IEM's AI Modeling: Short-term COVID-19 Projections
Date: 6/9/21

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 6/9/21 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
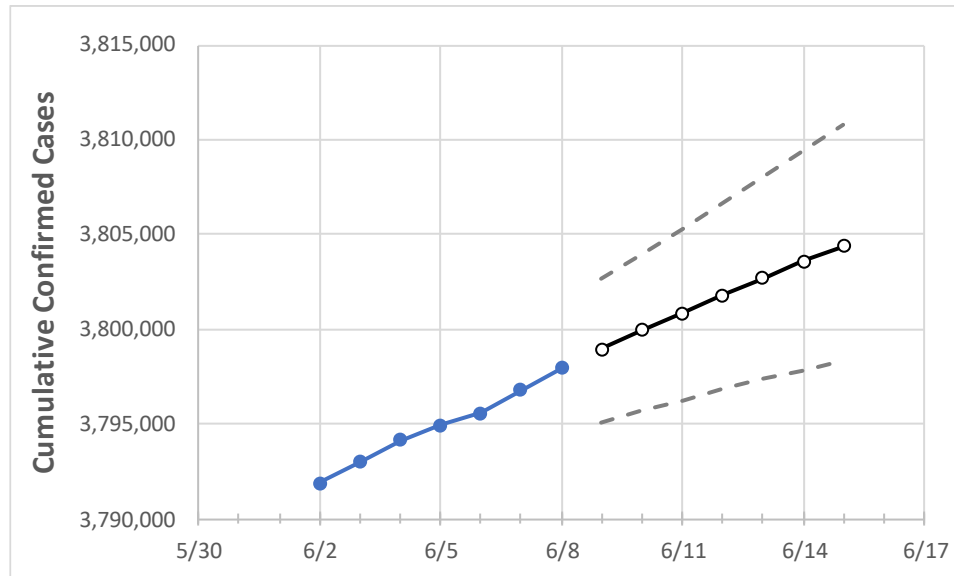
	Actual Confirmed Cases On:				Projected Cases For:						
	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14	6/15
California	3,794,927	3,795,580	3,796,776	3,797,937	3,798,957	3,799,928	3,800,875	3,801,808	3,802,678	3,803,565	3,804,404

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:						
	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14	6/15
Alameda	89,129	89,141	89,147	89,201	89,229	89,257	89,283	89,309	89,334	89,358	89,381
Contra Costa	69,886	69,945	70,003	70,048	70,089	70,129	70,169	70,209	70,249	70,288	70,327
Fresno	102,601	102,626	102,642	102,659	102,678	102,695	102,712	102,729	102,744	102,759	102,774
Kern	110,350	110,372	110,395	110,458	110,501	110,542	110,585	110,626	110,667	110,708	110,747
Lake	3,528	3,534	3,535	3,540	3,543	3,546	3,549	3,552	3,555	3,559	3,562
Los Angeles	1,244,917	1,245,120	1,245,254	1,245,429	1,245,587	1,245,745	1,245,901	1,246,059	1,246,214	1,246,362	1,246,512
Marin	14,153	14,156	14,157	14,160	14,163	14,167	14,170	14,173	14,177	14,180	14,183
Monterey	43,769	43,771	43,774	43,777	43,781	43,784	43,788	43,791	43,794	43,797	43,800
Orange	272,361	272,426	272,447	272,504	272,552	272,599	272,646	272,693	272,738	272,782	272,826
Placer	23,130	23,133	23,196	23,228	23,249	23,269	23,290	23,312	23,333	23,355	23,377
Riverside	300,957	300,985	301,013	301,128	301,166	301,204	301,241	301,277	301,313	301,349	301,386
Sacramento	106,796	106,879	106,961	107,030	107,099	107,168	107,236	107,302	107,367	107,431	107,495
San Bernardino	298,656	298,676	298,697	298,728	298,775	298,820	298,862	298,906	298,947	298,990	299,029
San Diego	280,675	280,742	280,807	280,878	280,948	281,017	281,087	281,154	281,222	281,289	281,356
San Francisco	37,079	37,111	37,118	37,122	37,133	37,145	37,157	37,168	37,179	37,190	37,200
San Joaquin	74,130	74,145	74,161	74,257	74,294	74,332	74,370	74,408	74,447	74,484	74,523
San Luis Obispo	21,365	21,367	21,369	21,383	21,389	21,395	21,401	21,407	21,413	21,419	21,424
San Mateo	42,413	42,433	42,457	42,479	42,492	42,504	42,517	42,528	42,540	42,551	42,562
Santa Barbara	34,531	34,536	34,541	34,547	34,552	34,557	34,561	34,565	34,570	34,574	34,578
Santa Clara	119,619	119,676	119,711	119,743	119,769	119,793	119,817	119,842	119,867	119,891	119,914
Santa Cruz	16,193	16,197	16,200	16,199	16,201	16,203	16,205	16,207	16,209	16,211	16,212
Solano	33,498	33,504	33,511	33,518	33,537	33,557	33,576	33,595	33,613	33,632	33,649
Sonoma	30,493	30,518	30,544	30,569	30,600	30,632	30,664	30,698	30,733	30,772	30,808
Ventura	81,474	81,490	81,507	81,511	81,524	81,536	81,549	81,560	81,572	81,583	81,594

