IEM's AI Modeling: Short-term COVID-19 Projections
Date: 6/17/21

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 6/17/21 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
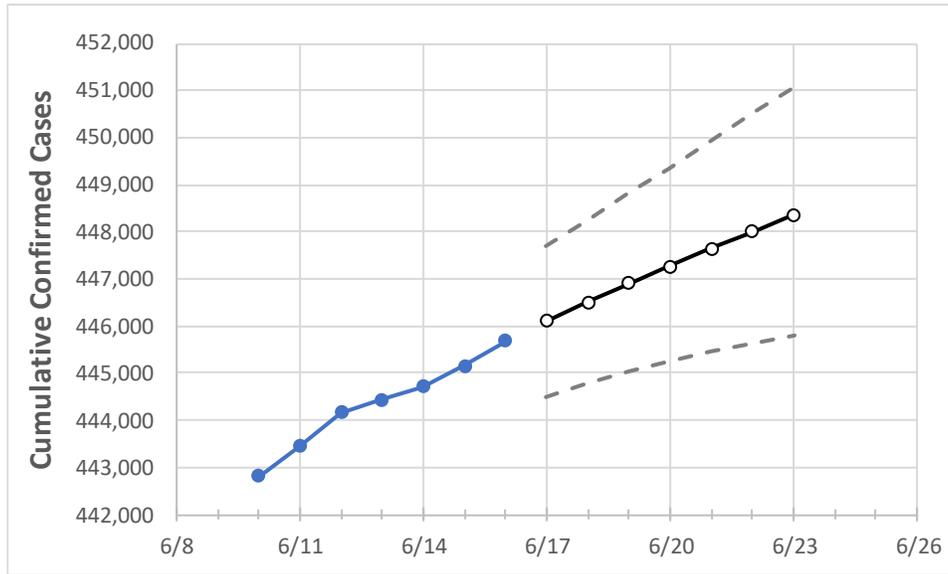
	Actual Confirmed Cases On:				Projected Cases For:						
	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20	6/21	6/22	6/23
Washington	444,444	444,722	445,155	445,686	446,111	446,511	446,902	447,277	447,652	448,008	448,362

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:						
	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20	6/21	6/22	6/23
Benton	17,530	17,546	17,561	17,575	17,593	17,610	17,627	17,645	17,662	17,679	17,696
Clark	25,550	25,581	25,622	25,645	25,678	25,710	25,741	25,771	25,800	25,827	25,853
Grant	9,248	9,261	9,271	9,281	9,293	9,306	9,319	9,331	9,344	9,357	9,371
Island	1,825	1,827	1,830	1,832	1,835	1,838	1,841	1,844	1,847	1,850	1,854
King	111,080	111,137	111,201	111,306	111,387	111,464	111,542	111,617	111,688	111,759	111,828
Kitsap	8,637	8,646	8,659	8,668	8,677	8,685	8,693	8,700	8,708	8,715	8,721
Pierce	56,258	56,300	56,333	56,381	56,423	56,461	56,498	56,533	56,565	56,595	56,624
Skagit	5,975	5,977	5,983	5,991	5,996	6,002	6,007	6,012	6,017	6,021	6,026
Snohomish	39,565	39,585	39,617	39,662	39,696	39,727	39,757	39,787	39,817	39,844	39,872
Spokane	46,128	46,155	46,191	46,262	46,295	46,325	46,354	46,381	46,405	46,427	46,447
Thurston	10,726	10,738	10,751	10,783	10,804	10,825	10,846	10,867	10,886	10,905	10,923
Whatcom	9,718	9,722	9,737	9,763	9,774	9,785	9,795	9,805	9,815	9,824	9,833
Yakima	30,422	30,430	30,466	30,486	30,509	30,532	30,557	30,583	30,608	30,632	30,658

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:		
	6/13	6/14	6/15	6/16	6/18	6/20	6/22
Benton	17,530	17,546	17,561	17,575	17,610 (3,522) [845] {423}	17,645 (3,529) [847] {423}	17,679 (3,536) [849] {424}
Clark	25,550	25,581	25,622	25,645	25,710 (5,142) [1,234] {617}	25,771 (5,154) [1,237] {619}	25,827 (5,165) [1,240] {620}
Grant	9,248	9,261	9,271	9,281	9,306 (1,861) [447] {223}	9,331 (1,866) [448] {224}	9,357 (1,871) [449] {225}
Island	1,825	1,827	1,830	1,832	1,838 (368) [88] {44}	1,844 (369) [89] {44}	1,850 (370) [89] {44}
King	111,080	111,137	111,201	111,306	111,464 (22,293) [5,350] {2,675}	111,617 (22,323) [5,358] {2,679}	111,759 (22,352) [5,364] {2,682}
Kitsap	8,637	8,646	8,659	8,668	8,685 (1,737) [417] {208}	8,700 (1,740) [418] {209}	8,715 (1,743) [418] {209}
Pierce	56,258	56,300	56,333	56,381	56,461 (11,292) [2,710] {1,355}	56,533 (11,307) [2,714] {1,357}	56,595 (11,319) [2,717] {1,358}
Skagit	5,975	5,977	5,983	5,991	6,002 (1,200) [288] {144}	6,012 (1,202) [289] {144}	6,021 (1,204) [289] {145}
Snohomish	39,565	39,585	39,617	39,662	39,727 (7,945) [1,907] {953}	39,787 (7,957) [1,910] {955}	39,844 (7,969) [1,913] {956}
Spokane	46,128	46,155	46,191	46,262	46,325 (9,265) [2,224] {1,112}	46,381 (9,276) [2,226] {1,113}	46,427 (9,285) [2,228] {1,114}
Thurston	10,726	10,738	10,751	10,783	10,825 (2,165) [520] {260}	10,867 (2,173) [522] {261}	10,905 (2,181) [523] {262}
Whatcom	9,718	9,722	9,737	9,763	9,785 (1,957) [470] {235}	9,805 (1,961) [471] {235}	9,824 (1,965) [472] {236}
Yakima	30,422	30,430	30,466	30,486	30,532 (6,106) [1,466] {733}	30,583 (6,117) [1,468] {734}	30,632 (6,126) [1,470] {735}

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.