IEM's AI Modeling: Short-term COVID-19 Projections
Date: 7/23/21

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 7/23/21 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
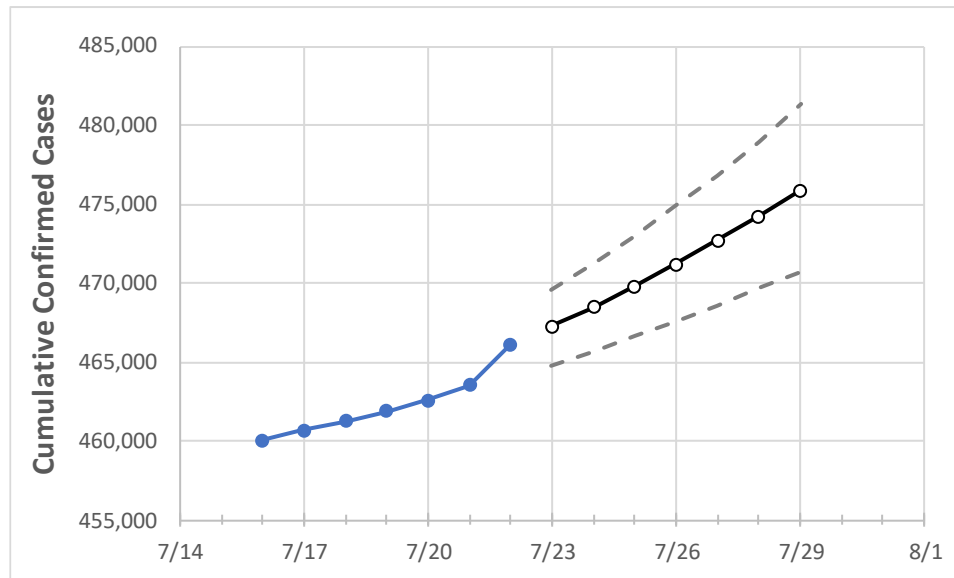
	Actual Confirmed Cases On:				Projected Cases For:						
	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29
Washington	461,847	462,577	463,537	466,099	467,260	468,490	469,805	471,172	472,671	474,231	475,853

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:						
	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29
Benton	18,636	18,702	18,775	19,037	19,133	19,238	19,350	19,471	19,601	19,742	19,894
Clark	26,416	26,487	26,553	26,601	26,644	26,688	26,735	26,781	26,830	26,882	26,937
Grant	9,967	9,974	9,985	9,993	9,999	10,005	10,011	10,017	10,023	10,029	10,035
Island	1,953	1,967	1,979	1,993	2,005	2,019	2,033	2,048	2,065	2,083	2,102
King	114,637	114,683	114,922	115,189	115,381	115,583	115,793	116,017	116,244	116,485	116,732
Kitsap	9,057	9,073	9,096	9,123	9,144	9,166	9,188	9,211	9,236	9,262	9,288
Pierce	58,170	58,277	58,377	58,519	58,645	58,779	58,918	59,067	59,223	59,390	59,563
Skagit	6,142	6,148	6,173	6,194	6,207	6,220	6,236	6,252	6,270	6,288	6,308
Snohomish	41,366	41,478	41,553	41,696	41,804	41,917	42,037	42,161	42,289	42,421	42,562
Spokane	47,658	47,726	47,769	48,890	48,954	49,019	49,086	49,154	49,223	49,295	49,368
Thurston	11,463	11,498	11,535	11,620	11,664	11,709	11,758	11,810	11,864	11,922	11,983
Whatcom	10,096	10,113	10,135	10,162	10,179	10,198	10,217	10,237	10,258	10,280	10,303
Yakima	31,228	31,259	31,297	31,358	31,405	31,453	31,504	31,559	31,615	31,674	31,734

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:		
	7/19	7/20	7/21	7/22	7/24	7/26	7/28
Benton	18,636	18,702	18,775	19,037	19,238 (3,848) [923] {462}	19,471 (3,894) [935] {467}	19,742 (3,948) [948] {474}
Clark	26,416	26,487	26,553	26,601	26,688 (5,338) [1,281] {641}	26,781 (5,356) [1,285] {643}	26,882 (5,376) [1,290] {645}
Grant	9,967	9,974	9,985	9,993	10,005 (2,001) [480] {240}	10,017 (2,003) [481] {240}	10,029 (2,006) [481] {241}
Island	1,953	1,967	1,979	1,993	2,019 (404) [97] {48}	2,048 (410) [98] {49}	2,083 (417) [100] {50}
King	114,637	114,683	114,922	115,189	115,583 (23,117) [5,548] {2,774}	116,017 (23,203) [5,569] {2,784}	116,485 (23,297) [5,591] {2,796}
Kitsap	9,057	9,073	9,096	9,123	9,166 (1,833) [440] {220}	9,211 (1,842) [442] {221}	9,262 (1,852) [445] {222}
Pierce	58,170	58,277	58,377	58,519	58,779 (11,756) [2,821] {1,411}	59,067 (11,813) [2,835] {1,418}	59,390 (11,878) [2,851] {1,425}
Skagit	6,142	6,148	6,173	6,194	6,220 (1,244) [299] {149}	6,252 (1,250) [300] {150}	6,288 (1,258) [302] {151}
Snohomish	41,366	41,478	41,553	41,696	41,917 (8,383) [2,012] {1,006}	42,161 (8,432) [2,024] {1,012}	42,421 (8,484) [2,036] {1,018}
Spokane	47,658	47,726	47,769	48,890	49,019 (9,804) [2,353] {1,176}	49,154 (9,831) [2,359] {1,180}	49,295 (9,859) [2,366] {1,183}
Thurston	11,463	11,498	11,535	11,620	11,709 (2,342) [562] {281}	11,810 (2,362) [567] {283}	11,922 (2,384) [572] {286}
Whatcom	10,096	10,113	10,135	10,162	10,198 (2,040) [489] {245}	10,237 (2,047) [491] {246}	10,280 (2,056) [493] {247}
Yakima	31,228	31,259	31,297	31,358	31,453 (6,291) [1,510] {755}	31,559 (6,312) [1,515] {757}	31,674 (6,335) [1,520] {760}

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.