IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/7/20

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 10/7/20 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
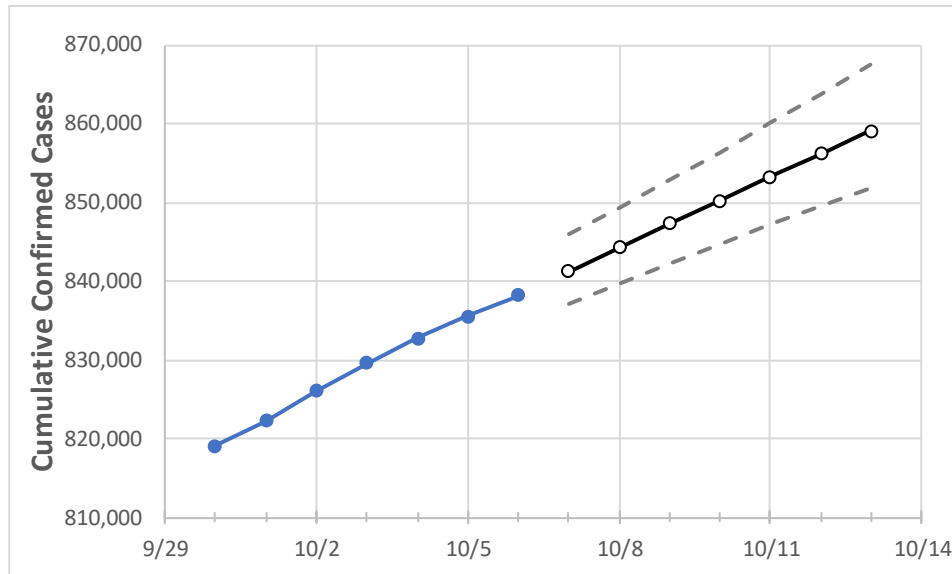
	Actual Confirmed Cases On:				Projected Cases For:						
	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12	10/13
California	829,521	832,713	835,507	838,202	841,247	844,271	847,274	850,256	853,217	856,158	859,078

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 20%, and are often within 10%, of actual confirmed cases.

California Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12	10/13
Alameda	21,621	21,708	21,746	21,809	21,872	21,935	21,997	22,058	22,119	22,179	22,238
Contra Costa	17,069	17,159	17,263	17,322	17,408	17,493	17,578	17,663	17,748	17,833	17,917
Fresno	28,855	28,975	29,065	29,136	29,220	29,303	29,386	29,469	29,551	29,632	29,714
Kern	32,343	32,443	32,491	32,522	32,569	32,616	32,661	32,705	32,748	32,791	32,832
Los Angeles	273,638	274,565	274,942	275,856	276,769	277,679	278,586	279,491	280,393	281,293	282,191
Marin	6,764	6,773	6,781	6,796	6,806	6,816	6,826	6,836	6,845	6,855	6,864
Monterey	10,219	10,312	10,359	10,402	10,456	10,509	10,562	10,616	10,669	10,722	10,775
Orange	54,357	54,640	54,760	54,898	55,071	55,246	55,422	55,598	55,776	55,955	56,134
Placer	3,638	3,648	3,684	3,694	3,703	3,713	3,721	3,730	3,739	3,747	3,755
Riverside	59,963	59,991	60,738	60,867	60,982	61,095	61,206	61,316	61,423	61,528	61,632
Sacramento	22,855	23,076	23,162	23,245	23,339	23,432	23,524	23,615	23,706	23,796	23,885
San Bernardino	56,011	56,275	56,400	56,522	56,687	56,853	57,018	57,184	57,349	57,515	57,681
San Diego	48,200	48,436	48,660	48,821	49,077	49,333	49,591	49,850	50,109	50,370	50,632
San Francisco	11,414	11,475	11,480	11,505	11,534	11,562	11,589	11,615	11,640	11,664	11,687
San Joaquin	20,513	20,541	20,569	20,731	20,763	20,794	20,825	20,855	20,884	20,913	20,941
San Luis Obispo	3,685	3,687	3,688	3,742	3,751	3,760	3,768	3,777	3,785	3,793	3,800
San Mateo	10,207	10,241	10,275	10,309	10,349	10,389	10,429	10,468	10,507	10,545	10,583
Santa Barbara	9,249	9,256	9,276	9,319	9,343	9,366	9,389	9,412	9,435	9,457	9,480
Santa Clara	21,734	21,840	21,926	21,978	22,064	22,149	22,234	22,317	22,400	22,481	22,562
Santa Cruz	2,481	2,494	2,501	2,519	2,531	2,542	2,554	2,565	2,577	2,588	2,599
Solano	6,547	6,574	6,601	6,624	6,652	6,680	6,709	6,737	6,765	6,793	6,821
Sonoma	7,752	7,861	7,940	8,037	8,114	8,194	8,277	8,363	8,452	8,545	8,641
Ventura	13,120	13,150	13,197	13,224	13,269	13,314	13,358	13,402	13,445	13,488	13,531