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:		
	6/5	6/6	6/7	6/8	6/10	6/12	6/14
Alameda	89,129	89,141	89,147	89,201	89,257 (17,851) [4,284] {2,142}	89,309 (17,862) [4,287] {2,143}	89,358 (17,872) [4,289] {2,145}
Contra Costa	69,886	69,945	70,003	70,048	70,129 (14,026) [3,366] {1,683}	70,209 (14,042) [3,370] {1,685}	70,288 (14,058) [3,374] {1,687}
Fresno	102,601	102,626	102,642	102,659	102,695 (20,539) [4,929] {2,465}	102,729 (20,546) [4,931] {2,465}	102,759 (20,552) [4,932] {2,466}
Kern	110,350	110,372	110,395	110,458	110,542 (22,108) [5,306] {2,653}	110,626 (22,125) [5,310] {2,655}	110,708 (22,142) [5,314] {2,657}
Lake	3,528	3,534	3,535	3,540	3,546 (709) [170] {85}	3,552 (710) [171] {85}	3,559 (712) [171] {85}
Los Angeles	1,244,917	1,245,120	1,245,254	1,245,429	1,245,745 (249,149) [59,796] {29,898}	1,246,059 (249,212) [59,811] {29,905}	1,246,362 (249,272) [59,825] {29,913}
Marin	14,153	14,156	14,157	14,160	14,167 (2,833) [680] {340}	14,173 (2,835) [680] {340}	14,180 (2,836) [681] {340}
Monterey	43,769	43,771	43,774	43,777	43,784 (8,757) [2,102] {1,051}	43,791 (8,758) [2,102] {1,051}	43,797 (8,759) [2,102] {1,051}
Orange	272,361	272,426	272,447	272,504	272,599 (54,520) [13,085] {6,542}	272,693 (54,539) [13,089] {6,545}	272,782 (54,556) [13,094] {6,547}
Placer	23,130	23,133	23,196	23,228	23,269 (4,654) [1,117] {558}	23,312 (4,662) [1,119] {559}	23,355 (4,671) [1,121] {561}
Riverside	300,957	300,985	301,013	301,128	301,204 (60,241) [14,458] {7,229}	301,277 (60,255) [14,461] {7,231}	301,349 (60,270) [14,465] {7,232}
Sacramento	106,796	106,879	106,961	107,030	107,168 (21,434) [5,144] {2,572}	107,302 (21,460) [5,150] {2,575}	107,431 (21,486) [5,157] {2,578}
San Bernardino	298,656	298,676	298,697	298,728	298,820 (59,764) [14,343] {7,172}	298,906 (59,781) [14,347] {7,174}	298,990 (59,798) [14,352] {7,176}
San Diego	280,675	280,742	280,807	280,878	281,017 (56,203) [13,489] {6,744}	281,154 (56,231) [13,495] {6,748}	281,289 (56,258) [13,502] {6,751}
San Francisco	37,079	37,111	37,118	37,122	37,145 (7,429) [1,783] {891}	37,168 (7,434) [1,784] {892}	37,190 (7,438) [1,785] {893}
San Joaquin	74,130	74,145	74,161	74,257	74,332 (14,866) [3,568] {1,784}	74,408 (14,882) [3,572] {1,786}	74,484 (14,897) [3,575] {1,788}
San Luis Obispo	21,365	21,367	21,369	21,383	21,395 (4,279) [1,027] {513}	21,407 (4,281) [1,028] {514}	21,419 (4,284) [1,028] {514}
San Mateo	42,413	42,433	42,457	42,479	42,504 (8,501) [2,040] {1,020}	42,528 (8,506) [2,041] {1,021}	42,551 (8,510) [2,042] {1,021}
Santa Barbara	34,531	34,536	34,541	34,547	34,557 (6,911) [1,659] {829}	34,565 (6,913) [1,659] {830}	34,574 (6,915) [1,660] {830}
Santa Clara	119,619	119,676	119,711	119,743	119,793 (23,959) [5,750] {2,875}	119,842 (23,968) [5,752] {2,876}	119,891 (23,978) [5,755] {2,877}
Santa Cruz	16,193	16,197	16,200	16,199	16,203 (3,241) [778] {389}	16,207 (3,241) [778] {389}	16,211 (3,242) [778] {389}
Solano	33,498	33,504	33,511	33,518	33,557 (6,711) [1,611] {805}	33,595 (6,719) [1,613] {806}	33,632 (6,726) [1,614] {807}
Sonoma	30,493	30,518	30,544	30,569	30,632 (6,126) [1,470] {735}	30,698 (6,140) [1,474] {737}	30,772 (6,154) [1,477] {739}
Ventura	81,474	81,490	81,507	81,511	81,536 (16,307) [3,914] {1,957}	81,560 (16,312) [3,915] {1,957}	81,583 (16,317) [3,916] {1,958}

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.