IEM's AI Modeling: Short-term COVID-19 Projections
Date: 7/1/21

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 7/1/21 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.

Washington State Projections
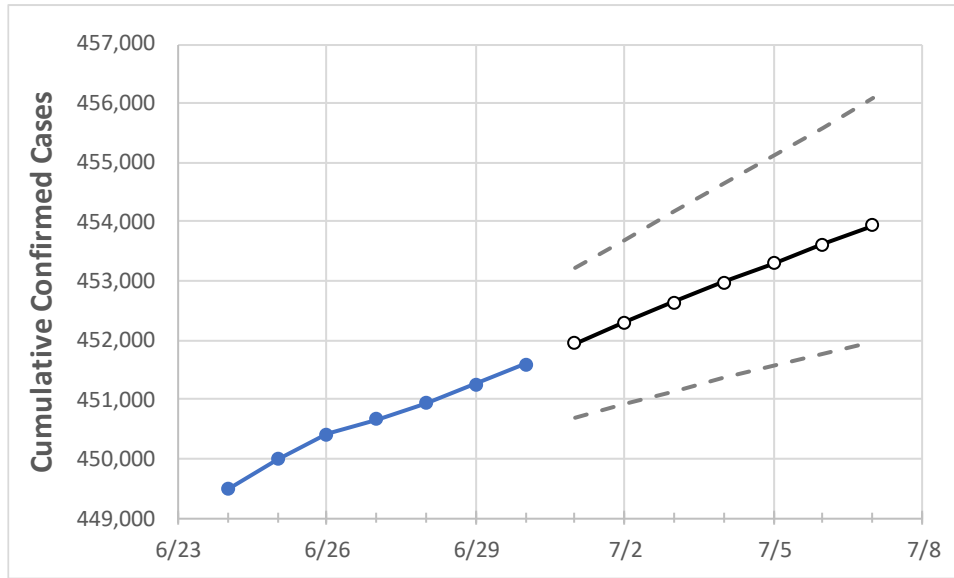
	Actual Confirmed Cases On:				Projected Cases For:						
	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7
Washington	450,667	450,930	451,248	451,595	451,951	452,296	452,639	452,973	453,300	453,625	453,937

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.

Washington Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7
Benton	17,801	17,813	17,841	17,869	17,892	17,915	17,939	17,963	17,988	18,012	18,038
Clark	25,917	25,935	25,953	25,962	25,977	25,990	26,004	26,016	26,028	26,040	26,051
Grant	9,365	9,369	9,376	9,380	9,385	9,390	9,395	9,400	9,404	9,408	9,412
Island	1,868	1,869	1,871	1,872	1,874	1,876	1,879	1,881	1,883	1,885	1,887
King	112,396	112,453	112,482	112,529	112,606	112,681	112,753	112,826	112,897	112,965	113,035
Kitsap	8,801	8,809	8,822	8,845	8,857	8,869	8,882	8,894	8,906	8,918	8,931
Pierce	56,880	56,915	56,940	56,965	56,999	57,031	57,062	57,092	57,122	57,150	57,180
Skagit	6,041	6,043	6,045	6,047	6,050	6,053	6,055	6,058	6,060	6,063	6,065
Snohomish	40,104	40,137	40,179	40,232	40,269	40,306	40,342	40,378	40,415	40,451	40,486
Spokane	46,783	46,806	46,838	46,863	46,895	46,925	46,954	46,982	47,009	47,035	47,060
Thurston	11,005	11,016	11,026	11,052	11,068	11,084	11,099	11,114	11,129	11,144	11,158
Whatcom	9,889	9,893	9,905	9,908	9,915	9,922	9,929	9,935	9,941	9,947	9,953
Yakima	30,675	30,689	30,701	30,714	30,727	30,740	30,753	30,766	30,778	30,791	30,804

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.*

Washington Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	6/27	6/28	6/29	6/30	7/2	7/4	7/6
Benton	17,801	17,813	17,841	17,869	17,915 (3,583) [860] {430}	17,963 (3,593) [862] {431}	18,012 (3,602) [865] {432}
Clark	25,917	25,935	25,953	25,962	25,990 (5,198) [1,248] {624}	26,016 (5,203) [1,249] {624}	26,040 (5,208) [1,250] {625}
Grant	9,365	9,369	9,376	9,380	9,390 (1,878) [451] {225}	9,400 (1,880) [451] {226}	9,408 (1,882) [452] {226}
Island	1,868	1,869	1,871	1,872	1,876 (375) [90] {45}	1,881 (376) [90] {45}	1,885 (377) [90] {45}
King	112,396	112,453	112,482	112,529	112,681 (22,536) [5,409] {2,704}	112,826 (22,565) [5,416] {2,708}	112,965 (22,593) [5,422] {2,711}
Kitsap	8,801	8,809	8,822	8,845	8,869 (1,774) [426] {213}	8,894 (1,779) [427] {213}	8,918 (1,784) [428] {214}
Pierce	56,880	56,915	56,940	56,965	57,031 (11,406) [2,737] {1,369}	57,092 (11,418) [2,740] {1,370}	57,150 (11,430) [2,743] {1,372}
Skagit	6,041	6,043	6,045	6,047	6,053 (1,211) [291] {145}	6,058 (1,212) [291] {145}	6,063 (1,213) [291] {146}
Snohomish	40,104	40,137	40,179	40,232	40,306 (8,061) [1,935] {967}	40,378 (8,076) [1,938] {969}	40,451 (8,090) [1,942] {971}
Spokane	46,783	46,806	46,838	46,863	46,925 (9,385) [2,252] {1,126}	46,982 (9,396) [2,255] {1,128}	47,035 (9,407) [2,258] {1,129}
Thurston	11,005	11,016	11,026	11,052	11,084 (2,217) [532] {266}	11,114 (2,223) [533] {267}	11,144 (2,229) [535] {267}
Whatcom	9,889	9,893	9,905	9,908	9,922 (1,984) [476] {238}	9,935 (1,987) [477] {238}	9,947 (1,989) [477] {239}
Yakima	30,675	30,689	30,701	30,714	30,740 (6,148) [1,476] {738}	30,766 (6,153) [1,477] {738}	30,791 (6,158) [1,478] {739}

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.