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

Date: 12/9/20

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 12/9/20 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.

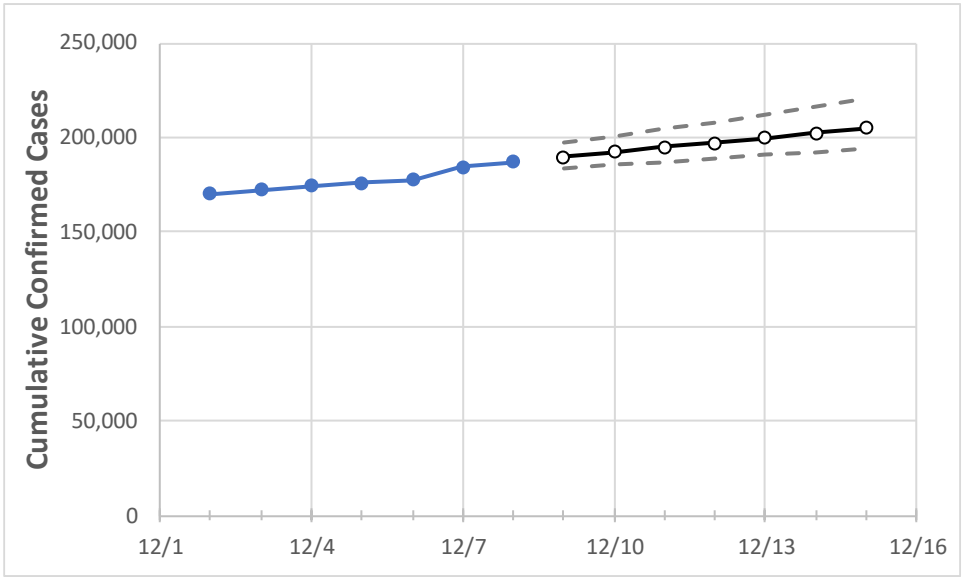
IEM's Modeling Lead

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:						
	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	12/15
Washington	175,793	177,447	184,404	187,327	189,805	192,302	194,818	197,354	199,910	202,485	205,079

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 20%, and are often within 10%, of actual confirmed cases.

Washington Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	12/15
Benton	8,571	8,618	8,963	9,068	9,138	9,206	9,273	9,338	9,402	9,464	9,525
Clark	9,540	9,659	9,847	10,017	10,157	10,297	10,437	10,576	10,715	10,854	10,993
Grant	4,312	4,339	4,418	4,458	4,494	4,530	4,567	4,606	4,645	4,685	4,726
Island	692	698	715	731	740	749	758	767	776	786	795
King	47,032	47,435	49,355	50,188	50,678	51,161	51,637	52,107	52,570	53,027	53,477
Kitsap	2,706	2,753	2,857	2,919	2,975	3,034	3,094	3,157	3,223	3,291	3,361
Pierce	18,356	18,533	19,163	19,427	19,714	20,004	20,296	20,591	20,889	21,190	21,493
Skagit	2,181	2,214	2,270	2,318	2,355	2,393	2,432	2,472	2,512	2,554	2,597
Snohomish	15,624	15,736	16,422	16,713	16,938	17,164	17,391	17,620	17,850	18,081	18,314
Spokane	18,143	18,433	19,318	19,865	20,178	20,497	20,824	21,158	21,500	21,849	22,206
Thurston	3,206	3,236	3,353	3,420	3,455	3,489	3,522	3,556	3,588	3,621	3,653
Whatcom	2,627	2,641	2,706	2,737	2,765	2,793	2,821	2,849	2,877	2,904	2,932
Yakima	14,175	14,215	14,613	14,823	14,916	15,011	15,108	15,207	15,307	15,410	15,515

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:		
	12/5	12/6	12/7	12/8	12/10	12/12	12/14
Benton	8,571	8,618	8,963	9,068	9,206 (1,841) [442] {221}	9,338 (1,868) [448] {224}	9,464 (1,893) [454] {227}
Clark	9,540	9,659	9,847	10,017	10,297 (2,059) [494] {247}	10,576 (2,115) [508] {254}	10,854 (2,171) [521] {260}
Grant	4,312	4,339	4,418	4,458	4,530 (906) [217] {109}	4,606 (921) [221] {111}	4,685 (937) [225] {112}
Island	692	698	715	731	749 (150) [36] {18}	767 (153) [37] {18}	786 (157) [38] {19}
King	47,032	47,435	49,355	50,188	51,161 (10,232) [2,456] {1,228}	52,107 (10,421) [2,501] {1,251}	53,027 (10,605) [2,545] {1,273}
Kitsap	2,706	2,753	2,857	2,919	3,034 (607) [146] {73}	3,157 (631) [152] {76}	3,291 (658) [158] {79}
Pierce	18,356	18,533	19,163	19,427	20,004 (4,001) [960] {480}	20,591 (4,118) [988] {494}	21,190 (4,238) [1,017] {509}
Skagit	2,181	2,214	2,270	2,318	2,393 (479) [115] {57}	2,472 (494) [119] {59}	2,554 (511) [123] {61}
Snohomish	15,624	15,736	16,422	16,713	17,164 (3,433) [824] {412}	17,620 (3,524) [846] {423}	18,081 (3,616) [868] {434}
Spokane	18,143	18,433	19,318	19,865	20,497 (4,099) [984] {492}	21,158 (4,232) [1,016] {508}	21,849 (4,370) [1,049] {524}
Thurston	3,206	3,236	3,353	3,420	3,489 (698) [167] {84}	3,556 (711) [171] {85}	3,621 (724) [174] {87}
Whatcom	2,627	2,641	2,706	2,737	2,793 (559) [134] {67}	2,849 (570) [137] {68}	2,904 (581) [139] {70}
Yakima	14,175	14,215	14,613	14,823	15,011 (3,002) [721] {360}	15,207 (3,041) [730] {365}	15,410 (3,082) [740] {370}

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.