IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/27/21

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 12/27/21 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
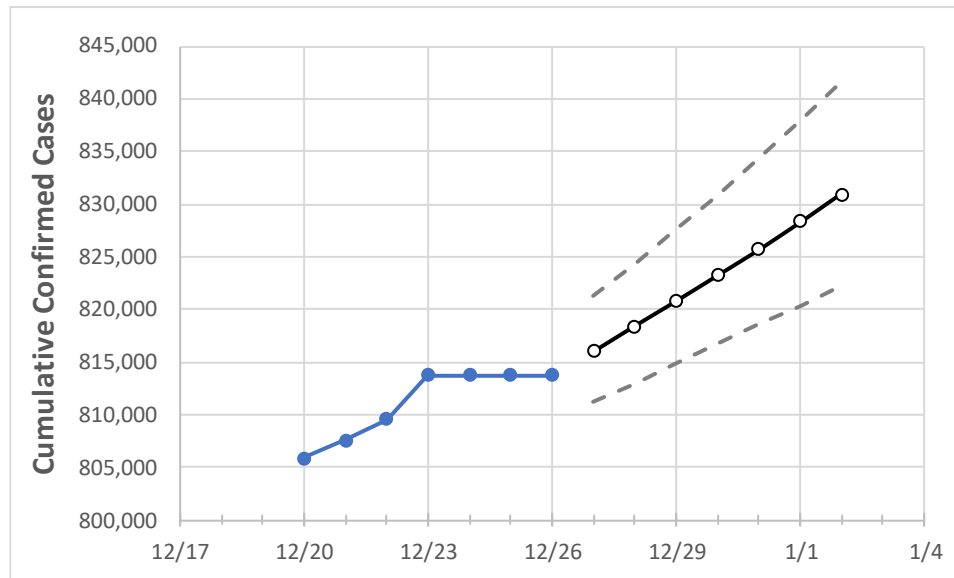
	Actual Confirmed Cases On:				Projected Cases For:						
	12/23	12/24	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2
Washington	813,741	813,741	813,741	813,741	816,047	818,412	820,773	823,238	825,746	828,404	830,962

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:						
	12/23	12/24	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2
Benton	32,916	32,916	32,916	32,916	32,933	32,950	32,966	32,982	32,998	33,013	33,030
Clark	47,712	47,712	47,712	47,712	47,857	48,002	48,149	48,300	48,457	48,614	48,780
Grant	17,437	17,437	17,437	17,437	17,453	17,469	17,484	17,500	17,515	17,531	17,545
Island	4,750	4,750	4,750	4,750	4,762	4,775	4,787	4,801	4,813	4,826	4,839
King	184,473	184,473	184,473	184,473	185,734	187,054	188,471	189,984	191,577	193,308	195,062
Kitsap	19,210	19,210	19,210	19,210	19,261	19,312	19,365	19,415	19,470	19,523	19,579
Pierce	104,998	104,998	104,998	104,998	105,420	105,860	106,310	106,769	107,242	107,741	108,249
Skagit	13,591	13,591	13,591	13,591	13,630	13,669	13,706	13,746	13,784	13,828	13,867
Snohomish	76,527	76,527	76,527	76,527	76,771	77,027	77,266	77,524	77,792	78,054	78,332
Spokane	79,492	79,492	79,492	79,492	79,556	79,616	79,678	79,737	79,797	79,854	79,911
Thurston	24,713	24,713	24,713	24,713	24,846	24,984	25,129	25,274	25,427	25,594	25,756
Whatcom	19,614	19,614	19,614	19,614	19,668	19,720	19,775	19,826	19,880	19,933	19,987
Yakima	46,140	46,140	46,140	46,140	46,163	46,185	46,207	46,230	46,252	46,275	46,294

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:		
	12/23	12/24	12/25	12/26	12/28	12/30	1/1
Benton	32,916	32,916	32,916	32,916	32,950 (6,590) [1,582] {791}	32,982 (6,596) [1,583] {792}	33,013 (6,603) [1,585] {792}
Clark	47,712	47,712	47,712	47,712	48,002 (9,600) [2,304] {1,152}	48,300 (9,660) [2,318] {1,159}	48,614 (9,723) [2,333] {1,167}
Grant	17,437	17,437	17,437	17,437	17,469 (3,494) [838] {419}	17,500 (3,500) [840] {420}	17,531 (3,506) [841] {421}
Island	4,750	4,750	4,750	4,750	4,775 (955) [229] {115}	4,801 (960) [230] {115}	4,826 (965) [232] {116}
King	184,473	184,473	184,473	184,473	187,054 (37,411) [8,979] {4,489}	189,984 (37,997) [9,119] {4,560}	193,308 (38,662) [9,279] {4,639}
Kitsap	19,210	19,210	19,210	19,210	19,312 (3,862) [927] {463}	19,415 (3,883) [932] {466}	19,523 (3,905) [937] {469}
Pierce	104,998	104,998	104,998	104,998	105,860 (21,172) [5,081] {2,541}	106,769 (21,354) [5,125] {2,562}	107,741 (21,548) [5,172] {2,586}
Skagit	13,591	13,591	13,591	13,591	13,669 (2,734) [656] {328}	13,746 (2,749) [660] {330}	13,828 (2,766) [664] {332}
Snohomish	76,527	76,527	76,527	76,527	77,027 (15,405) [3,697] {1,849}	77,524 (15,505) [3,721] {1,861}	78,054 (15,611) [3,747] {1,873}
Spokane	79,492	79,492	79,492	79,492	79,616 (15,923) [3,822] {1,911}	79,737 (15,947) [3,827] {1,914}	79,854 (15,971) [3,833] {1,916}
Thurston	24,713	24,713	24,713	24,713	24,984 (4,997) [1,199] {600}	25,274 (5,055) [1,213] {607}	25,594 (5,119) [1,229] {614}
Whatcom	19,614	19,614	19,614	19,614	19,720 (3,944) [947] {473}	19,826 (3,965) [952] {476}	19,933 (3,987) [957] {478}
Yakima	46,140	46,140	46,140	46,140	46,185 (9,237) [2,217] {1,108}	46,230 (9,246) [2,219] {1,110}	46,275 (9,255) [2,221] {1,111}

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.