IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/1/21

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 10/1/21 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
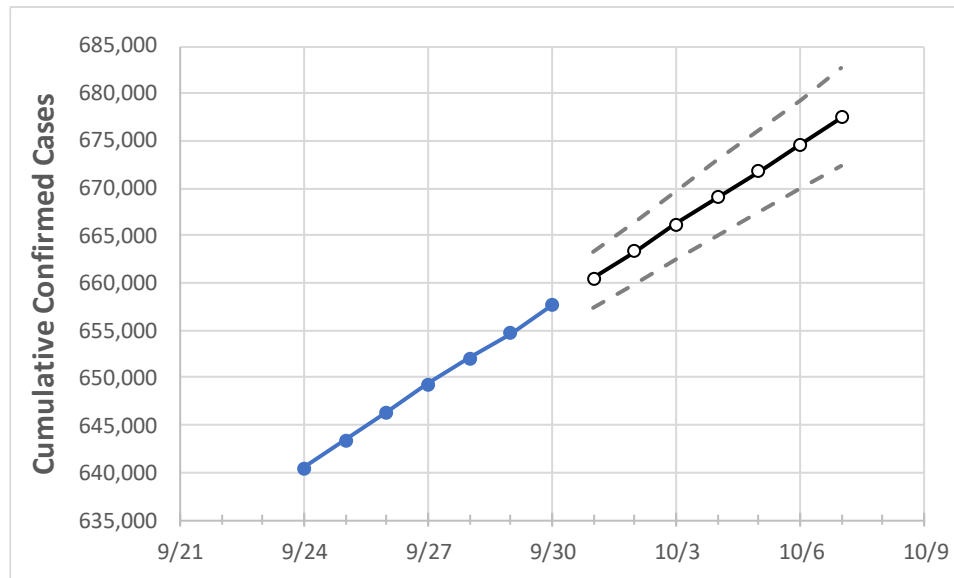
	Actual Confirmed Cases On:				Projected Cases For:						
	9/27	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5	10/6	10/7
Washington	649,284	652,011	654,710	657,626	660,491	663,334	666,166	669,007	671,804	674,663	677,517

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:						
	9/27	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5	10/6	10/7
Benton	28,842	28,960	29,104	29,192	29,317	29,445	29,568	29,691	29,811	29,936	30,057
Clark	36,961	37,140	37,307	37,484	37,653	37,822	37,990	38,159	38,328	38,497	38,668
Grant	14,165	14,222	14,284	14,365	14,437	14,514	14,580	14,652	14,725	14,795	14,866
Island	3,358	3,379	3,412	3,446	3,476	3,506	3,537	3,568	3,600	3,633	3,666
King	150,197	150,532	150,923	151,467	151,934	152,389	152,850	153,307	153,770	154,229	154,665
Kitsap	14,734	14,787	14,864	14,998	15,088	15,174	15,263	15,349	15,433	15,521	15,607
Pierce	82,480	82,901	83,261	83,560	83,946	84,340	84,723	85,114	85,508	85,912	86,299
Skagit	9,316	9,353	9,422	9,497	9,559	9,621	9,684	9,746	9,808	9,874	9,937
Snohomish	58,287	58,518	58,769	59,052	59,299	59,550	59,800	60,051	60,299	60,552	60,801
Spokane	64,693	65,010	65,281	65,555	65,829	66,095	66,363	66,634	66,902	67,171	67,436
Thurston	17,770	17,888	18,001	18,121	18,236	18,352	18,469	18,588	18,707	18,829	18,951
Whatcom	14,389	14,483	14,521	14,606	14,672	14,737	14,802	14,867	14,932	14,998	15,062
Yakima	40,247	40,382	40,517	40,605	40,734	40,865	40,988	41,115	41,235	41,360	41,479

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:		
	9/27	9/28	9/29	9/30	10/2	10/4	10/6
Benton	28,842	28,960	29,104	29,192	29,445 (5,889) [1,413] {707}	29,691 (5,938) [1,425] {713}	29,936 (5,987) [1,437] {718}
Clark	36,961	37,140	37,307	37,484	37,822 (7,564) [1,815] {908}	38,159 (7,632) [1,832] {916}	38,497 (7,699) [1,848] {924}
Grant	14,165	14,222	14,284	14,365	14,514 (2,903) [697] {348}	14,652 (2,930) [703] {352}	14,795 (2,959) [710] {355}
Island	3,358	3,379	3,412	3,446	3,506 (701) [168] {84}	3,568 (714) [171] {86}	3,633 (727) [174] {87}
King	150,197	150,532	150,923	151,467	152,389 (30,478) [7,315] {3,657}	153,307 (30,661) [7,359] {3,679}	154,229 (30,846) [7,403] {3,701}
Kitsap	14,734	14,787	14,864	14,998	15,174 (3,035) [728] {364}	15,349 (3,070) [737] {368}	15,521 (3,104) [745] {372}
Pierce	82,480	82,901	83,261	83,560	84,340 (16,868) [4,048] {2,024}	85,114 (17,023) [4,085] {2,043}	85,912 (17,182) [4,124] {2,062}
Skagit	9,316	9,353	9,422	9,497	9,621 (1,924) [462] {231}	9,746 (1,949) [468] {234}	9,874 (1,975) [474] {237}
Snohomish	58,287	58,518	58,769	59,052	59,550 (11,910) [2,858] {1,429}	60,051 (12,010) [2,882] {1,441}	60,552 (12,110) [2,906] {1,453}
Spokane	64,693	65,010	65,281	65,555	66,095 (13,219) [3,173] {1,586}	66,634 (13,327) [3,198] {1,599}	67,171 (13,434) [3,224] {1,612}
Thurston	17,770	17,888	18,001	18,121	18,352 (3,670) [881] {440}	18,588 (3,718) [892] {446}	18,829 (3,766) [904] {452}
Whatcom	14,389	14,483	14,521	14,606	14,737 (2,947) [707] {354}	14,867 (2,973) [714] {357}	14,998 (3,000) [720] {360}
Yakima	40,247	40,382	40,517	40,605	40,865 (8,173) [1,961] {981}	41,115 (8,223) [1,974] {987}	41,360 (8,272) [1,985] {993}

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.