IEM's AI Modeling: Short-term COVID-19 Projections
Date: 11/15/21

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 11/15/21 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
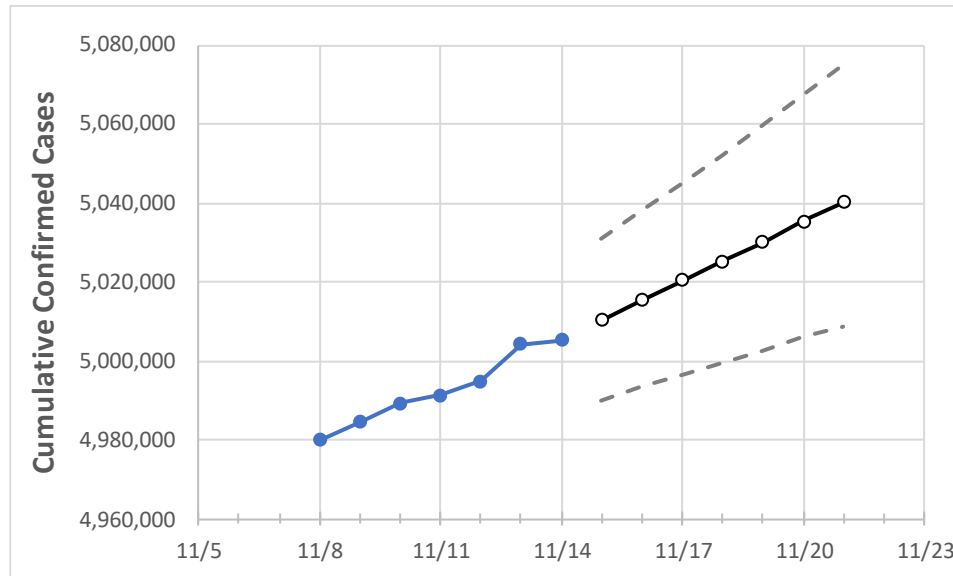
	Actual Confirmed Cases On:				Projected Cases For:						
	11/11	11/12	11/13	11/14	11/15	11/16	11/17	11/18	11/19	11/20	11/21
California	4,991,264	4,994,913	5,004,302	5,005,192	5,010,299	5,015,279	5,020,533	5,025,266	5,029,991	5,035,418	5,040,184

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:						
	11/11	11/12	11/13	11/14	11/15	11/16	11/17	11/18	11/19	11/20	11/21
Alameda	123,239	123,325	123,412	123,412	123,515	123,616	123,713	123,802	123,909	124,016	124,115
Contra Costa	102,178	102,244	102,309	102,309	102,386	102,464	102,536	102,618	102,689	102,771	102,846
Fresno	153,220	153,221	153,840	153,840	154,092	154,256	154,469	154,678	154,887	155,103	155,315
Kern	153,365	153,681	153,681	153,681	154,010	154,334	154,653	154,983	155,312	155,639	155,963
Lake	6,902	6,910	6,918	6,918	6,925	6,931	6,938	6,943	6,950	6,955	6,961
Los Angeles	1,507,736	1,509,073	1,510,434	1,511,324	1,512,709	1,514,086	1,515,451	1,516,858	1,518,234	1,519,710	1,521,149
Marin	18,128	18,143	18,158	18,158	18,178	18,197	18,216	18,235	18,255	18,276	18,296
Monterey	51,812	51,812	51,891	51,891	51,920	51,953	51,985	52,020	52,050	52,083	52,111
Orange	329,817	330,093	330,093	330,093	330,373	330,656	330,936	331,224	331,505	331,794	332,078
Placer	41,191	41,231	41,271	41,271	41,330	41,382	41,427	41,477	41,533	41,583	41,631
Riverside	380,180	380,181	381,052	381,052	381,417	381,798	382,101	382,460	382,831	383,198	383,543
Sacramento	164,961	164,961	165,396	165,396	165,571	165,769	165,958	166,123	166,311	166,518	166,683
San Bernardino	367,029	367,034	367,946	367,946	368,327	368,742	369,111	369,523	369,915	370,351	370,703
San Diego	398,272	398,875	399,477	399,477	400,059	400,630	401,222	401,805	402,404	403,006	403,620
San Francisco	55,868	55,912	55,956	55,956	56,026	56,101	56,172	56,247	56,328	56,409	56,493
San Joaquin	105,612	105,720	105,829	105,829	105,926	106,033	106,130	106,224	106,325	106,429	106,521
San Luis Obispo	30,840	30,859	30,878	30,878	30,907	30,937	30,966	30,992	31,020	31,049	31,077
San Mateo	55,408	55,451	55,495	55,495	55,541	55,587	55,634	55,679	55,723	55,770	55,816
Santa Barbara	46,354	46,397	46,441	46,441	46,487	46,533	46,576	46,623	46,668	46,713	46,758
Santa Clara	148,887	148,888	149,251	149,251	149,410	149,547	149,693	149,853	150,008	150,160	150,315
Santa Cruz	21,601	21,629	21,658	21,658	21,688	21,719	21,749	21,780	21,810	21,843	21,873
Solano	46,915	46,926	47,021	47,021	47,059	47,100	47,135	47,171	47,210	47,248	47,287
Sonoma	42,350	42,386	42,422	42,422	42,472	42,519	42,565	42,614	42,660	42,709	42,752
Ventura	102,753	102,753	102,908	102,908	102,988	103,059	103,135	103,210	103,290	103,371	103,434

