IEM's AI Modeling: Short-term COVID-19 Projections

Date: 3/10/21

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 not 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 3/10/21 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.

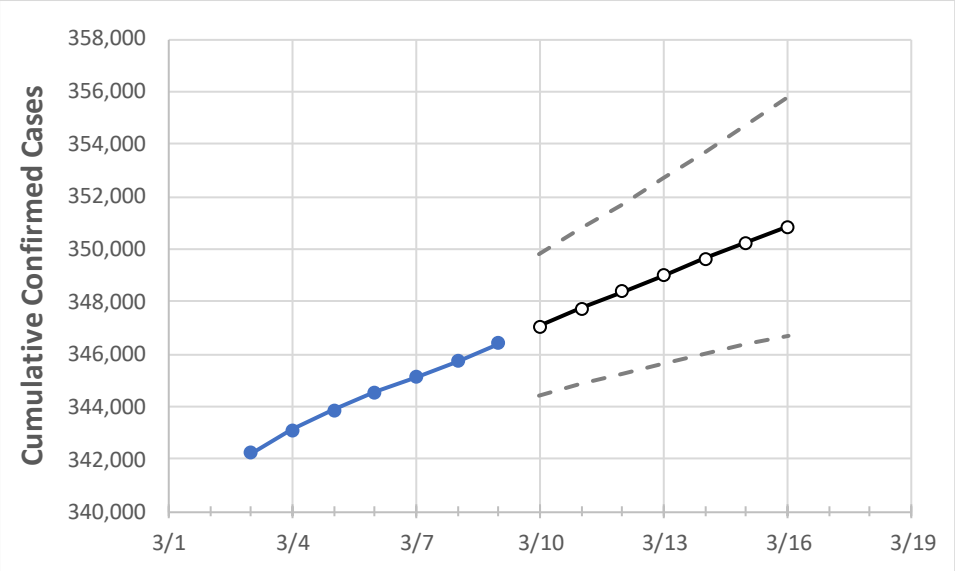
IEM's Modeling Lead

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:						
	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16
Washington	344,532	345,132	345,731	346,403	347,069	347,725	348,373	349,000	349,619	350,233	350,844

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:						
	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16
Benton	15,169	15,189	15,208	15,226	15,244	15,262	15,279	15,297	15,314	15,331	15,347
Clark	19,142	19,159	19,175	19,228	19,260	19,292	19,323	19,353	19,383	19,413	19,443
Grant	7,751	7,758	7,764	7,788	7,797	7,806	7,815	7,824	7,832	7,840	7,848
Island	1,363	1,370	1,377	1,387	1,398	1,410	1,423	1,436	1,450	1,466	1,482
King	85,015	85,149	85,282	85,417	85,553	85,689	85,825	85,957	86,090	86,221	86,346
Kitsap	5,863	5,880	5,897	5,918	5,931	5,944	5,957	5,970	5,983	5,995	6,008
Pierce	39,031	39,152	39,272	39,367	39,486	39,606	39,726	39,847	39,964	40,086	40,207
Skagit	4,531	4,543	4,555	4,562	4,576	4,590	4,604	4,618	4,633	4,648	4,663
Snohomish	30,566	30,609	30,651	30,712	30,761	30,808	30,854	30,898	30,940	30,983	31,024
Spokane	36,816	36,854	36,892	36,933	36,981	37,028	37,075	37,120	37,165	37,206	37,247
Thurston	7,336	7,345	7,353	7,369	7,384	7,399	7,414	7,427	7,440	7,453	7,465
Whatcom	6,953	6,973	6,992	7,017	7,040	7,063	7,086	7,107	7,128	7,148	7,168
Yakima	26,869	26,965	27,060	27,099	27,157	27,216	27,275	27,332	27,393	27,454	27,514

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:		
	3/6	3/7	3/8	3/9	3/11	3/13	3/15
Benton	15,169	15,189	15,208	15,226	15,262 (3,052) [733] {366}	15,297 (3,059) [734] {367}	15,331 (3,066) [736] {368}
Clark	19,142	19,159	19,175	19,228	19,292 (3,858) [926] {463}	19,353 (3,871) [929] {464}	19,413 (3,883) [932] {466}
Grant	7,751	7,758	7,764	7,788	7,806 (1,561) [375] {187}	7,824 (1,565) [376] {188}	7,840 (1,568) [376] {188}
Island	1,363	1,370	1,377	1,387	1,410 (282) [68] {34}	1,436 (287) [69] {34}	1,466 (293) [70] {35}
King	85,015	85,149	85,282	85,417	85,689 (17,138) [4,113] {2,057}	85,957 (17,191) [4,126] {2,063}	86,221 (17,244) [4,139] {2,069}
Kitsap	5,863	5,880	5,897	5,918	5,944 (1,189) [285] {143}	5,970 (1,194) [287] {143}	5,995 (1,199) [288] {144}
Pierce	39,031	39,152	39,272	39,367	39,606 (7,921) [1,901] {951}	39,847 (7,969) [1,913] {956}	40,086 (8,017) [1,924] {962}
Skagit	4,531	4,543	4,555	4,562	4,590 (918) [220] {110}	4,618 (924) [222] {111}	4,648 (930) [223] {112}
Snohomish	30,566	30,609	30,651	30,712	30,808 (6,162) [1,479] {739}	30,898 (6,180) [1,483] {742}	30,983 (6,197) [1,487] {744}
Spokane	36,816	36,854	36,892	36,933	37,028 (7,406) [1,777] {889}	37,120 (7,424) [1,782] {891}	37,206 (7,441) [1,786] {893}
Thurston	7,336	7,345	7,353	7,369	7,399 (1,480) [355] {178}	7,427 (1,485) [356] {178}	7,453 (1,491) [358] {179}
Whatcom	6,953	6,973	6,992	7,017	7,063 (1,413) [339] {170}	7,107 (1,421) [341] {171}	7,148 (1,430) [343] {172}
Yakima	26,869	26,965	27,060	27,099	27,216 (5,443) [1,306] {653}	27,332 (5,466) [1,312] {656}	27,454 (5,491) [1,318] {659}

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.