IEM's AI Modeling: Short-term COVID-19 Projections
Date: 5/26/21

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 <u>not</u> 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 5/26/21 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
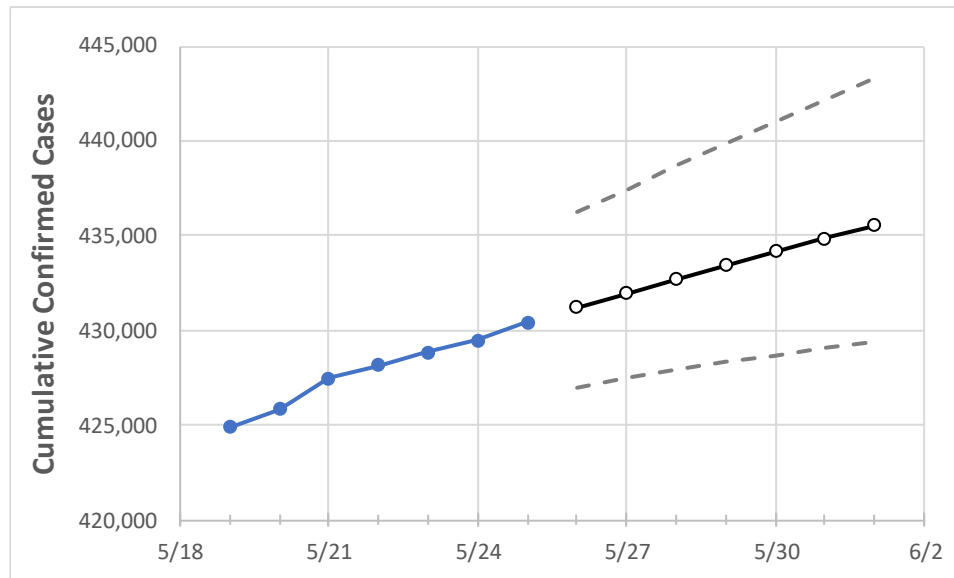
	Actual Confirmed Cases On:				Projected Cases For:						
	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31	6/1
Washington	428,162	428,831	429,499	430,415	431,193	431,951	432,690	433,410	434,152	434,877	435,554

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:						
	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31	6/1
Benton	17,113	17,124	17,136	17,153	17,167	17,181	17,194	17,207	17,219	17,231	17,243
Clark	24,308	24,344	24,379	24,501	24,562	24,622	24,681	24,739	24,799	24,858	24,913
Grant	9,003	9,016	9,028	9,036	9,049	9,062	9,075	9,087	9,099	9,111	9,122
Island	1,760	1,763	1,766	1,769	1,772	1,775	1,777	1,780	1,782	1,785	1,787
King	108,249	108,379	108,508	108,614	108,768	108,909	109,050	109,178	109,309	109,428	109,553
Kitsap	8,276	8,298	8,320	8,351	8,372	8,392	8,412	8,432	8,451	8,470	8,489
Pierce	53,499	53,606	53,713	53,912	54,089	54,260	54,430	54,603	54,770	54,929	55,088
Skagit	5,772	5,781	5,791	5,811	5,823	5,835	5,847	5,858	5,869	5,880	5,890
Snohomish	38,314	38,366	38,419	38,489	38,556	38,623	38,688	38,753	38,814	38,872	38,927
Spokane	43,786	43,885	43,984	44,115	44,237	44,361	44,486	44,613	44,742	44,876	45,006
Thurston	9,892	9,929	9,966	10,006	10,043	10,082	10,120	10,159	10,198	10,237	10,275
Whatcom	9,207	9,229	9,250	9,286	9,316	9,345	9,374	9,402	9,431	9,459	9,486
Yakima	29,940	29,955	29,969	29,973	29,986	29,998	30,010	30,021	30,032	30,043	30,054

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:		
	5/22	5/23	5/24	5/25	5/27	5/29	5/31
Benton	17,113	17,124	17,136	17,153	17,181 (3,436) [825] {412}	17,207 (3,441) [826] {413}	17,231 (3,446) [827] {414}
Clark	24,308	24,344	24,379	24,501	24,622 (4,924) [1,182] {591}	24,739 (4,948) [1,187] {594}	24,858 (4,972) [1,193] {597}
Grant	9,003	9,016	9,028	9,036	9,062 (1,812) [435] {217}	9,087 (1,817) [436] {218}	9,111 (1,822) [437] {219}
Island	1,760	1,763	1,766	1,769	1,775 (355) [85] {43}	1,780 (356) [85] {43}	1,785 (357) [86] {43}
King	108,249	108,379	108,508	108,614	108,909 (21,782) [5,228] {2,614}	109,178 (21,836) [5,241] {2,620}	109,428 (21,886) [5,253] {2,626}
Kitsap	8,276	8,298	8,320	8,351	8,392 (1,678) [403] {201}	8,432 (1,686) [405] {202}	8,470 (1,694) [407] {203}
Pierce	53,499	53,606	53,713	53,912	54,260 (10,852) [2,604] {1,302}	54,603 (10,921) [2,621] {1,310}	54,929 (10,986) [2,637] {1,318}
Skagit	5,772	5,781	5,791	5,811	5,835 (1,167) [280] {140}	5,858 (1,172) [281] {141}	5,880 (1,176) [282] {141}
Snohomish	38,314	38,366	38,419	38,489	38,623 (7,725) [1,854] {927}	38,753 (7,751) [1,860] {930}	38,872 (7,774) [1,866] {933}
Spokane	43,786	43,885	43,984	44,115	44,361 (8,872) [2,129] {1,065}	44,613 (8,923) [2,141] {1,071}	44,876 (8,975) [2,154] {1,077}
Thurston	9,892	9,929	9,966	10,006	10,082 (2,016) [484] {242}	10,159 (2,032) [488] {244}	10,237 (2,047) [491] {246}
Whatcom	9,207	9,229	9,250	9,286	9,345 (1,869) [449] {224}	9,402 (1,880) [451] {226}	9,459 (1,892) [454] {227}
Yakima	29,940	29,955	29,969	29,973	29,998 (6,000) [1,440] {720}	30,021 (6,004) [1,441] {721}	30,043 (6,009) [1,442] {721}

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.