IEM's AI Modeling: Short-term COVID-19 Projections
Date: 7/14/21

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 7/14/21 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
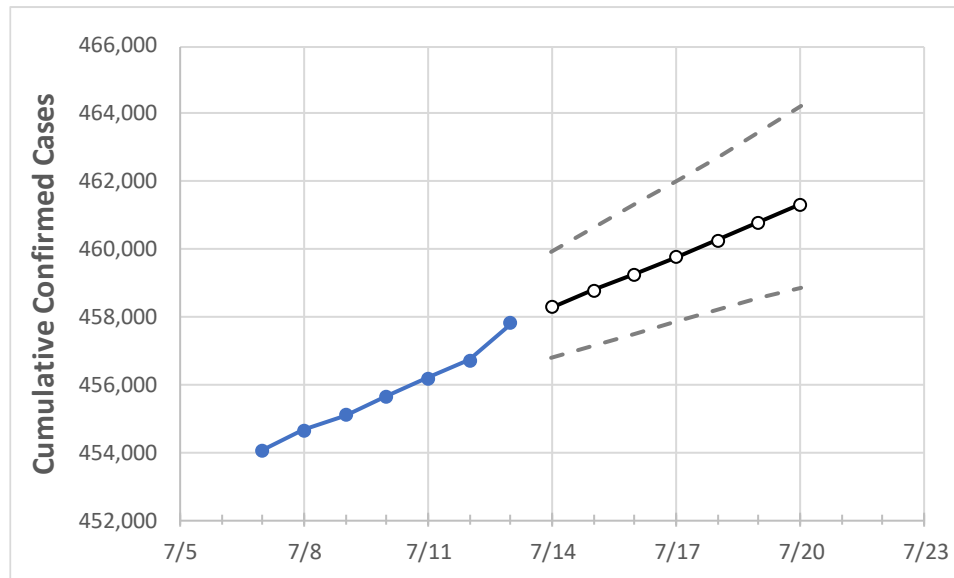
	Actual Confirmed Cases On:				Projected Cases For:						
	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20
Washington	455,638	456,174	456,709	457,814	458,295	458,778	459,267	459,761	460,268	460,789	461,318

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:						
	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20
Benton	18,236	18,271	18,306	18,344	18,389	18,435	18,483	18,532	18,583	18,635	18,691
Clark	26,159	26,182	26,204	26,229	26,246	26,263	26,280	26,297	26,313	26,330	26,345
Grant	9,434	9,439	9,444	9,934	9,938	9,943	9,947	9,951	9,955	9,959	9,963
Island	1,896	1,903	1,911	1,918	1,922	1,927	1,932	1,937	1,942	1,947	1,953
King	113,374	113,498	113,621	113,725	113,823	113,923	114,023	114,125	114,229	114,333	114,438
Kitsap	8,925	8,932	8,939	8,949	8,957	8,964	8,972	8,979	8,987	8,994	9,001
Pierce	57,416	57,495	57,575	57,635	57,690	57,746	57,803	57,861	57,920	57,979	58,040
Skagit	6,081	6,083	6,085	6,092	6,095	6,098	6,101	6,104	6,107	6,110	6,113
Snohomish	40,661	40,744	40,828	40,925	41,000	41,078	41,160	41,245	41,335	41,428	41,526
Spokane	47,147	47,176	47,205	47,310	47,339	47,366	47,394	47,423	47,450	47,477	47,505
Thurston	11,239	11,258	11,276	11,297	11,315	11,334	11,352	11,370	11,389	11,407	11,425
Whatcom	10,000	10,009	10,017	10,027	10,035	10,042	10,050	10,057	10,065	10,072	10,079
Yakima	30,934	30,960	30,987	31,007	31,031	31,055	31,081	31,107	31,133	31,160	31,188

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:		
	7/10	7/11	7/12	7/13	7/15	7/17	7/19
Benton	18,236	18,271	18,306	18,344	18,435 (3,687) [885] {442}	18,532 (3,706) [890] {445}	18,635 (3,727) [894] {447}
Clark	26,159	26,182	26,204	26,229	26,263 (5,253) [1,261] {630}	26,297 (5,259) [1,262] {631}	26,330 (5,266) [1,264] {632}
Grant	9,434	9,439	9,444	9,934	9,943 (1,989) [477] {239}	9,951 (1,990) [478] {239}	9,959 (1,992) [478] {239}
Island	1,896	1,903	1,911	1,918	1,927 (385) [92] {46}	1,937 (387) [93] {46}	1,947 (389) [93] {47}
King	113,374	113,498	113,621	113,725	113,923 (22,785) [5,468] {2,734}	114,125 (22,825) [5,478] {2,739}	114,333 (22,867) [5,488] {2,744}
Kitsap	8,925	8,932	8,939	8,949	8,964 (1,793) [430] {215}	8,979 (1,796) [431] {216}	8,994 (1,799) [432] {216}
Pierce	57,416	57,495	57,575	57,635	57,746 (11,549) [2,772] {1,386}	57,861 (11,572) [2,777] {1,389}	57,979 (11,596) [2,783] {1,392}
Skagit	6,081	6,083	6,085	6,092	6,098 (1,220) [293] {146}	6,104 (1,221) [293] {146}	6,110 (1,222) [293] {147}
Snohomish	40,661	40,744	40,828	40,925	41,078 (8,216) [1,972] {986}	41,245 (8,249) [1,980] {990}	41,428 (8,286) [1,989] {994}
Spokane	47,147	47,176	47,205	47,310	47,366 (9,473) [2,274] {1,137}	47,423 (9,485) [2,276] {1,138}	47,477 (9,495) [2,279] {1,139}
Thurston	11,239	11,258	11,276	11,297	11,334 (2,267) [544] {272}	11,370 (2,274) [546] {273}	11,407 (2,281) [548] {274}
Whatcom	10,000	10,009	10,017	10,027	10,042 (2,008) [482] {241}	10,057 (2,011) [483] {241}	10,072 (2,014) [483] {242}
Yakima	30,934	30,960	30,987	31,007	31,055 (6,211) [1,491] {745}	31,107 (6,221) [1,493] {747}	31,160 (6,232) [1,496] {748}

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.