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

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 5/21
/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
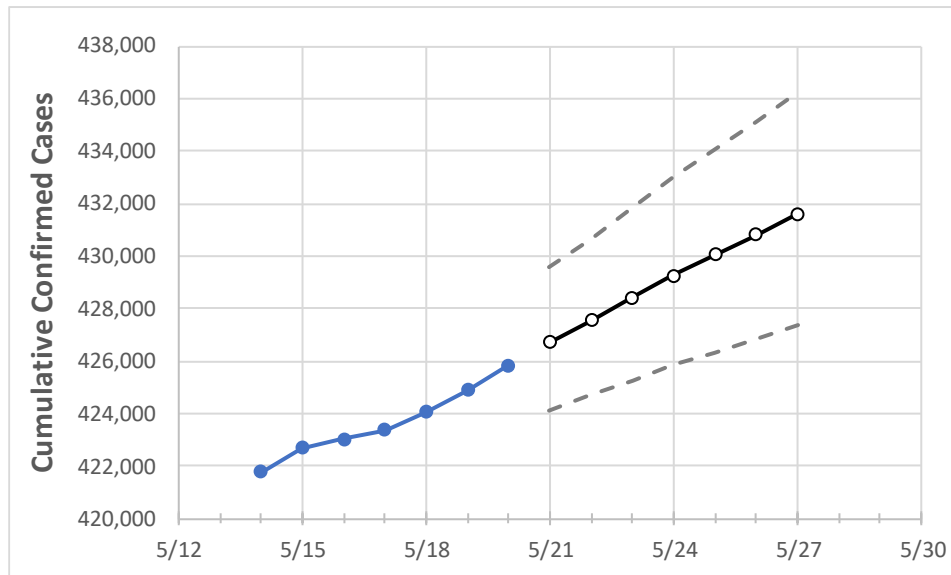
	Actual Confirmed Cases On:				Projected Cases For:						
	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27
Washington	423,382	424,050	424,903	425,848	426,721	427,563	428,413	429,240	430,039	430,829	431,605

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:						
	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27
Benton	17,019	17,033	17,051	17,078	17,095	17,111	17,126	17,141	17,156	17,170	17,185
Clark	23,960	24,012	24,092	24,178	24,246	24,315	24,383	24,451	24,516	24,578	24,642
Grant	8,927	8,938	8,952	8,972	8,987	9,001	9,016	9,030	9,044	9,057	9,071
Island	1,744	1,745	1,748	1,751	1,754	1,757	1,760	1,763	1,766	1,768	1,771
King	107,366	107,462	107,632	107,845	108,034	108,218	108,395	108,565	108,728	108,884	109,038
Kitsap	8,156	8,170	8,187	8,203	8,224	8,245	8,266	8,287	8,306	8,325	8,343
Pierce	52,749	52,833	52,963	53,069	53,286	53,501	53,717	53,931	54,143	54,350	54,564
Skagit	5,699	5,712	5,734	5,744	5,757	5,769	5,782	5,793	5,805	5,816	5,827
Snohomish	37,861	37,932	38,013	38,097	38,176	38,250	38,323	38,397	38,466	38,532	38,598
Spokane	43,105	43,227	43,311	43,407	43,505	43,603	43,700	43,799	43,894	43,990	44,088
Thurston	9,659	9,680	9,719	9,757	9,793	9,827	9,862	9,897	9,931	9,965	9,997
Whatcom	9,028	9,058	9,097	9,139	9,171	9,204	9,235	9,266	9,297	9,328	9,360
Yakima	29,842	29,849	29,855	29,896	29,910	29,923	29,936	29,948	29,959	29,971	29,982

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:		
	5/17	5/18	5/19	5/20	5/22	5/24	5/26
Benton	17,019	17,033	17,051	17,078	17,111 (3,422) [821] {411}	17,141 (3,428) [823] {411}	17,170 (3,434) [824] {412}
Clark	23,960	24,012	24,092	24,178	24,315 (4,863) [1,167] {584}	24,451 (4,890) [1,174] {587}	24,578 (4,916) [1,180] {590}
Grant	8,927	8,938	8,952	8,972	9,001 (1,800) [432] {216}	9,030 (1,806) [433] {217}	9,057 (1,811) [435] {217}
Island	1,744	1,745	1,748	1,751	1,757 (351) [84] {42}	1,763 (353) [85] {42}	1,768 (354) [85] {42}
King	107,366	107,462	107,632	107,845	108,218 (21,644) [5,194] {2,597}	108,565 (21,713) [5,211] {2,606}	108,884 (21,777) [5,226] {2,613}
Kitsap	8,156	8,170	8,187	8,203	8,245 (1,649) [396] {198}	8,287 (1,657) [398] {199}	8,325 (1,665) [400] {200}
Pierce	52,749	52,833	52,963	53,069	53,501 (10,700) [2,568] {1,284}	53,931 (10,786) [2,589] {1,294}	54,350 (10,870) [2,609] {1,304}
Skagit	5,699	5,712	5,734	5,744	5,769 (1,154) [277] {138}	5,793 (1,159) [278] {139}	5,816 (1,163) [279] {140}
Snohomish	37,861	37,932	38,013	38,097	38,250 (7,650) [1,836] {918}	38,397 (7,679) [1,843] {922}	38,532 (7,706) [1,850] {925}
Spokane	43,105	43,227	43,311	43,407	43,603 (8,721) [2,093] {1,046}	43,799 (8,760) [2,102] {1,051}	43,990 (8,798) [2,112] {1,056}
Thurston	9,659	9,680	9,719	9,757	9,827 (1,965) [472] {236}	9,897 (1,979) [475] {238}	9,965 (1,993) [478] {239}
Whatcom	9,028	9,058	9,097	9,139	9,204 (1,841) [442] {221}	9,266 (1,853) [445] {222}	9,328 (1,866) [448] {224}
Yakima	29,842	29,849	29,855	29,896	29,923 (5,985) [1,436] {718}	29,948 (5,990) [1,437] {719}	29,971 (5,994) [1,439] {719}

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.