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

Date: 3/8/21

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 3/8/21 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.

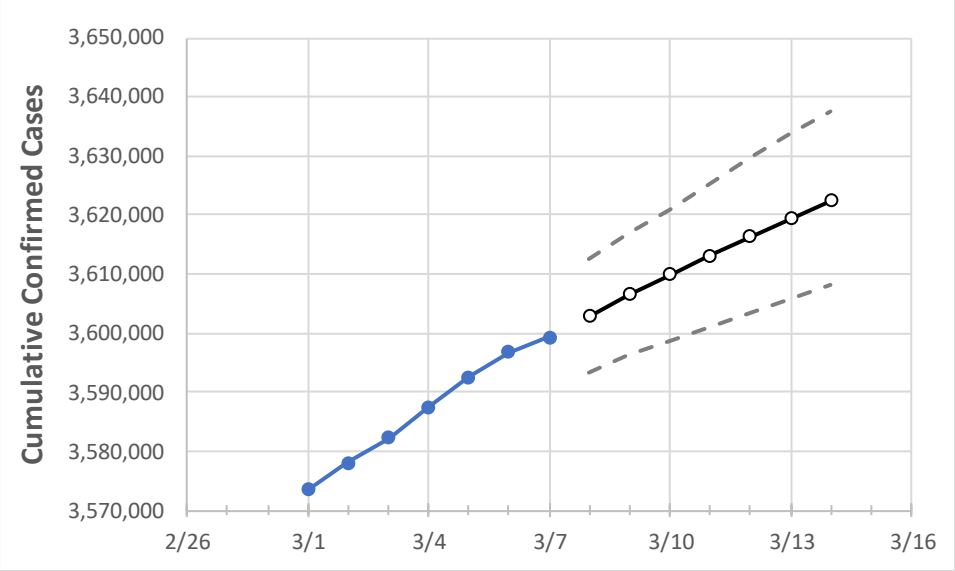
IEM's Modeling Lead

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:						
	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14
California	3,587,567	3,592,560	3,596,760	3,599,250	3,602,932	3,606,526	3,609,889	3,613,168	3,616,296	3,619,474	3,622,414

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:						
	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14
Alameda	81,086	81,168	81,255	81,345	81,431	81,515	81,595	81,670	81,744	81,813	81,879
Contra Costa	63,053	63,142	63,297	63,297	63,402	63,505	63,605	63,699	63,795	63,887	63,976
Fresno	95,893	96,023	96,184	96,366	96,485	96,605	96,723	96,838	96,948	97,058	97,162
Kern	103,894	104,057	104,181	104,181	104,320	104,454	104,588	104,718	104,838	104,958	105,071
Lake	3,175	3,181	3,185	3,189	3,194	3,199	3,204	3,208	3,213	3,217	3,221
Los Angeles	1,198,178	1,200,128	1,201,868	1,203,152	1,204,446	1,205,705	1,206,922	1,208,118	1,209,289	1,210,419	1,211,525
Marin	13,316	13,337	13,358	13,358	13,380	13,402	13,423	13,444	13,464	13,485	13,506
Monterey	42,362	42,373	42,404	42,404	42,426	42,446	42,465	42,481	42,499	42,514	42,529
Orange	261,976	262,241	262,550	262,674	262,839	262,995	263,152	263,303	263,443	263,578	263,706
Placer	19,963	20,035	20,035	20,035	20,072	20,108	20,148	20,183	20,219	20,255	20,291
Riverside	290,744	290,904	290,904	290,904	291,052	291,193	291,330	291,458	291,580	291,695	291,802
Sacramento	93,947	94,129	94,182	94,332	94,458	94,580	94,701	94,818	94,927	95,033	95,139
San Bernardino	287,246	287,513	287,782	287,867	288,038	288,195	288,349	288,496	288,638	288,774	288,909
San Diego	261,861	262,360	262,781	262,781	263,128	263,465	263,780	264,096	264,400	264,682	264,968
San Francisco	34,443	34,480	34,526	34,560	34,599	34,635	34,669	34,703	34,736	34,766	34,795
San Joaquin	67,213	67,284	67,284	67,284	67,362	67,437	67,511	67,581	67,653	67,721	67,785
San Luis Obispo	19,797	19,835	19,835	19,835	19,861	19,885	19,909	19,931	19,953	19,974	19,993
San Mateo	39,189	39,225	39,305	39,384	39,438	39,491	39,541	39,588	39,634	39,680	39,725
Santa Barbara	32,219	32,267	32,301	32,301	32,344	32,387	32,428	32,468	32,507	32,543	32,578
Santa Clara	111,281	111,460	111,638	111,814	111,972	112,133	112,287	112,435	112,579	112,725	112,862
Santa Cruz	14,760	14,790	14,790	14,790	14,812	14,833	14,854	14,874	14,894	14,914	14,933
Solano	30,262	30,305	30,305	30,305	30,335	30,365	30,394	30,423	30,451	30,478	30,505
Sonoma	28,307	28,379	28,417	28,484	28,534	28,582	28,629	28,676	28,724	28,769	28,813
Ventura	78,057	78,184	78,368	78,439	78,524	78,608	78,690	78,765	78,839	78,910	78,980

