IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/8/22

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 3/8/22 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:						
3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14
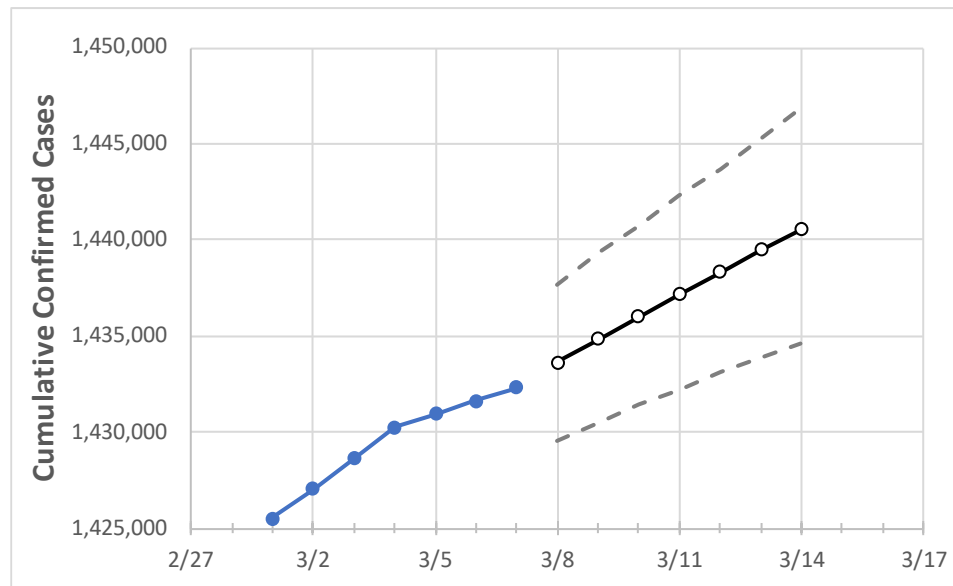
	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14
Washington	1,430,235	1,430,930	1,431,626	1,432,321	1,433,611	1,434,867	1,436,016	1,437,177	1,438,333	1,439,464	1,440,542

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:						
	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14
Benton	51,592	51,614	51,637	51,659	51,691	51,723	51,754	51,784	51,812	51,838	51,863
Clark	84,903	84,963	85,023	85,083	85,172	85,245	85,324	85,392	85,463	85,533	85,594
Grant	25,401	25,408	25,415	25,422	25,432	25,441	25,450	25,459	25,468	25,476	25,484
Island	9,795	9,802	9,810	9,817	9,823	9,829	9,834	9,838	9,843	9,848	9,852
King	367,268	367,433	367,597	367,762	368,036	368,304	368,554	368,820	369,070	369,307	369,543
Kitsap	38,604	38,626	38,648	38,670	38,711	38,753	38,791	38,831	38,871	38,909	38,947
Pierce	188,320	188,416	188,511	188,607	188,940	189,241	189,569	189,865	190,193	190,522	190,810
Skagit	21,751	21,765	21,778	21,792	21,805	21,817	21,830	21,842	21,854	21,866	21,878
Snohomish	147,275	147,332	147,388	147,445	147,514	147,578	147,639	147,696	147,751	147,810	147,857
Spokane	120,980	121,045	121,109	121,174	121,232	121,287	121,341	121,385	121,437	121,487	121,534
Thurston	45,829	45,849	45,870	45,890	45,914	45,937	45,958	45,980	46,001	46,021	46,040
Whatcom	36,538	36,561	36,585	36,608	36,630	36,649	36,667	36,686	36,705	36,725	36,740
Yakima	70,598	70,626	70,655	70,683	70,714	70,747	70,777	70,805	70,831	70,859	70,885

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:		
	3/4	3/5	3/6	3/7	3/9	3/11	3/13
Benton	51,592	51,614	51,637	51,659	51,723 (10,345) [2,483] {1,241}	51,784 (10,357) [2,486] {1,243}	51,838 (10,368) [2,488] {1,244}
Clark	84,903	84,963	85,023	85,083	85,245 (17,049) [4,092] {2,046}	85,392 (17,078) [4,099] {2,049}	85,533 (17,107) [4,106] {2,053}
Grant	25,401	25,408	25,415	25,422	25,441 (5,088) [1,221] {611}	25,459 (5,092) [1,222] {611}	25,476 (5,095) [1,223] {611}
Island	9,795	9,802	9,810	9,817	9,829 (1,966) [472] {236}	9,838 (1,968) [472] {236}	9,848 (1,970) [473] {236}
King	367,268	367,433	367,597	367,762	368,304 (73,661) [17,679] {8,839}	368,820 (73,764) [17,703] {8,852}	369,307 (73,861) [17,727] {8,863}
Kitsap	38,604	38,626	38,648	38,670	38,753 (7,751) [1,860] {930}	38,831 (7,766) [1,864] {932}	38,909 (7,782) [1,868] {934}
Pierce	188,320	188,416	188,511	188,607	189,241 (37,848) [9,084] {4,542}	189,865 (37,973) [9,114] {4,557}	190,522 (38,104) [9,145] {4,573}
Skagit	21,751	21,765	21,778	21,792	21,817 (4,363) [1,047] {524}	21,842 (4,368) [1,048] {524}	21,866 (4,373) [1,050] {525}
Snohomish	147,275	147,332	147,388	147,445	147,578 (29,516) [7,084] {3,542}	147,696 (29,539) [7,089] {3,545}	147,810 (29,562) [7,095] {3,547}
Spokane	120,980	121,045	121,109	121,174	121,287 (24,257) [5,822] {2,911}	121,385 (24,277) [5,826] {2,913}	121,487 (24,297) [5,831] {2,916}
Thurston	45,829	45,849	45,870	45,890	45,937 (9,187) [2,205] {1,102}	45,980 (9,196) [2,207] {1,104}	46,021 (9,204) [2,209] {1,105}
Whatcom	36,538	36,561	36,585	36,608	36,649 (7,330) [1,759] {880}	36,686 (7,337) [1,761] {880}	36,725 (7,345) [1,763] {881}
Yakima	70,598	70,626	70,655	70,683	70,747 (14,149) [3,396] {1,698}	70,805 (14,161) [3,399] {1,699}	70,859 (14,172) [3,401] {1,701}

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.