IEM's AI Modeling: Short-term COVID-19 Projections
Date: 6/14/21

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 6/14/21 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
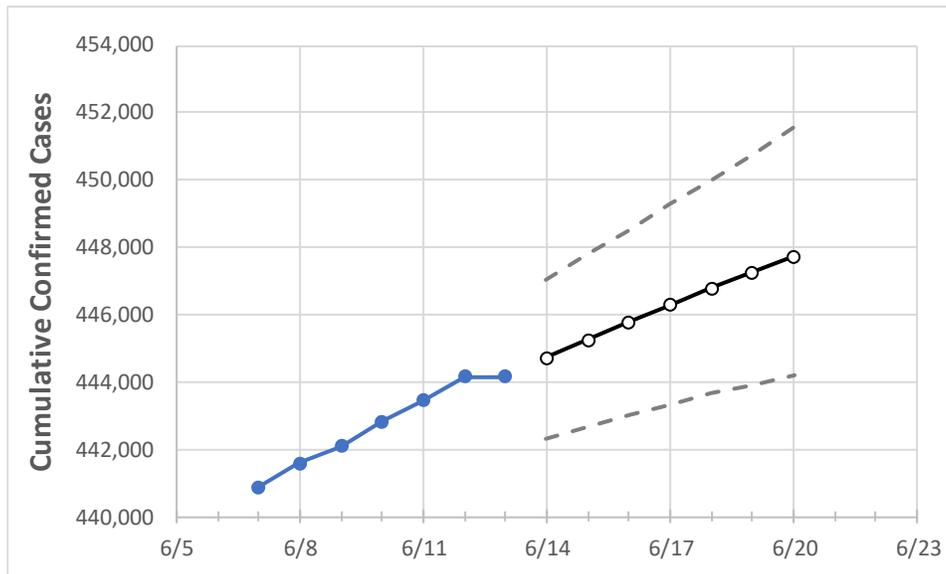
	Actual Confirmed Cases On:				Projected Cases For:						
	6/10	6/11	6/12	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20
Washington	442,815	443,454	444,166	444,166	444,717	445,257	445,770	446,281	446,781	447,261	447,740

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:						
	6/10	6/11	6/12	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20
Benton	17,475	17,492	17,514	17,514	17,536	17,558	17,579	17,602	17,624	17,648	17,671
Clark	25,410	25,454	25,518	25,518	25,566	25,615	25,661	25,709	25,756	25,801	25,846
Grant	9,207	9,218	9,234	9,234	9,243	9,251	9,260	9,268	9,277	9,285	9,293
Island	1,813	1,816	1,822	1,822	1,825	1,828	1,831	1,834	1,838	1,841	1,844
King	110,799	110,911	111,022	111,022	111,107	111,190	111,273	111,350	111,429	111,504	111,574
Kitsap	8,598	8,616	8,628	8,628	8,639	8,650	8,660	8,670	8,680	8,689	8,698
Pierce	56,054	56,153	56,215	56,215	56,275	56,331	56,381	56,435	56,482	56,530	56,577
Skagit	5,953	5,961	5,972	5,972	5,978	5,984	5,990	5,996	6,002	6,007	6,012
Snohomish	39,426	39,459	39,545	39,545	39,589	39,631	39,675	39,715	39,757	39,797	39,835
Spokane	45,965	46,028	46,100	46,100	46,165	46,225	46,285	46,344	46,398	46,454	46,508
Thurston	10,625	10,680	10,713	10,713	10,738	10,763	10,789	10,812	10,835	10,859	10,883
Whatcom	9,691	9,698	9,713	9,713	9,732	9,749	9,767	9,785	9,801	9,818	9,834
Yakima	30,359	30,391	30,413	30,413	30,439	30,465	30,491	30,519	30,547	30,576	30,607

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:		
	6/10	6/11	6/12	6/13	6/15	6/17	6/19
Benton	17,475	17,492	17,514	17,514	17,558 (3,512) [843] {421}	17,602 (3,520) [845] {422}	17,648 (3,530) [847] {424}
Clark	25,410	25,454	25,518	25,518	25,615 (5,123) [1,230] {615}	25,709 (5,142) [1,234] {617}	25,801 (5,160) [1,238] {619}
Grant	9,207	9,218	9,234	9,234	9,251 (1,850) [444] {222}	9,268 (1,854) [445] {222}	9,285 (1,857) [446] {223}
Island	1,813	1,816	1,822	1,822	1,828 (366) [88] {44}	1,834 (367) [88] {44}	1,841 (368) [88] {44}
King	110,799	110,911	111,022	111,022	111,190 (22,238) [5,337] {2,669}	111,350 (22,270) [5,345] {2,672}	111,504 (22,301) [5,352] {2,676}
Kitsap	8,598	8,616	8,628	8,628	8,650 (1,730) [415] {208}	8,670 (1,734) [416] {208}	8,689 (1,738) [417] {209}
Pierce	56,054	56,153	56,215	56,215	56,331 (11,266) [2,704] {1,352}	56,435 (11,287) [2,709] {1,354}	56,530 (11,306) [2,713] {1,357}
Skagit	5,953	5,961	5,972	5,972	5,984 (1,197) [287] {144}	5,996 (1,199) [288] {144}	6,007 (1,201) [288] {144}
Snohomish	39,426	39,459	39,545	39,545	39,631 (7,926) [1,902] {951}	39,715 (7,943) [1,906] {953}	39,797 (7,959) [1,910] {955}
Spokane	45,965	46,028	46,100	46,100	46,225 (9,245) [2,219] {1,109}	46,344 (9,269) [2,225] {1,112}	46,454 (9,291) [2,230] {1,115}
Thurston	10,625	10,680	10,713	10,713	10,763 (2,153) [517] {258}	10,812 (2,162) [519] {259}	10,859 (2,172) [521] {261}
Whatcom	9,691	9,698	9,713	9,713	9,749 (1,950) [468] {234}	9,785 (1,957) [470] {235}	9,818 (1,964) [471] {236}
Yakima	30,359	30,391	30,413	30,413	30,465 (6,093) [1,462] {731}	30,519 (6,104) [1,465] {732}	30,576 (6,115) [1,468] {734}

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.