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:		
	10/3	10/4	10/5	10/6	10/8	10/10	10/12
Alameda	21,621	21,708	21,746	21,809	21,935 (4,387) [1,053] {526}	22,058 (4,412) [1,059] {529}	22,179 (4,436) [1,065] {532}
Contra Costa	17,069	17,159	17,263	17,322	17,493 (3,499) [840] {420}	17,663 (3,533) [848] {424}	17,833 (3,567) [856] {428}
Fresno	28,855	28,975	29,065	29,136	29,303 (5,861) [1,407] {703}	29,469 (5,894) [1,415] {707}	29,632 (5,926) [1,422] {711}
Kern	32,343	32,443	32,491	32,522	32,616 (6,523) [1,566] {783}	32,705 (6,541) [1,570] {785}	32,791 (6,558) [1,574] {787}
Los Angeles	273,638	274,565	274,942	275,856	277,679 (55,536) [13,329] {6,664}	279,491 (55,898) [13,416] {6,708}	281,293 (56,259) [13,502] {6,751}
Marin	6,764	6,773	6,781	6,796	6,816 (1,363) [327] {164}	6,836 (1,367) [328] {164}	6,855 (1,371) [329] {165}
Monterey	10,219	10,312	10,359	10,402	10,509 (2,102) [504] {252}	10,616 (2,123) [510] {255}	10,722 (2,144) [515] {257}
Orange	54,357	54,640	54,760	54,898	55,246 (11,049) [2,652] {1,326}	55,598 (11,120) [2,669] {1,334}	55,955 (11,191) [2,686] {1,343}
Placer	3,638	3,648	3,684	3,694	3,713 (743) [178] {89}	3,730 (746) [179] {90}	3,747 (749) [180] {90}
Riverside	59,963	59,991	60,738	60,867	61,095 (12,219) [2,933] {1,466}	61,316 (12,263) [2,943] {1,472}	61,528 (12,306) [2,953] {1,477}
Sacramento	22,855	23,076	23,162	23,245	23,432 (4,686) [1,125] {562}	23,615 (4,723) [1,134] {567}	23,796 (4,759) [1,142] {571}
San Bernardino	56,011	56,275	56,400	56,522	56,853 (11,371) [2,729] {1,364}	57,184 (11,437) [2,745] {1,372}	57,515 (11,503) [2,761] {1,380}
San Diego	48,200	48,436	48,660	48,821	49,333 (9,867) [2,368] {1,184}	49,850 (9,970) [2,393] {1,196}	50,370 (10,074) [2,418] {1,209}
San Francisco	11,414	11,475	11,480	11,505	11,562 (2,312) [555] {277}	11,615 (2,323) [558] {279}	11,664 (2,333) [560] {280}
San Joaquin	20,513	20,541	20,569	20,731	20,794 (4,159) [998] {499}	20,855 (4,171) [1,001] {501}	20,913 (4,183) [1,004] {502}
San Luis Obispo	3,685	3,687	3,688	3,742	3,760 (752) [180] {90}	3,777 (755) [181] {91}	3,793 (759) [182] {91}
San Mateo	10,207	10,241	10,275	10,309	10,389 (2,078) [499] {249}	10,468 (2,094) [502] {251}	10,545 (2,109) [506] {253}
Santa Barbara	9,249	9,256	9,276	9,319	9,366 (1,873) [450] {225}	9,412 (1,882) [452] {226}	9,457 (1,891) [454] {227}
Santa Clara	21,734	21,840	21,926	21,978	22,149 (4,430) [1,063] {532}	22,317 (4,463) [1,071] {536}	22,481 (4,496) [1,079] {540}
Santa Cruz	2,481	2,494	2,501	2,519	2,542 (508) [122] {61}	2,565 (513) [123] {62}	2,588 (518) [124] {62}
Solano	6,547	6,574	6,601	6,624	6,680 (1,336) [321] {160}	6,737 (1,347) [323] {162}	6,793 (1,359) [326] {163}
Sonoma	7,752	7,861	7,940	8,037	8,194 (1,639) [393] {197}	8,363 (1,673) [401] {201}	8,545 (1,709) [410] {205}
Ventura	13,120	13,150	13,197	13,224	13,314 (2,663) [639] {320}	13,402 (2,680) [643] {322}	13,488 (2,698) [647] {324}

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.