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:		
	11/11	11/12	11/13	11/14	11/16	11/18	11/20
Alameda	123,239	123,325	123,412	123,412	123,616 (24,723) [5,934] {2,967}	123,802 (24,760) [5,943] {2,971}	124,016 (24,803) [5,953] {2,976}
Contra Costa	102,178	102,244	102,309	102,309	102,464 (20,493) [4,918] {2,459}	102,618 (20,524) [4,926] {2,463}	102,771 (20,554) [4,933] {2,467}
Fresno	153,220	153,221	153,840	153,840	154,256 (30,851) [7,404] {3,702}	154,678 (30,936) [7,425] {3,712}	155,103 (31,021) [7,445] {3,722}
Kern	153,365	153,681	153,681	153,681	154,334 (30,867) [7,408] {3,704}	154,983 (30,997) [7,439] {3,720}	155,639 (31,128) [7,471] {3,735}
Lake	6,902	6,910	6,918	6,918	6,931 (1,386) [333] {166}	6,943 (1,389) [333] {167}	6,955 (1,391) [334] {167}
Los Angeles	1,507,736	1,509,073	1,510,434	1,511,324	1,514,086 (302,817) [72,676] {36,338}	1,516,858 (303,372) [72,809] {36,405}	1,519,710 (303,942) [72,946] {36,473}
Marin	18,128	18,143	18,158	18,158	18,197 (3,639) [873] {437}	18,235 (3,647) [875] {438}	18,276 (3,655) [877] {439}
Monterey	51,812	51,812	51,891	51,891	51,953 (10,391) [2,494] {1,247}	52,020 (10,404) [2,497] {1,248}	52,083 (10,417) [2,500] {1,250}
Orange	329,817	330,093	330,093	330,093	330,656 (66,131) [15,872] {7,936}	331,224 (66,245) [15,899] {7,949}	331,794 (66,359) [15,926] {7,963}
Placer	41,191	41,231	41,271	41,271	41,382 (8,276) [1,986] {993}	41,477 (8,295) [1,991] {995}	41,583 (8,317) [1,996] {998}
Riverside	380,180	380,181	381,052	381,052	381,798 (76,360) [18,326] {9,163}	382,460 (76,492) [18,358] {9,179}	383,198 (76,640) [18,393] {9,197}
Sacramento	164,961	164,961	165,396	165,396	165,769 (33,154) [7,957] {3,978}	166,123 (33,225) [7,974] {3,987}	166,518 (33,304) [7,993] {3,996}
San Bernardino	367,029	367,034	367,946	367,946	368,742 (73,748) [17,700] {8,850}	369,523 (73,905) [17,737] {8,869}	370,351 (74,070) [17,777] {8,888}
San Diego	398,272	398,875	399,477	399,477	400,630 (80,126) [19,230] {9,615}	401,805 (80,361) [19,287] {9,643}	403,006 (80,601) [19,344] {9,672}
San Francisco	55,868	55,912	55,956	55,956	56,101 (11,220) [2,693] {1,346}	56,247 (11,249) [2,700] {1,350}	56,409 (11,282) [2,708] {1,354}
San Joaquin	105,612	105,720	105,829	105,829	106,033 (21,207) [5,090] {2,545}	106,224 (21,245) [5,099] {2,549}	106,429 (21,286) [5,109] {2,554}
San Luis Obispo	30,840	30,859	30,878	30,878	30,937 (6,187) [1,485] {742}	30,992 (6,198) [1,488] {744}	31,049 (6,210) [1,490] {745}
San Mateo	55,408	55,451	55,495	55,495	55,587 (11,117) [2,668] {1,334}	55,679 (11,136) [2,673] {1,336}	55,770 (11,154) [2,677] {1,338}
Santa Barbara	46,354	46,397	46,441	46,441	46,533 (9,307) [2,234] {1,117}	46,623 (9,325) [2,238] {1,119}	46,713 (9,343) [2,242] {1,121}
Santa Clara	148,887	148,888	149,251	149,251	149,547 (29,909) [7,178] {3,589}	149,853 (29,971) [7,193] {3,596}	150,160 (30,032) [7,208] {3,604}
Santa Cruz	21,601	21,629	21,658	21,658	21,719 (4,344) [1,043] {521}	21,780 (4,356) [1,045] {523}	21,843 (4,369) [1,048] {524}
Solano	46,915	46,926	47,021	47,021	47,100 (9,420) [2,261] {1,130}	47,171 (9,434) [2,264] {1,132}	47,248 (9,450) [2,268] {1,134}
Sonoma	42,350	42,386	42,422	42,422	42,519 (8,504) [2,041] {1,020}	42,614 (8,523) [2,045] {1,023}	42,709 (8,542) [2,050] {1,025}
Ventura	102,753	102,753	102,908	102,908	103,059 (20,612) [4,947] {2,473}	103,210 (20,642) [4,954] {2,477}	103,371 (20,674) [4,962] {2,481}

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.