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:		
	3/4	3/5	3/6	3/7	3/9	3/11	3/13
Alameda	81,086	81,168	81,255	81,345	81,515 (16,303) [3,913] {1,956}	81,670 (16,334) [3,920] {1,960}	81,813 (16,363) [3,927] {1,964}
Contra Costa	63,053	63,142	63,297	63,297	63,505 (12,701) [3,048] {1,524}	63,699 (12,740) [3,058] {1,529}	63,887 (12,777) [3,067] {1,533}
Fresno	95,893	96,023	96,184	96,366	96,605 (19,321) [4,637] {2,319}	96,838 (19,368) [4,648] {2,324}	97,058 (19,412) [4,659] {2,329}
Kern	103,894	104,057	104,181	104,181	104,454 (20,891) [5,014] {2,507}	104,718 (20,944) [5,026] {2,513}	104,958 (20,992) [5,038] {2,519}
Lake	3,175	3,181	3,185	3,189	3,199 (640) [154] {77}	3,208 (642) [154] {77}	3,217 (643) [154] {77}
Los Angeles	1,198,178	1,200,128	1,201,868	1,203,152	1,205,705 (241,141) [57,874] {28,937}	1,208,118 (241,624) [57,990] {28,995}	1,210,419 (242,084) [58,100] {29,050}
Marin	13,316	13,337	13,358	13,358	13,402 (2,680) [643] {322}	13,444 (2,689) [645] {323}	13,485 (2,697) [647] {324}
Monterey	42,362	42,373	42,404	42,404	42,446 (8,489) [2,037] {1,019}	42,481 (8,496) [2,039] {1,020}	42,514 (8,503) [2,041] {1,020}
Orange	261,976	262,241	262,550	262,674	262,995 (52,599) [12,624] {6,312}	263,303 (52,661) [12,639] {6,319}	263,578 (52,716) [12,652] {6,326}
Placer	19,963	20,035	20,035	20,035	20,108 (4,022) [965] {483}	20,183 (4,037) [969] {484}	20,255 (4,051) [972] {486}
Riverside	290,744	290,904	290,904	290,904	291,193 (58,239) [13,977] {6,989}	291,458 (58,292) [13,990] {6,995}	291,695 (58,339) [14,001] {7,001}
Sacramento	93,947	94,129	94,182	94,332	94,580 (18,916) [4,540] {2,270}	94,818 (18,964) [4,551] {2,276}	95,033 (19,007) [4,562] {2,281}
San Bernardino	287,246	287,513	287,782	287,867	288,195 (57,639) [13,833] {6,917}	288,496 (57,699) [13,848] {6,924}	288,774 (57,755) [13,861] {6,931}
San Diego	261,861	262,360	262,781	262,781	263,465 (52,693) [12,646] {6,323}	264,096 (52,819) [12,677] {6,338}	264,682 (52,936) [12,705] {6,352}
San Francisco	34,443	34,480	34,526	34,560	34,635 (6,927) [1,662] {831}	34,703 (6,941) [1,666] {833}	34,766 (6,953) [1,669] {834}
San Joaquin	67,213	67,284	67,284	67,284	67,437 (13,487) [3,237] {1,618}	67,581 (13,516) [3,244] {1,622}	67,721 (13,544) [3,251] {1,625}
San Luis Obispo	19,797	19,835	19,835	19,835	19,885 (3,977) [954] {477}	19,931 (3,986) [957] {478}	19,974 (3,995) [959] {479}
San Mateo	39,189	39,225	39,305	39,384	39,491 (7,898) [1,896] {948}	39,588 (7,918) [1,900] {950}	39,680 (7,936) [1,905] {952}
Santa Barbara	32,219	32,267	32,301	32,301	32,387 (6,477) [1,555] {777}	32,468 (6,494) [1,558] {779}	32,543 (6,509) [1,562] {781}
Santa Clara	111,281	111,460	111,638	111,814	112,133 (22,427) [5,382] {2,691}	112,435 (22,487) [5,397] {2,698}	112,725 (22,545) [5,411] {2,705}
Santa Cruz	14,760	14,790	14,790	14,790	14,833 (2,967) [712] {356}	14,874 (2,975) [714] {357}	14,914 (2,983) [716] {358}
Solano	30,262	30,305	30,305	30,305	30,365 (6,073) [1,458] {729}	30,423 (6,085) [1,460] {730}	30,478 (6,096) [1,463] {731}
Sonoma	28,307	28,379	28,417	28,484	28,582 (5,716) [1,372] {686}	28,676 (5,735) [1,376] {688}	28,769 (5,754) [1,381] {690}
Ventura	78,057	78,184	78,368	78,439	78,608 (15,722) [3,773] {1,887}	78,765 (15,753) [3,781] {1,890}	78,910 (15,782) [3,788] {1,894}

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.