123,585	124,520	125,291	126,015	126,960	127,847	128,663	129,324
Santa Barbara	88,028	88,080	88,230	88,230	88,474	88,703	88,929	89,137	89,351	89,561	89,756
Santa Clara	312,452	313,197	314,104	314,107	314,885	315,726	316,461	317,174	317,941	318,680	319,349
Santa Cruz	46,781	46,928	47,083	47,083	47,281	47,477	47,663	47,830	48,023	48,198	48,358
Solano	83,457	83,643	83,752	83,776	84,192	84,591	84,967	85,360	85,749	86,188	86,531
Sonoma	82,109	82,322	82,486	82,487	82,696	82,891	83,083	83,277	83,445	83,621	83,772
Ventura	178,466	178,695	178,998	178,999	179,266	179,519	179,759	180,028	180,243	180,443	180,643

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:											
	2/12	2/13	2/14	2/15	2/17			2/19			2/21					
Alameda	257,992	258,507	259,141	259,143	260,305	(52,061)	[12,495]	{6,247}	261,311	(52,262)	[12,543]	{6,271}	262,238	(52,448)	[12,587]	{6,294}
Contra Costa	194,021	194,369	194,809	194,811	195,606	(39,121)	[9,389]	{4,695}	196,313	(39,263)	[9,423]	{4,712}	197,010	(39,402)	[9,456]	{4,728}
Fresno	241,690	242,282	242,956	242,960	244,215	(48,843)	[11,722]	{5,861}	245,288	(49,058)	[11,774]	{5,887}	246,443	(49,289)	[11,829]	{5,915}
Kern	227,196	227,674	228,153	229,034	230,414	(46,083)	[11,060]	{5,530}	231,686	(46,337)	[11,121]	{5,560}	232,915	(46,583)	[11,180]	{5,590}
Lake	10,746	10,785	10,833	10,833	10,963	(2,193)	[526]	{263}	11,081	(2,216)	[532]	{266}	11,214	(2,243)	[538]	{269}
Los Angeles	2,757,058	2,761,870	2,764,073	2,766,161	2,773,586	(554,717)	[133,132]	{66,566}	2,780,405	(556,081)	[133,459]	{66,730}	2,786,386	(557,277)	[133,747]	{66,873}
Marin	35,600	35,658	35,740	35,740	35,883	(7,177)	[1,722]	{861}	36,025	(7,205)	[1,729]	{865}	36,158	(7,232)	[1,736]	{868}
Monterey	88,060	88,211	88,323	88,328	89,466	(17,893)	[4,294]	{2,147}	90,531	(18,106)	[4,345]	{2,173}	91,678	(18,336)	[4,401]	{2,200}
Orange	575,166	575,709	576,253	577,043	579,135	(115,827)	[27,798]	{13,899}	581,157	(116,231)	[27,896]	{13,948}	583,231	(116,646)	[27,995]	{13,998}
Placer	68,065	68,193	68,296	68,297	68,589	(13,718)	[3,292]	{1,646}	68,834	(13,767)	[3,304]	{1,652}	69,103	(13,821)	[3,317]	{1,658}
Riverside	604,603	605,535	606,346	606,348	608,333	(121,667)	[29,200]	{14,600}	610,228	(122,046)	[29,291]	{14,645}	612,036	(122,407)	[29,378]	{14,689}
Sacramento	293,892	294,425	295,025	295,029	296,265	(59,253)	[14,221]	{7,110}	297,416	(59,483)	[14,276]	{7,138}	298,464	(59,693)	[14,326]	{7,163}
San Bernardino	573,904	574,507	575,213	575,225	576,799	(115,360)	[27,686]	{13,843}	578,264	(115,653)	[27,757]	{13,878}	579,601	(115,920)	[27,821]	{13,910}
San Diego	768,152	769,357	770,562	770,562	773,437	(154,687)	[37,125]	{18,562}	776,217	(155,243)	[37,258]	{18,629}	778,459	(155,692)	[37,366]	{18,683}
San Francisco	128,637	129,031	129,317	129,318	130,419	(26,084)	[6,260]	{3,130}	131,358	(26,272)	[6,305]	{3,153}	132,372	(26,474)	[6,354]	{3,177}
San Joaquin	171,189	171,454	171,789	171,791	172,432	(34,486)	[8,277]	{4,138}	173,019	(34,604)	[8,305]	{4,152}	173,576	(34,715)	[8,332]	{4,166}
San Luis Obispo	54,111	54,218	54,299	54,300	54,594	(10,919)	[2,620]	{1,310}	54,861	(10,972)	[2,633]	{1,317}	55,142	(11,028)	[2,647]	{1,323}
San Mateo	123,118	123,332	123,585	123,585	125,291	(25,058)	[6,014]	{3,007}	126,960	(25,392)	[6,094]	{3,047}	128,663	(25,733)	[6,176]	{3,088}
Santa Barbara	88,028	88,080	88,230	88,230	88,703	(17,741)	[4,258]	{2,129}	89,137	(17,827)	[4,279]	{2,139}	89,561	(17,912)	[4,299]	{2,149}
Santa Clara	312,452	313,197	314,104	314,107	315,726	(63,145)	[15,155]	{7,577}	317,174	(63,435)	[15,224]	{7,612}	318,680	(63,736)	[15,297]	{7,648}
Santa Cruz	46,781	46,928	47,083	47,083	47,477	(9,495)	[2,279]	{1,139}	47,830	(9,566)	[2,296]	{1,148}	48,198	(9,640)	[2,314]	{1,157}
Solano	83,457	83,643	83,752	83,776	84,591	(16,918)	[4,060]	{2,030}	85,360	(17,072)	[4,097]	{2,049}	86,188	(17,238)	[4,137]	{2,069}
Sonoma	82,109	82,322	82,486	82,487	82,891	(16,578)	[3,979]	{1,989}	83,277	(16,655)	[3,997]	{1,999}	83,621	(16,724)	[4,014]	{2,007}
Ventura	178,466	178,695	178,998	178,999	179,519	(35,904)	[8,617]	{4,308}	180,028	(36,006)	[8,641]	{4,321}	180,443	(36,089)	[8,661]	{4,331}

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.